Hydro Resources, Inc

Crownpoint Uranium Project
USNRC License
SUA-1580 Renewal
McKinley County, New Mexico

Environmental Report

March 2013

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LIST OF ABBREVIATIONS/ACRONYMS

AADT	Annual Average Daily Traffic
ACHP	Advisory Council on Historic Preservation
ACL	Alternate Concentration Limit
ACOE	Army Corp of Engineers
AEA	Atomic Energy Act
AEO2012	Annual Energy Outlook 2012
ALARA	As Low As Reasonably Achievable
ASLB	Atomic Safety Licensing Board
ATV	All-terrain Vehicle
BACT	Best Available Control Technology
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
BPT	Best Practicable Technology
CAA	Clean Air Act
CBNG	Coalbed Natural Gas
CCP	Crownpoint Central Plant
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COC	Constitute of Concern
COP	Consolidated Operations Plan
CRMP	Cultural Resource Management Plan
CUP FEIS	Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project (NUREG-1508)
CUP	Crownpoint Uranium Project
CWA	Clean Water Act
D&D	Decommissioning and Decontamination
DEIS	Draft Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project (NUREG-1508)
DOT	U.S. Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Emergency Medical Service
ENDAUM	Eastern Navajo Diné Against Uranium Mining
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
FAC	Facultative
FACW	Facultative Wet
FPP	Formation Parting Pressure
GDP	Gross Domestic Product
HDPE	High Density Polyethylene
HERO	High Efficiency Reverse Osmosis
HMR	Hazardous Materials Regulations
HRI	Hydro Resources, Inc.
HUC	Hydrologic Unit Code

LIST OF ABBREVIATIONS/ACRONYMS (Continued)

IBC	International Building Code
IO	Isolated Occurrence
ISR	In-situ Recovery
ISR GEIS	Generic Environmental Impact Statement for In-situ Leach Uranium Milling Facilities (NUREG-1910)
IX	Ion exchange
LC	License Condition of SUA-1580
LLD	Lower Limit of Detection
LSA	Low Specific-Activity
MCL	Maximum Contaminant Level
MIT	Mechanical Integrity Test
MNM	Museum of New Mexico
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NCRP	National Council on Radiation Protection and Measurements
NECR	Northeast Church Rock
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NMAAQS	New Mexico Ambient Air Quality Standards
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMED-AQB	New Mexico Environment Department, Air Quality Bureau
NMED-GWQB	New Mexico Environment Department, Ground Water Quality Bureau
NMED-HWB	New Mexico Environment Department, Hazardous Waste Bureau
NMED-SWB	New Mexico Environment Department, Solid Waste Bureau
NMED-SWQB	New Mexico Environment Department, Surface Water Quality Bureau
NMHPD	New Mexico Historic Preservation District
NMOSE	New Mexico Office of the State Engineer
NMSHPO	New Mexico State Historic Preservation Office
NMSS	Nuclear Materials Safety and Safeguards
NMWQCC	New Mexico Water Quality Control Commission
NNDOT	Navajo Nation Department of Transportation
NNEPA	Navajo Nation Environmental Protection Agency
NNHPD	Navajo Nation Historic Preservation Department
NNWCA	Navajo Nation Water Code Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSR	New Source Review
NTUA	Navajo Tribal Utility Authority
NWS	National Weather Service

LIST OF ABBREVIATIONS/ACRONYMS (Continued)

OBL	Obligate
OCRM	Old Church Rock Mine
OSHA	Occupational Health and Safety Administration
OWoUS	Other Waters of the U.S.
PA	Programmatic Agreement
PCB	Polychlorinated Biphenyls
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PPE	Personal Protective Equipment
PSD	Prevention of Significant Deterioration
PVC	Polyvinyl Chloride
RAML	Rio Algom Mining, LLC
RAP	Restoration Action Plan
RCRA	Resource Conservation and Recovery Act
RFFA	Reasonably Foreseeable Future Action
RIS	Regulatory Issue Summary
RO	Reverse Osmosis
RSO	Radiation Safety Officer
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Officer
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SRIC	Southwest Research and Information Center
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
TEDE	Total Effective Dose Equivalent
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TEOM	Tapered Element Oscillating Membrane
THPO	Tribal Historic Preservation Officer
TLD	Thermoluminescent Dosimeter
TRV	Target Restoration Value
TVA	Tennessee Valley Authority
UBC	Uniform Building Code
UCL	Upper Control Limit
UIC	Underground Injection Permit
UNC	United Nuclear Corporation
URI	Uranium Resources, Inc.
USDA	U.S. Department of Agriculture
USDW	Underground Sources of Drinking Water
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

LIST OF ABBREVIATIONS/ACRONYMS (Continued)

VRM	Visual Resource Management
WoUS	Waters of the U.S.

UNITS OF MEASURE

%	percent
%g	percent of gravitational acceleration
°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre
ac-ft	acre-feet
bbl	barrel
Btu	British thermal unit
cfs	cubic feet per second
cm	centimeter
cm^2	square centimeter
dB	decibel
dBA	A-weighted decibels
dpm	disintegrations per minute
ft	feet
ft/ft	feet per foot
ft/sec	feet per second
ft/yr	foot per year
gal	gallon
gal/day/ft	gallons per day per foot
gpd	gallons per day
gpm	gallons per minute
ha	hectares
in	inches
kg/cm^2	kilograms per square centimeter
kg/L	kilograms per liter
kg/yr	kilograms per year
km	kilometer
km^2	square kilometer
kWh	kilowatt hours
L	liter
lb/gal	pounds per gallon
lb/in^2	pounds per square inch
lb/yr	pound per year
Lpd	liters per day
Lpm	liters per minute
m	meters
m AMSL	meter above mean sea level
m^2	square meters
m^3	cubic meters

UNITS OF MEASURE (Continued)

m/sec	meters per second
m/yr	meters per year
m^2/day	square meters per day
m^3/sec	cubic meters per second
mcf	thousand cubic feet
mg	milligram
mg/L	milligrams per liter
mi	miles
mi^2	square miles
mL	milliliter
mm	millimeters
mm/mm	millimeter per millimeter
mph	miles per hour
mrem	millirem
mrem/hr	millirem per hour
mrem/yr	millirem per year
mSv	millisievert
mSv/hr	millisieverts per hour
mSv/yr	millisieverts per year
µCi	microcuries
µCi/mL	microcuries per milliliter
µg/m^3	microcuries per cubic meter
µmhos/cm	micromhos per centimeter
pCi/L	picocuries per liter
ppm	parts per million
s.u.	standard units
WL	working levels

1.0 INTRODUCTION

Hydro Resources, Inc. (HRI) hereby submits this Environmental Report (ER) to the United States Nuclear Regulatory Commission (NRC) to supplement renewal of HRI's combined source and 11e.(2) byproduct material license (SUA-1580) to produce uranium commercially using in-situ recovery (ISR) methods. HRI submitted the original application to the NRC on April 25, 1988 for its Church Rock properties in McKinley County, New Mexico. The application was amended on May 8, 1989 to include an existing mine facility in Crownpoint, New Mexico and on April 23, 1992 to include ISR uranium recovery in Unit 1, west of Crownpoint. The final application amendment was submitted July 31, 1992 and included additional lands associated with the Crownpoint facility. NRC published the Draft Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project (DEIS) in October 1994 and the Final Environmental Impact Statement (herein referred to as the CUP FEIS) in February 1997. HRI's combined source and 11e.(2) byproduct material license (SUA-1580) was issued on January 5, 1998.

Although HRI received its license in January of 1998, no construction or other site development activities have occurred within the Crownpoint Uranium Project (CUP) project areas due to fluctuating uranium prices and extensive administrative litigation. The procedural history of the project is discussed in Section 1.2.1 of this ER. On October 14, 2011 NRC reactivated HRI's license and requested an updated ER for license renewal as required by Title 10 U.S. Code of Federal Regulations (CFR) § 51.60 (NRC 2011). While not included in this ER, HRI also will submit a revised Consolidated Operations Plan (COP) to assist NRC staff in its safety review.

This ER provides the information necessary to determine the environmental impacts of renewing SUA-1580 to allow uranium recovery activities in the CUP. The renewal application is submitted in accordance with the licensing requirements contained in 10 CFR Part 40 and provides the NRC staff with the necessary information to support the preparation of an Environmental Assessment (EA) as required in 10 CFR Part 51.

This ER has been prepared in accordance with the guidance contained in NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with Nuclear Material Safety and Safeguards (NMSS) Programs, dated August 2003. However, since this ER is based on previously published documents and rulings, the scope primarily focuses on areas of potentially significant change to site-specific circumstances resulting in increased potential impacts since the issuance of the CUP FEIS and SUA-1580. While this ER follows the recommendations of NUREG-1748, the structure is somewhat different from a new uranium recovery facility application. Each section of this ER will incorporate by reference the CUP FEIS as well as other relevant portions of the administrative record and provide a brief summary of any potentially significant changes between conditions reported in the CUP FEIS and current conditions. In the event that there is no change, the information in the CUP FEIS and the Generic Environmental Impact Statement for In-situ Leach Uranium Milling Facilities (NRC 2009a, herein referred to as the ISR GEIS) is summarized to provide the basis for the no change determination. Table 1.1-1 indicates the status of each environmental resource addressed in the ER and notes if changes are made to resource discussions. The table also includes a summary of any changes. The potential impacts section is restructured to separate the potential impacts by project phase (i.e., construction, operation, aquifer restoration, decommissioning) and to add discussions of potential significance levels consistent with the ISR GEIS. Similarly, since mitigation measures were not addressed separately in the CUP FEIS, Chapter 5 of this ER describes mitigation based on the CUP FEIS, SUA-1580, the COP, and the ISR GEIS.

1.1 Purpose for Proposed Action

The Proposed Action (renewal of SUA-1580) will allow HRI to extract uranium from four project areas (Crownpoint, Unit 1, Church Rock Section 8, and Church Rock Section 17) in McKinley County, New Mexico using ISR techniques as currently licensed at a maximum rate of approximately 1.5 million kg/yr [3 million lb/yr]. Over the course of the project, HRI could extract a total of 19 million kg [42 million lb] of uranium. The produced yellowcake will help supply the nuclear power industry. It is likely that a majority of the yellowcake produced as a result of the CUP will be utilized by the U.S. nuclear power industry. As of 2012, uranium production from uranium recovery facilities in the U.S. provided approximately 1.8 million kg/yr [4 million lb/yr] of yellowcake (EIA 2012a), while domestic nuclear fuel reactors consume approximately 23 million kg/yr [50 million lb/yr] of yellowcake equivalent (WNA 2012a).

Table 1.1-1. Summary of Changes between the CUP FEIS and this ER

Environmental Resource	Section 3 – Affected Environment	Section 4 – Potential Impacts
Land Use	**No significant change** • Provides updated figures showing land use classifications and residences – ***no new residences within the project areas***	**No significant change** • Revises HRI's plan to limit disturbance within the project areas to well fields and processing facilities • Revises estimated disturbance areas for each project
Transportation	**No significant change** • Provides updated traffic statistics • Includes proposed transportation routes for material shipments	**No significant change** • Compares impacts associated with hauling loaded resin to Texas to the impacts included in the R.M.D. Operations, LLC EA impacts – ***no additional transportation impacts*** • Summarizes Regulatory Issue Summary (RIS) 2012-06, which states that there are no additional transportation impacts associated with transporting resin to licensed uranium recovery facilities • Includes potential impacts associated with shipments of solid and hazardous wastes
Geology and Soils	**No significant change** • Provides updated soil survey data and provided earthquake analysis	**No significant change** • Adds potential impacts from hydraulic fracturing of wells
Water Resources	**No significant change** • Reanalyzes hydrology at the Church Rock Sections 8 and 17 project areas – ***no change to flood inundation areas*** • Provides water quantity and quality from United States Geological Survey (USGS) station near Church Rock Sections 8 and 17 project areas • Includes new discussion on wetlands within the project areas • Includes new discussion on water distribution system in the vicinity of the Church Rock Sections 8 and 17 project areas • Includes new discussion on HRI's involvement with the Navajo-Gallup Water Supply Project/Conjunctive Groundwater Development Plan • Revises groundwater quality tables to reflect current U.S. Environmental Protection Agency (EPA)/Navajo Nation EPA (NNEPA) groundwater quality standards • Includes an updated groundwater rights search within and 3.2 km [2 mi] surrounding each project area – ***no new wells***	**No significant change** • Includes potential impacts to wetlands

Table 1.1-1. Summary of Changes between the CUP FEIS and this ER (Continued)

Environmental Resource	Section 3 – Affected Environment	Section 4 – Potential Impacts
Ecological Resources	**No significant change** • Includes revised tables of U.S. Fish and Wildlife Service (USFWS) and State listed and sensitive species	**No significant change** • Updates potential impacts based on revised tables USFWS and State listed and sensitive species.
Meteorology, Climatology, and Air Quality	**No significant change** • Revises regional meteorology and climatology – ***no change to wind speed and wind direction*** • Updates wind roses for Gallup National Weather Service (NWS) station • Revises air quality assessment to reflect current National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments • Provides existing air quality data	**No significant change** • Summarizes results of preliminary emission inventory
Noise	**No significant change** • Provides discussion of background noise levels and exposure levels	**No significant change** • Describes potential impacts to nearby residences and workers
Historic and Cultural Resources	**Change – Section 106 process was on-going when CUP FEIS was published** • Provides a discussion on background historic and cultural resources work completed by HRI and NRC • Summarizes the Section 106 process completed for HRI's five-year disturbance plan • Provides a summary of litigation related to historic and cultural resources	**No significant change** • Describes potential impacts based on completion of the Section 106 process for the five-year disturbance areas
Visual and Scenic Resources	**No significant change** • Classifies the project areas according to visual resource management (VRM) system	**No significant change** • Describes potential impacts resulting from additional light sources
Socioeconomics	**No significant change** • Updates demographics, income, housing, and public infrastructure using most recent census data • Updates earnings, employment, taxes, and local finance to reflect current conditions	**No significant change** • Reflects the current project schedule • Updates socioeconomic statistics based on current yellowcake prices and demographics

Table 1.1-1. Summary of Changes between the CUP FEIS and this ER (Continued)

Environmental Resource	Section 3 – Affected Environment	Section 4 – Potential Impacts
Environmental Justice	**No significant change** • Updated to reflect the disparities of the environmental justice population	**No significant change** • Summarizes NRC staff recommendations presented in CUP FEIS that are still appropriate
Public and Occupational Health	**Change – Not discussed in CUP FEIS** • Provides discussion on background radiological conditions • Includes results of the 2009 radiological surveys conducted in and around the Church Rock Section 17 project area – ***no impacts outside of HRI's lease area***	**No significant change** • Discusses lack of potential impacts related to the 2009 radiological surveys conducted in and around the Church Rock Section 17 project area • Describes the adequacy of the MILDOS-AREA analyses completed as part of the license application
Waste Management	**Change – Not discussed in CUP FEIS** • Provides discussion of existing waste sources	**Change – Not discussed in CUP FEIS** • Describes potential impacts related to Atomic Energy Act (AEA)-regulated and non-AEA-regulated liquid and solid wastes

1.2 Proposed Action

The Proposed Action is to utilize the information in this ER to support renewal of HRI's currently approved license. SUA-1580 allows HRI to construct and operate ISR facilities in the Crownpoint, Unit 1, Church Rock Section 8, and Church Rock Section 17 project areas in McKinley County, New Mexico. Figure 1.2-1 shows the regional location of the project and the four project areas. The following summarizes the CUP. Section 2 provides a detailed description of the No Action Alternative and Proposed Action as well as a detailed description of the CUP.

Each of the project areas and associated acreages was reevaluated by HRI as part of this ER based on the legal descriptions provided in Section 1.1 of the COP. The following describes each of the project areas including associated acreages and describes how the project areas differ from those presented in the CUP FEIS.

- Crownpoint – Encompasses 287 ha [708.8 ac] in Section 24 and 25 of T17N, R13W and Sections 19 and 29 of T17N, R12W. In the CUP FEIS, the Crownpoint project area included the northwest quarter of Section 24, which is allotted land held in trust for Navajo individuals by the Bureau of Indian Affairs (BIA). As part of this ER, HRI determined that the northwest quarter of Section 24 should be included with Unit 1 in order to maintain all of the allotted land under one project area.

- Unit 1 – This project area comprises 583 ha [1,440 ac] of allotted land held in trust for Navajo individuals by the BIA. The Unit 1 project area is located in Sections 15, 16, 21, 22, and 24 of T17N, R13W. As discussed above, the allotted land formerly included in the Crownpoint project area is now included in the Unit 1 project area.

- Church Rock Section 8 – Includes 70.6 ha [174.5 ac] in Section 8, T16N, R16W. In the CUP FEIS, the Church Rock Section 8 project included only the SW quarter of Section 8 (64.8 ha [160 ac]); however, HRI's mining claim for the project area encompasses 70.6 ha [174.5 ac] as described in Section 1.1 of the COP.

- Church Rock Section 17 – Comprises 81 ha [200 ac] of private mineral operating leases in Section 17 of T16N, R16W. There is no change from the CUP FEIS.

As part of the CUP, HRI will construct and operate well fields and associated infrastructure within the project areas to extract uranium from the Westwater Canyon Member of the Morrison Formation. Extraction will be conducted by injecting groundwater fortified with dissolved oxygen and sodium bicarbonate into the production zone to dissolve uranium minerals. In the Crownpoint and Unit 1 project areas, the top of the Westwater Canyon is at an average depth of 560 m [1,840 ft], while the top of the Westwater Canyon in the Church Rock Sections 8 and 17 project areas ranges from 140 to 230 m [460 to 760 ft]. Well fields will use patterns of injection and production wells drilled into the production zone. Each production well will be pumped at approximately 95 L/min (Lpm) [25 gal/min (gpm)], and enough patterns will operate to provide a maximum processing facility flow rate of 15,000 Lpm [4,000 gpm], which is the currently licensed rate at each project area.

Prior to operation in Church Rock Section 17, Unit 1, and Crownpoint project areas, HRI will be required by license condition (LC) 10.28 of SUA-1580 to conduct an aquifer restoration demonstration at the Church Rock Section 8 project area. The demonstration will be conducted at a large enough scale to determine the number of pore volumes required to restore a production-scale well field.

Recovered uranium solution will be processed at satellite facilities located at the Crownpoint, Unit 1, and Church Rock Section 8 project areas. The satellite facilities will recover the uranium using pressurized, down-flow ion exchange (IX) columns. The loaded resin from the IX columns will be processed at the Crownpoint Central Plant (CCP) or transported to one of HRI sister company's (URI) two licensed production facilities in Texas according to the criteria outlines in NRC RIS 2012-06. Although the Proposed Action in the CUP FEIS did not address transporting loaded resin to Texas, it was evaluated as Alternative 2. This ER (Sections 3.2 and 4.2) supports the conclusion that potential impacts associated with transporting loaded resin to licensed production facilities in Texas will be SMALL.

After uranium recovery is no longer economical in a given well field, groundwater in that well field will be restored consistent with the groundwater protection standards presented in 10 CFR Part 40, Appendix A, Criterion 5(B)(5) on a constituent-by-constituent basis using Best Practicable Technology (BPT). If the restoration activities are unable to achieve the background or maximum contaminant levels (MCLs), whichever is greater, in Criterion 5(B)(5), the secondary goal will be to return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR § 141.62 or 143.3. These restoration goals are also required by SUA-1580 and 10 CFR Part 40, Appendix A.

Following NRC and New Mexico Environment Department, Ground Water Quality Bureau (NMED-GWQB) approved aquifer restoration, all surface facilities specifically associated with any given well field will be subject to decommissioning and decontamination (D&D) requirements such that, ultimately, there will be no visual evidence of project use and the entire disturbance area can be released for unrestricted use. D&D of the satellite facilities and CCP will occur after uranium recovery in all well fields is no longer economical. The buildings and equipment within the processing facilities will be decontaminated to levels acceptable for unrestricted use. Any equipment or building materials that cannot be decontaminated will be treated as solid 11e.(2) byproduct material and disposed of at a licensed facility.

1.2.1 Procedural History

The CUP has an extensive NRC and Federal court litigation history. The following describes the key details of the litigation including changes to NRC license SUA-1580.

Following issuance of HRI's license, the Licensing Board commenced its administrative hearing process regarding the merits of certain contentions proffered by several Intervenors, including the Eastern Navajo Diné Against Uranium Mining (ENDAUM), Southwest Research and Information Center (SRIC), Marilyn Morris, and Grace Sam. Due to the magnitude of the litigation and HRI's plan to initially construct and operate the Church Rock Section 8 project area, the litigation was separated into two phases. Phase I included eight areas of concern relating to the Church Rock Section 8 project area, while Phase II included four areas of concern relating to the Crownpoint, Unit 1, and Church Rock Section 17 project areas. Table 1.2-1 provides a summary of the litigation by phase. The following describes the litigation that resulted in changes to SUA-1580.

As part of the Phase I litigation, the Intervenors alleged that HRI's proposed financial assurance for the Church Rock Section 8 project area was inadequate. At the Licensing Board level, the Presiding Officer determined that NRC staff's review of HRI's proposed financial assurance approach was consistent with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 9 as applied to ISR facilities. On appeal, the Commission interpreted its regulations, including Criterion 9, to require that license applicants proposing new ISR projects provide a restoration action plan (RAP) with financial assurance calculation methodologies and preliminary financial assurance cost estimates for D&D of a proposed ISR project, including aquifer restoration, prior to the issuance of an NRC license. While NRC staff's approval of the RAP is required prior to license issuance, the Commission determined that the NRC-approved financial mechanism/instrument providing financial assurance for a proposed project need not be posted until the licensee is prepared to commence licensed operations.

Despite the fact that the Commission found this aspect of NRC staff's review of HRI's license application deficient and presumably because this interpretation of Criterion 9 was essentially "breaking new ground," it determined that HRI's license should not be revoked; but rather, the Commission imposed a prohibition on the use of HRI's license until NRC staff received and approved RAPs for each of the four project areas. Accordingly, HRI considered the license to no longer be effective. Over the course of 2001 and 2002, HRI submitted and NRC staff approved RAPs for each project area. After these approvals were issued, the provisions of the RAP for the Church Rock Section 8 project area became subject to the aforementioned administrative hearing process. On February 27, 2004 the Licensing Board issued an order which prohibited HRI from conducting ISR operations under the license pending resolution of three specific RAP issues: (1) recalculation of Church Rock Section 8 project area financial assurance estimate using the "tremmie" line method for well-plugging; (2) recalculation of reclamation costs based on the average costs estimated by two or more independent contractors, without assuming any use of HRI's "major" equipment; and (3) recalculation of labor costs using the average costs estimated by two independent contractors or estimates provided by Intervenors without assuming employees would wear "multiple hats." HRI appealed the Licensing Board decisions on Items 2 and 3 in LBP-04-03 to the Commission and, on December 8, 2004, the Commission determined that the Boards decisions were not in accord with NRC regulations and, thus, were inapplicable to HRI's RAPs. Item 1 was conceded by HRI and corrected in its RAPs.

After the conclusion of the administrative hearing process for the Church Rock Section 8 project area, the Licensing Board proceeded to litigate issues raised regarding the remaining three project areas simultaneously. On July 20, 2005, the Presiding Officer issued an order holding that HRI's NRC license and its health and safety commitments encompassed therein with respect to potential operational groundwater impacts, aquifer restoration, and financial assurance adequately protect public health and safety. The Presiding Officer determined that the law of the case doctrine precluded consideration of several of the Intervenors' challenges. But, the Presiding Officer also held that Intervenors' arguments were insufficient substantively to warrant revocation or modification of HRI's NRC license. The Presiding Officer's decision also required HRI and NRC staff to revise the applicable secondary groundwater standard for uranium to reflect new EPA Safe Drinking Water Act (SDWA) requirements and required that HRI's RAPs for the Church Rock Section 17, Unit 1, and Crownpoint project areas be revised to provide financial assurance cost estimates for surveying and offloading of wastes and decontamination of transport containers at licensed disposal sites. HRI did not contest either of these requirements and addressed each in its RAPs and license.

After the administrative litigation was completed at the Commission level on February 9, 2007, Intervenors appealed the Commission's final determinations to the United States Court of Appeals for the Tenth Circuit for review. After written submissions and oral argument on March 8, 2010, the Tenth Circuit determined that HRI's License with the revisions mandated by the Licensing Board and the Commission is adequately protective of public health and safety and the environment. On September 15, 2010 Intervenors appealed the Tenth Circuit Court's decision to the United States Supreme Court for review. The federal government and HRI waived the right to a response and, on November 15, 2010, the Court declined review of Intervenors' appeal. At that time, the litigation over HRI's license was terminated.

Due to the ongoing litigation at the time, on August 22, 2002, and in accordance with its license, HRI submitted a request for timely renewal of its license. On December 16, 2002, NRC staff accepted HRI's request and issued a Federal Register notice providing members of the public and interested stakeholders, including Intervenors, with notice that HRI's request had been received and that an opportunity for a hearing was available. No requests for a hearing on the license renewal were submitted. After the time period for requesting a hearing elapsed, NRC staff determined that license renewal review would be held in abeyance as timely pending resolution of the aforementioned administrative litigation.

On July 29, 2010, HRI and NRC staff held a public meeting at NRC Headquarters at which Intervenors and other members of the public participated. Representatives of HRI and NRC staff discussed a variety of items including a summary of the administrative litigation and its results, two planned submissions from HRI, and the path forward for review and approval of the two planned submissions. The two submissions include revisions to HRI's CUP RAPs as required by the Licensing Board and the Commission and renewal of HRI's license. On October 18, 2010 HRI submitted the required revisions to its CUP RAPs to NRC. NRC staff reviewed and approved the revised RAPs, as described in the Safety Evaluation Report (SER) included with the October 14, 2011 letter from NRC to HRI. This approval resulted in the reactivation of HRI’s license and triggered the need for proceeding with the license renewal.

1.2.2 HRI’s History and Current ISR Licensing

HRI’s licensing history and extensive litigation have provided the framework for the current ISR licensing process. The following presents the key aspects of the framework:

- Natural conditions conducive to safe ISR operations
- Phased development and groundwater restoration
- License conditions and standard operating procedures (SOPs) for control of ISR activities.
- Baseline monitoring and regulatory monitoring

- Excursion, if any, response
- RAPs
- Phased Section 106
- Commitments for 11e.(2) byproduct waste disposal

Table 1.2-1. Summary of CUP Litigation

CUP FEIS Issue	Atomic Safety Licensing Board (ASLB) Order	Commission Order	Result of Order	Remaining Issue
Phase I Litigation - Section 8: February 1997 – February 2004				
Groundwater protection/restoration and financial assurance	LBP-99-13 LBP-99-30 LBP-04-03	CLI-99-18 CLI-00-08 CLI-04-33	HRI ordered to complete RAPs for each project area.	None
Historic and cultural resource preservation	LBP-99-9 LBP-99-30	CLI-99-22	No change	None
Radiological air emissions	LBP-99-15 LBP-99-19	CLI-99-08 CLI-00-12	No change	None
Environmental Impact Statement adequacy	LBP-99-18	CLI-99-18 CLI-00-12	No change	None
Financial and technical qualifications	LBP-99-18	CLI-00-12	No change	None
Environmental justice	LBP-99-30	CLI-99-18	No change	None
Surface water protection and liquid waste disposal	LBP-99-1	CLI-99-22	No change	None
Performance based licensing	LBP-99-10	CLI-99-22	No change	None
Phase II Litigation - Section 17, Crownpoint and Unit 1: March 2005 – June 2010				
Groundwater protection and restoration and financial assurance estimates	LBP-05-17	CLI-06-01	License Amendment No. 3. LC 21(A) of SUA-1580 changed uranium standard from 0.44 to 0.03 mg/L. HRI also had to revise RAPs to include the tremmie method of well plugging and abandonment and costs associated with D&D of 11e.(2) byproduct material transport trucks.	None
Cultural resources	LBP-05-26	CLI-06-11	No change	None
Radiological air emission controls in Section 17	LBP-06-1	CLI-06-14	No change	None
Adequacy of the Environmental Impact Statement	LBP-06-19	CLI-06-29	No change	None

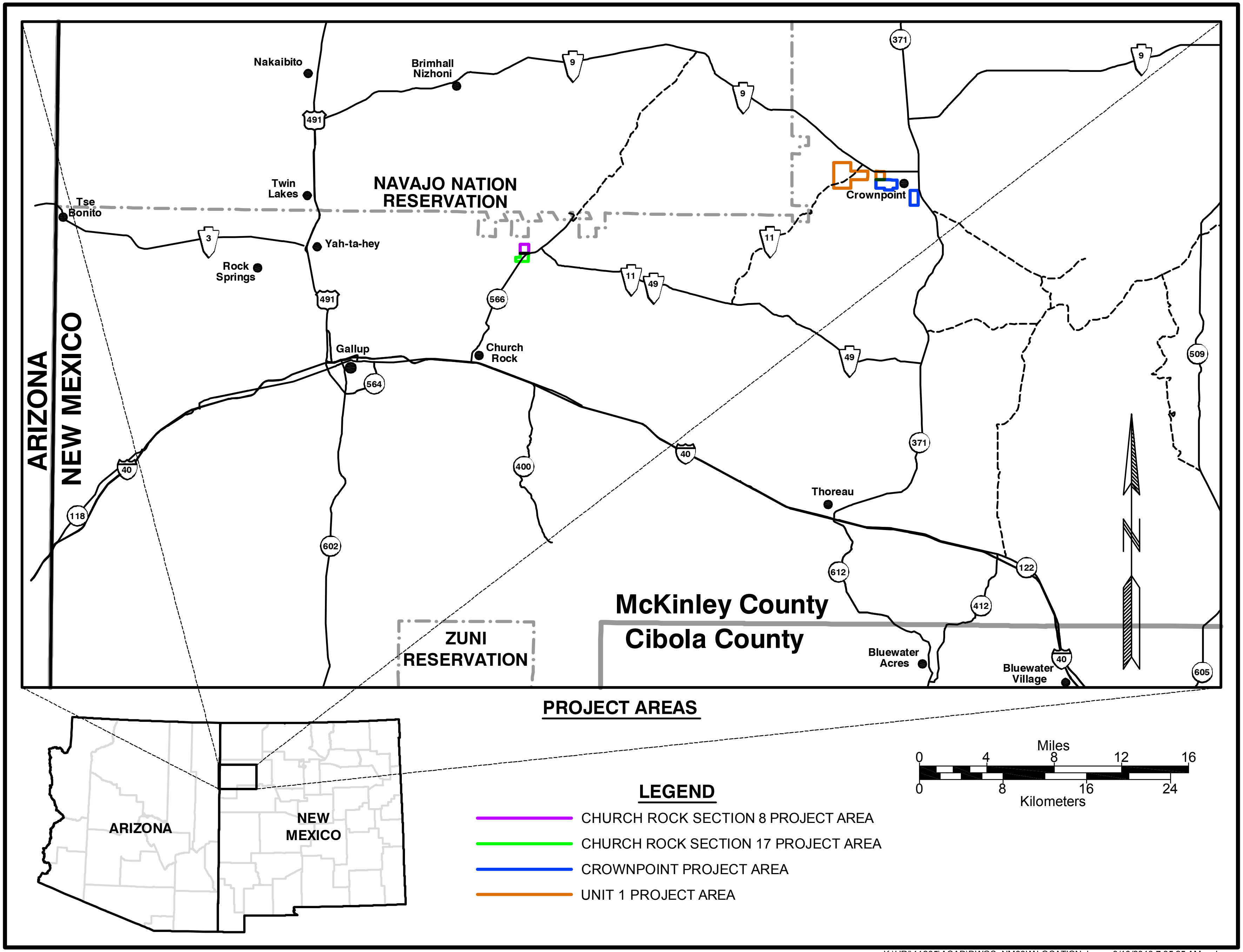

Figure 1.2-1. Regional Location Map of West-Central New Mexico and the Project Areas.

1.3 Applicable Regulatory Requirements, Permits, and Required Consultations

Prior to construction, HRI is required to and will obtain the necessary licenses and permits from relevant Federal and State agencies (applicable requirements dependent on land status). Table 1.3-1 provides information regarding the relevant agencies, the types of licenses/permits, and the current status of applications for such licenses/permits associated with the Proposed Action.

In addition to the required licenses/permits and public involvement as part of the licensing HRI also maintains extensive public involvement with members of the public and interested stakeholders. Current and past public outreach activities include:

- Employee workshops held twice a year to involve the public in discussions regarding employment.
- Semi-annual meetings with allottees in Unit 1 to discuss the status of the project.
- Meetings with the Shelly Energy Committee in Window Rock to discuss the status of the CUP.
- Collaborated with the City of Gallup and the Navajo Nation on the Navajo-Gallup Supply Project Conjunctive Groundwater Development Plan (discussed in Section 3.4 of this ER).
- Existing facilities at the Crownpoint project area were used by the Crownpoint Institute of Technology and continue to provide storage.
- HRI participated in the radiological surveys completed in and around the Church Rock Sections 8 and 17 project areas (discussed in Section 3.11 of this ER).
- HRI has committed to the Navajo Nation to clean-up spoilage in Section 17 prior to construction. As part of the clean-up HRI will characterize the project area and remove or remediate spoilage with elevated radium-226 to acceptable Navajo Nation standards. The standards will be levels that do not pose any public or occupational health risks.

Table 1.3-1. Summary of Potential, Proposed, Pending, and Approved Licenses and Permits

Regulatory Agency	Permit or License	Status
Federal		
NRC	11e.(2) Source and Byproduct Material License	Approved SUA-1580 (Timely Renewal October 14, 2011)
EPA	Class III Underground Injection Control (UIC) Permit (injection wells)	Approved in 1989 for Church Rock Section 8 project area. To be prepared for all other project areas.
	Class I UIC Permit (deep disposal wells)	Application to be prepared for each project area, if applicable.
	National Pollutant Discharge Elimination System (NPDES) Permit	Application to be prepared for all other project areas, as needed.
U.S. Bureau of Land Management (BLM)	Uranium Mining Plan of Operations	Application to be prepared for the Crownpoint Project Area
BIA	Allotted Leases	Lease agreements will be on record at BIA.
Army Corp of Engineers (ACOE)	Verification of Preliminary Wetlands Delineation	Application to be prepared for each project area.
	Nationwide Permit Coverage Authorization	Application to be prepared for each project area.
State		
NMED Air Quality Bureau (NMED-AQB)	Air Quality Permit	Application being prepared for Church Rock Section 8 project area. To be prepared for all other project areas, as needed.
NMED Surface Water Quality Bureau (NMED-SWQB)	Storm Water Discharge Permit Wetlands Conditional Certification	Application being prepared for Church Rock Section 8 project area. To be prepared for all other project areas, as needed.
NMED-GWQB	Groundwater Discharge Permit	Approved DP-558 for Church Rock Section 8 project area. Application to be prepared for all other project areas, as needed.
	Permit to Construct Domestic Wastewater Systems	Application to be prepared for all other project areas, as needed.
New Mexico Office of the State Engineer (NMOSE)	Water Rights	Approved G-11-A, SJ-125-T Application pending for Unit 1 project area

2.0 ALTERNATIVES

2.1 Description of Alternatives

As required by NRC regulations at 10 CFR Part 51 adopted by the Commission pursuant to the National Environmental Policy Act of 1969 (NEPA), this chapter provides a listing of alternatives, including the No Action Alternative and the Proposed Action. The CUP FEIS includes a discussion of the alternatives for the project, including alternative sites for ISR operations, alternative sites for yellowcake drying and packaging, and alternative liquid waste disposal methods. The CUP FEIS also includes the NRC staff recommended action as Alternative 3. Since the license for the CUP has already been issued, the alternatives for the project have been addressed in the CUP FEIS, and the elements of the CUP have not changed, this ER incorporates this analysis of alternatives by reference and will not readdress the reasonable alternatives.

2.1.1 No Action Alternative

10 CFR Part 51 requires that HRI assess the No Action Alternative. Under the No Action Alternative, SUA-1580 will not be renewed and D&D will commence, assuming construction in the Church Rock Section 8 project area had begun prior to the NRC decision. As a result of the No Action Alternative, the significant uranium resources in the project areas will not be recovered. Currently, the U.S. nuclear power generating industry is the world's largest producer of nuclear power, generating approximately 800 billion kWh of electricity in 2011, or almost 20% of the total U.S. output (WNA 2012a). The U.S. imports approximately 90% of its uranium from foreign sources such as Canada, Australia, Russia, and Kazakhstan. In 2011, domestic uranium recovery companies produced 1.9 million kg [4.1 million lb] of yellowcake uranium (EIA 2012a). By comparison, U.S. nuclear fuel reactors will require 21.4 million kg [47.1 million lb] of yellowcake equivalent in 2012 (WNA 2012a). As a result of the No Action Alternative, the U.S. will continue to be dependent on foreign sources of uranium.

2.1.2 Proposed Action

The Proposed Action is to utilize the information in this ER to support renewal of HRI's currently approved license. SUA-1580 allows HRI to construct and operate ISR facilities in the Crownpoint, Unit 1, Church Rock Section 8, and Church Rock Section 17 project areas.

2.1.2.1 Corporate Entities Involved

HRI's license renewal application and this ER are submitted by Hydro Resources, Inc., a Delaware Corporation licensed to do business in New Mexico. Because the name "Hydro Resources" was not available, the company operates as HRI, Inc. (also referred to as HRI). HRI is a wholly-owned subsidiary of Uranium Resources, Inc. (URI), a United States Corporation registered in Texas. The URI corporate office is located at 405 State Highway 121 Bypass, Building A, Suite 110, Lewisville, Texas. URI is a publicly traded corporation with shares traded (URRE) on the NASDAQ.

For the purposes of conducting NRC-licensed ISR operations in New Mexico, HRI will continue to be the holder of the current and renewed NRC license, and it managers and employees will be solely responsible for complying with NRC's financial and technical qualification regulations under 10 CFR Part 40, Appendix A Criteria, specific NRC license conditions, and relevant NRC guidance and policy.

2.1.3 CUP Description

This section provides a detailed discussion of the CUP project areas and the activities associated with the CUP by phase (construction, operation, aquifer restoration, and decommissioning). For the purposes of this report the Church Rock Sections 8 and Church Rock Section 17 project areas are discussed together since the project areas adjoin and processing for both project areas will occur at the Church Rock Section 8 satellite facility.

2.1.3.1 Proposed CUP Schedule

The proposed CUP schedule is provided in Figure 2.1-1. The initial construction in each project area is expected to last 6 to 12 months. Within all of the project areas well field construction will be phased, with two to three well fields in various stages of construction at one time. It is anticipated that construction for each well field will take approximately 6 to 12 months.

HRI proposes to initially commence construction activities in the Church Rock Section 8 project area. Loaded resin from the Church Rock satellite facility will be transported to one of URI's licensed production facilities in Texas for processing into yellowcake. The construction schedule for the CCP is currently unknown. After operations commence in the Church Rock Section 8, HRI will immediately begin work on a restoration demonstration as required by LC 10.28 of SUA-1580. The demonstration will be conducted at a large enough scale to determine the number of pore volumes that will be required to restore a production-scale well field. Operation in the Church Rock Section 8 project area is expected to last 6 years and aquifer restoration is expected to be complete in 4.6 years. According to current plans, construction and operation in the Church Rock Section 17 project area will be commence while the last well field in Church Rock Section 8 is in operation. It is estimated that production and aquifer restoration in the Church Rock Section 17 project area will be completed in 4 and 2.5 years, respectively. The Unit 1 and Crownpoint project areas are tentatively scheduled to begin 3.5 and 5.5 years after production commences in Church Rock Section 8, respectively. Production in the Unit 1 project area is anticipated for 6 years and production in the Crownpoint project area is estimated for 14 years. Aquifer restoration in the Crownpoint and Unit 1 project area is expected to last 13.3 and 5.4 years, respectively. Stability monitoring and decommissioning will continue throughout the life of each project.

2.1.3.2 CUP Project Areas

The project comprises four project areas located in McKinley County, New Mexico, as depicted on Figure 1.2-1. The following describes each of the project areas and provides an approximation of anticipated disturbance within each project area. HRI will continue to delineate uranium ore within these project areas and well fields are expected to increase as additional uranium ore is discovered.

2.1.3.2.1 Crownpoint

The Crownpoint project area is located adjacent to the town of Crownpoint, which had a 2010 population of 2,330 (USCB 2012a). The project area encompasses 287 ha [708.8 ac] in Sections 19 and 29 of T17N, R12W and Sections 24 and 25 of T17N, R13W. The project area comprises 76.2 ha [188.2 ac] of BLM land used as a community allotment, 64.8 ha [160 ac] owned by HRI, and 146 ha [360.6 ac] of tribal trust land.

Project Area	**Total Percent Area (ha)**	**Total Anticipated Disturbance[1] (ha)**
Crownpoint	287	74.5
Unit 1	583	46.5
Church Rock Section 8	70.6	33.2
Church Rock Section 17	81	39.3
CUP TOTAL	**1,021.6**	**193.5**

[1] The total anticipated disturbance is approximate

HRI will operate a satellite facility and, potentially, the CCP within the Crownpoint project area. The project area currently includes existing facilities (processing facilities and settling ponds) acquired from Conoco/Westinghouse in 1988. The existing disturbance associated with these facilities is 5.7 ha [14 ac]. The initial construction and operation phases will be confined to Section 24 with a total anticipated disturbance of 74.5 ha [184 ac].

Five well fields are proposed for Section 24 of the Crownpoint project area. Production within all of the well fields is anticipated to last 14 years and aquifer restoration for Section 24 of the Crownpoint project area is expected to be complete in 13.3 years.

Primary access to the Crownpoint project area is from County Road 47 (CR 47) (Crownpoint Drive). Beginning at I-40 exit 53, the primary access gate can be reached by traveling north on NM 371 for approximately 45 km [28 mi], then west on Navajo 9 for an additional 3.2 km [2 mi], then south on CR 47 for 1.3 km [0.8 mi].

2.1.3.2.2 Unit 1

The Unit 1 project area includes 583 ha [1,440 ac] of allotted land located approximately 3.2 km [2 mi] west of the town of Crownpoint. The project area is located within Sections 15, 16, 21, 22, and 24 of T17N, R13W. While not yet constructed, a satellite facility, retention ponds, and support facilities will be located in Section 21. One well field is proposed in the Unit 1 project area in Sections 15, 16, 21 and 22. Production within the well field is anticipated to last 6 years and aquifer restoration is expected to be complete in 5.4 years.

The land use within the Unit 1 project areas includes allotments composed of rangeland (livestock grazing). HRI's anticipated disturbance in Unit 1 is approximately 46.5 ha [115 ac].

Primary access to the Unit 1 project area will be from Navajo 11. Beginning at I-40 exit 53, the primary access gate will be reached by traveling north on NM 371 for approximately 45 km [28 mi], then west on Navajo 9 for an additional 6 km [3.5 mi], then south on Navajo 11 for approximately 1.6 km [1 mi].

2.1.3.2.3 Church Rock Sections 8 and 17

The Church Rock Sections 8 and 17 project areas lie approximately 10 km [6 mi] north of the town of Church Rock in T16N, R16W. The Church Rock Section 8 project area includes 70.6 ha [174.5 ac] owned by HRI, and Section 17 includes 81 ha [200 ac] of tribal trust land. .

Strata proposes to construct 7 well fields within the Church Rock Section 8 project area and 4 well fields within Church Rock Section 17 project area. Production and aquifer restoration in the Church Rock Section 8 project area is anticipated to last 6 years and 4.6 years, respectively. Production in the Church Rock Section 17 is anticipated to commence while the last well field in the Church Rock Section 8 project area is in production. Production in the Church Rock Section 17 is expected to last 4 years and aquifer restoration is anticipated to be complete in 2.5 years.

Current land uses within the project areas include industrial use and rangeland (livestock grazing). The Old Church Rock Mine (OCRM) is located in Section 17 and occupies approximately 22 ha [55 ac]. HRI will construct and operate a satellite facility, including retention ponds, in the southeast corner of Section 8 that will disturb approximately 2.4 ha [6 ac]. Additional disturbance associated with the well fields and associated infrastructure in the Church Rock Section 8 project area is 30.8 ha [76 ac]. HRI's anticipated total disturbance is the Church Rock Section 17 project area is 39.3 ha [97 ac], including the approximately 22 ha [55 ac] previously disturbed.

Primary access to the Church Rock Sections 8 and 17 project areas is from NM 566. Beginning at I-40 exit 33, the primary access gate will be reached by traveling northwest on NM 118 (I-40 Frontage) for approximately 6 km [4 mi], then north on NM 566 for about 11 km [7 mi].

2.1.3.3 Construction Activities

The CUP will consist of three separate satellite facilities at the Crownpoint, Unit 1, and Church Rock Section 8 project areas. Uranium recovered from Church Rock Section 17 will be processed at the adjacent Section 8 satellite facility. In addition to the satellite facilities, HRI may construct the currently licensed CCP within the Crownpoint project area. The following sections describe the construction activities that will occur within each project area.

2.1.3.3.1 Processing Facilities

At each of the project areas previously described, HRI will build new facilities or convert existing facilities for ISR processing. Schematics of the CCP and a typical satellite facility are presented in Figures 2.1-2 and 2.1-3, respectively. Uranium recovery equipment will include pressurized, down-flow IX columns, vessels to store and process various solutions, piping, and pumps. The proposed process flow involves pumping groundwater fortified with dissolved oxygen and sodium bicarbonate through production zone formations and bringing solubilized uranium to the surface. The recovered uranium solutions will be pumped through IX columns. The IX systems will be operated in closed systems under low pressure. Uranium loaded resin at the satellite facilities will be removed from the IX columns and transported to either the CCP or licensed production facilities where it will be processed into yellowcake.

HRI's processing facilities will include the following major structures:

- satellite facilities, in which uranium extraction equipment (pressurized, down-flow IX columns) will be located;
- a dryer building that will house the yellowcake vacuum dryer and drum packing unit (at CCP only);
- lined retention ponds (at all satellite facilities);
- waste water treatment (at all satellite facilities);
- solid 11e.(2) byproduct material storage facilities (at all satellite facilities); and
- administrative offices, laboratories, and workshops (at all satellite facilities).

All of the processing facilities will be fenced. Access to the processing facilities will be through the main gate.

The process pad will be made of concrete and will be equipped with sumps, drains, and at least a 15 cm [6 in] high curb at the periphery. The pad will be underlain by a synthetic liner that will capture potential leakage through cracks in the concrete. Thicker footers will be provided where heavy processing equipment and vessels will be located. The curb will be designed to confine and hold potential spills in the facilities as well as potentially contaminated runoff from the processing equipment areas. Spilled material will be transferred into storage tanks or lined retention ponds. The curb and sump will be adequate to contain the volume of the largest tank on each pad. Tank design specifications are discussed in Section 2.4 of the COP.

2.1.3.3.2 Access Roads

Primary access routes to each of the project areas are described above and in Section 3.2 of this ER. All roads along the primary access routes are currently paved roads with the exception of a 2,805 m [9,200 ft] segment of unpaved, maintained road on Navajo 11, accessing the Unit 1 project area and an approximately 460 m [1,500 ft] maintained section of County Road 42 between Navajo 9 and the Crownpoint project area.

2.1.3.3.3 Production Areas

The production areas within each of the project areas will be separated into well fields. Depending on the location and number of wells, each well field will include one to three metering houses. Typically, well field design is based on grids with alternating injection and production wells, monitor wells above and below the production zone, and a ring of monitor wells surrounding the entire production zone to detect any potential excursions of recovery solutions. Excursions are defined in LC 10.12 of SUA-1580 as the exceedance of upper control limits (UCLs) for two or more excursion indicators or one excursion indicator exceeding a UCL by 20% in a monitor well. The following describes the proposed well fields within each of the project areas. As previously discussed, the well fields are likely to increase as HRI continues exploration in the project areas.

Crownpoint

The operating area in the Crownpoint project area will consist of one production area in the south half of Section 24. HRI anticipates that the production area will be separated into five well fields and that 25 metering houses will be constructed within the Crownpoint project area. The layout of the well field is depicted on Figure 1.4-7 of the COP.

Unit 1

The operating area in the Unit 1 project area will consist of one production area in Sections 15, 16, 21, and 22. The production area comprises one well field. The well field layout is presented in Figure 1.4-9 of the COP. HRI anticipates that approximately 14 metering house will be constructed within the Unit 1 project area.

Church Rock Sections 8 and 17

HRI will construct one production area within each of the Church Rock Sections 8 and 17 project areas. The layout of the production areas is shown on Figures 1.4-4 and 1.4-5 of the COP. HRI anticipates that the production area in the Church Rock Section 8 project area will include 7 well fields. Four well fields are anticipated for the Church Rock Section 17 project area.

2.1.3.3.3.1 Injection and Production Wells

In the well field, injection wells will be arranged around production wells in patterns designed for optimum ISR operations. The physical configuration of the mineralized production zone, which is inferred from exploration geophysical logs, will determine injection and production well depths and the completion intervals. Typically, well patterns used for ISR operations will include, but will not be limited to, alternating single line drive, staggered line drive, and five spot. Each well field area will consist of groups of these patterns that will be installed to correspond with the irregular geometry of the ore bodies as determined from geological interpretation.

During operation each production well will be operated at the maximum continuous flow rate achievable for that pattern area (about 95 Lpm [25 gpm]). The primary consideration in determining maximum continuous flow rate is to assure the well field is collectively balanced. HRI will ensure that the maximum permitted processing flow rate of 15,000 Lpm [4,000 gpm] at each project area is not exceeded.

Generally, the overall injection flow rate into each well field will be less than the total extraction flow rate by an amount known as “process bleed.” This will result in a hydraulic pressure sink that draws native groundwater outside of the production zone into the well field. This process bleed is used to help prevent against fortified groundwater migrating away from the production zone causing an excursion and to minimize the level of contaminants in the production zone. The process bleed flow rate will vary according to ore geometry, well pattern, and magnitude and direction of the natural groundwater flow. Since uranium is recovered using fortified natural groundwater recirculated continuously from the production wells through the surface IX facilities, into the injection wells, through the production zone, and back to the production wells, the system can never be over injected, even with no process bleed. Groundwater velocity studies for the CUP indicate low natural groundwater velocities of 3 to 6 m/yr [10 to 20 ft/yr], which vary according to the site-specific natural hydraulic gradient. As a result, the amount of process bleed used in any portion of HRI's well fields also will be site specific, incorporating effects of actual ore geometry and overall well field pattern and operation. Since process bleed is considered a consumptive use of groundwater, it will be minimized in all cases, yet will be maintained at sufficient levels to protect against excursions.

2.1.3.3.3.2 Monitor Wells

In addition to the injection and production wells, HRI will install an extensive groundwater monitoring network within each project area meeting the requirements of LC 10.17 of SUA-1580. Production zone monitor wells will be completed in the ore-bearing aquifer, encircling each well field at a distance of no more than 122 m [400 ft] from the peripheral production or injection wells, and at a spacing of not more than 122 m [400 ft] apart. The angle formed by lines drawn from any production well to the two nearest monitor wells will not be greater than 75 degrees. At the Church Rock Section 17 project area, monitor wells will be located by treating historical production mine workings like they were injection or production wells. Therefore, monitor wells will encircle each well field at a distance of no more than 122 m [400 ft] from the edge of the production wells, injection wells, and mine workings, and will be no more than 122 m [400 ft] apart. The angle formed by lines drawn from any production well, injection well, or mine working to the two nearest monitor wells will not be greater than 75 degrees. This will ensure that the detection of potential horizontal excursions will not be influenced by the presence of the mine workings.

Shallow monitor wells, or non-production zone monitor wells, will be completed in the aquifers overlying the production zone. These wells will be located in the first overlying aquifer at a minimum density of one well per 1.6 ha [4 ac] of production wells. If a second overlying aquifer is identified, and evaluation of the thickness and integrity of the intervening aquitard will conservatively require its monitoring, then wells will be completed in the second overlying aquifer at a minimum density of one well per 3.2 ha [8 ac] of production wells.

In addition to these monitor wells, LC 10.18 of SUA-1580 requires HRI to complete monitor wells in the Dakota Sandstone aquifer at a minimum density of one well per 1.6 ha [4 ac] at the Unit 1 and Crownpoint project areas and LC 10.18 of SUA-1580 requires HRI to complete a minimum of three monitor wells in the Dakota Sandstone between the well fields and the town of Crownpoint water supply wells. At the Church Rock Sections 8 and 17 project areas, LC 10.20 of SUA-1580 requires HRI to complete monitor wells in the Brushy Basin "B" sand aquifer at a minimum density of one well per 1.6 ha [4 ac] and the Dakota Sandstone aquifer at a minimum density of one well per 3.2 ha [8 ac]. As stated in Section 8.2 of the COP, HRI does not propose to complete monitor wells in the underlying Cow Springs aquifer. Prior to operation, HRI will collect sufficient data to characterize the water quality of the Cow Springs aquifer beneath the project areas. In addition, HRI will conduct hydrological confinement tests to verify confinement between the aquifers. If a vertical connection is found to exist between the Westwater Canyon aquifer and the underlying Cow Springs aquifer monitor wells will be completed at a minimum density of on well per 1.6 ha [4 ac] (LC 10.25 of SUA-1580).

2.1.3.3.3.3 Well Construction and Integrity Testing

At the Unit 1 and Crownpoint project areas, injection and production well casings will be constructed using fiberglass or steel casing. Polyvinyl chloride (PVC), fiberglass, or steel casing will be used at the Church Rock Sections 8 and 17 project areas. These materials are consistent with LC 10.4 of SUA-1580 that requires HRI to use only steel or fiberglass well casing at the Unit 1 and Crownpoint sites for all wells completed into the Dakota Sandstone, Westwater Canyon, and Cow Springs.

All holes will be rotary-drilled with water well-type drilling rigs capable of circulating drilling fluids to the surface. The drill holes will be straight-drilled or directionally drilled depending on surface locations and proximities to building, cliffs, roads, and archaeological sites. Each hole will be checked for deviation and logged. Spontaneous potential, resistivity, and gamma ray logs will be obtained for all holes. This suite of logs is standard in the uranium industry. Where gamma logs indicate the presence of uranium mineralization, prompt fission neutron logging will be conducted. In the event that washouts are indicated, caliper logs will be used to determine the cement quantities required for subsequent casing activities. Once a hole is drilled and logged, it will be determined if the location qualifies for commercial ISR activity and the hole will be cased.

Casing of injection, production, and monitor wells will be either of threaded fiberglass, steel, or PVC, and perforated, underreamed, or screened. A combination of fiberglass in the lower section of the hole and PVC in the upper hole also will be an option that may be used dependent on the well function (production, injection, or monitor well) and the characteristics of the particular well field and the completion horizon. Besides its high resistance to collapse, fiberglass casing is acceptable for perforation since it will not shatter from the shock of perforation. Both fiberglass and PVC casings are resistant to the oxidized conditions inherent during ISR operations.

The casings in the injection, production, and monitor wells will use centering stabilizers spaced between 45 to 60 m [150 to 200 ft] along the total casing length to maintain the casing in the center of the hole. The casing will include a cap at the bottom with a weep hole to allow the cement to flow below and around the casing and back to the surface in the annular volume of the hole. Casing that will be used for integral screen completion will include the screen attached to the bottom of the casing, with a cement basket between the casing and screen. The cement basket will pack off the annular space between the casing and hole to isolate the screen from the cement, and it will include a plug inside the basket to seal off the inside of the casing from the screen. The cement will be allowed to flow through weep holes above the plug and to flow out to fill up the basket and return to the surface. When the well is completed, the plug will be drilled out to reveal a clean open, screen to the casing.

Once the casing is run into a well, it will be cemented from bottom to top. The cement will consist of a slurry of Class A cement, approximately 2% bentonite gel, and water and will have a density of approximately 1.6 kg/L [13 lb/gal]. The cement will be pumped through the casing, through the weep holes in the cap or basket, and up the annular volume between the casing and hole to the surface. The cement slurry volume will be sufficient to fill the annular volume, a portion of the lower casing volume, and to provide enough excess volume to fill any potential washouts with returns to the surface. After the entire cement slurry volume is pumped down the well, it will be displaced in the casing with water or a weighted fluid to a depth considered sufficient to ensure that enough cement remains in the casing to properly seal the bottom weep holes. The well will be sealed with the displacement fluid in the casing to prevent backflow and allowed to set for 48 hours to cure the cement. The properly designed displacement fluid will assure that the casing does not collapse prior to the curing of the cement.

HRI will use three principal completion techniques: perforated casing completion, underreamed or open hole casing completion, and integral screen completion. The method used will be determined by such factors as the casing material, depth of the well, and the nature of the completion horizon.

- Perforated and underreamed casing completion will both be used to open wells with casing placed across the target interval. The perforated casing completion utilizes hollow charge shots to punch holes through the casing and cement into the formation. The underreamed casing completion uses a mechanical downhole tool to cut away the casing, cement, and the filter cake on the sand face. Both techniques are very effective ways to open the well to the completion horizon. These completions provide very good vertical isolation of the interval due to cement remaining above and below the opening to seal the annulus of the casing from ISR solution migration.
- The integral screen completion typically will be used for shallower wells with very long completion intervals and satisfactory vertical isolation. The cement basket will be set in a confining shale above the completion interval and the screen will be suspended below the basket.

The advantage of perforations is derived from the ability to operate them with a wire line unit at any depth. The advantage of underreaming casing is that it allows the removal of the casing, cement and filter cake from the completion interval. This creates a large diameter hole which allows for a very large surface area in the formation to be open to the wellbore. Historically, wells completed by underreaming have demonstrated higher volumetric flow rates over those observed in perforated wells. The major disadvantage in underreaming results from the limitations of the rotary rig and underreaming tool. As the depths increase, the amount of weight resulting from the drill-string increases proportionally downhole on the blades of the cutter. HRI has a great deal of experience using underreamers in deep wells, and with careful management of string weight and torque, underreaming will be successful.

After the well is completed, a set of cased-hole geophysical logs will be run through the open interval and length of the casing. Single point resistivity and gamma ray logs will be run for this survey. The logs will be used to detect possible casing leaks. In addition to the logs, HRI will perform a mechanical integrity test (MIT) on all wells to further test the casing for possible leaks as required by LC 10.24 of SUA-1580. HRI will retest the integrity of injection, production, and monitor wells at a minimum frequency of every 5 years.

The MIT will be performed by inserting an inflatable packer into the well at a depth directly above the open interval. The packer then will be inflated and the casing filled with water and sealed. The pressure in the well will be raised to at least 125% of the maximum allowable wellhead injection pressure and maintained for 30 minutes. The well will pass the MIT if less than 10% of the starting pressure is lost over the course of the test. In the event that the MIT fails, the well will be repaired and the MIT repeated. All wells must pass MIT prior to being considered operational. Wells that cannot pass MIT will be plugged and abandoned in accordance with NMOSE or Navajo Nation Water Code Administration (NNWCA) requirements. Well construction details and MIT results will be recorded on a well completion report and maintained on site.

2.1.3.3.3.4 Pipelines

Underground piping will be installed within each of the project areas. Piping will include trunk lines between the metering houses and the processing facilities and individual pipelines from the metering houses to the injection and production wells. HRI will use high-density polyethylene (HDPE) for all trunk lines and distribution lines. All pipelines will be pressure tested for integrity prior to operation.

The well field piping and trunk lines will be buried at least 0.5 m [20 in] below the surface to prevent freezing. Manifolds in the metering houses will direct solutions between individual wells and the processing facilities. Meters and control valves on individual pipelines will monitor and control flow rates and pressures to each well. Additionally, the entire injection and production system will be metered on the trunk lines for continuous monitoring in the processing facilities. HRI will install pressure and flow transmitters on the lines and will program automatic shutdowns based upon the pressures in the lines. The high-pressure shutdown will be programmed to shut off the wells and injection pumps before permitted allowances are exceeded. Low-pressure shutdown will occur if a sudden drop in pressure is detected. Leak detection sensors also will be installed on each well head to notify operators of any leak around the well head.

2.1.3.4 Operation Activities

Uranium recovery at the CUP will involve two processes. The first is uranium mobilization, where solid uranium in subsurface ore bodies will be dissolved and extracted in solution from the production zone at each of the project areas. The second process is uranium processing, where the dissolved uranium will be removed from the recovery solution and ultimately dried and packaged into yellowcake at the currently licensed CCP or licensed production facilities in Texas. The following sections describe these processes at the CUP.

2.1.3.4.1 Fortified Groundwater Chemistry

Uranium, present in the production zone in a reduced, insoluble form, will be oxidized and dissolved by injecting fortified groundwater into the production zone. Once uranium is oxidized, it easily complexes with bicarbonate anions in the fortified groundwater and becomes mobile in the recovery solution. The anticipated constituent concentrations of the recovered uranium solution and the principal chemical reactions are presented in Tables 2.1 and 2.2 of the CUP FEIS, respectively.

2.1.3.4.2 Injection and Production

The maximum flow rate at each processing facility will be 15,000 Lpm [4,000 gpm], exclusive of restoration flow as required by LC 10.2 of SUA-1580. The approximate values of allowable surface pressures for each project area are 21 kg/cm^2 [301 lb/in^2] at the Crownpoint and Unit 1 project areas and 8 kg/cm^2 [117 lb/in^2] at the Church Rock Sections 8 and 17 project areas. During normal conditions, the process bleed will be controlled to approximately 1% of the processing facility flow rate.

2.1.3.4.3 Excursion Monitoring

During operation HRI will implement a groundwater monitoring program to detect potential excursions. Biweekly samples will be collected from the monitor wells and analyzed for conductivity, chloride, and bicarbonate. The UCLs will be based on the average baseline water quality plus 5 standard deviations for each of the COCs. The methodology used to determine UCLs is presented in Section 6.2.1 of this ER and Section 8.6.4 of the COP.

A possible excursion will be declared if any two excursion indicators in any monitor well exceed a UCL value or a single excursion indicator exceeds the UCL by 20% as required by LC 10.12 of SUA-1580. A verification sample will be collected within 24 hours after the initial results are received. If the second sample does not indicate that UCLs have been exceeded a third sample will be collected within 48 hours after results from the second sample are received. If neither the second nor third sample results indicate UCLs are exceeded, the first sample will be considered in error. If the second or third samples indicate that UCLs are exceeded the excursion is confirmed. Section 8.7.2 of the COP discusses the corrective action procedures for an excursion. As required in LC 10.13 of SUA-1580, in the event that an excursion is not corrected within 60 days of confirmation, injection in the vicinity of the monitor well will be terminated until aquifer restoration is complete, or an increase (agreeable by NRC) in the financial assurance will be arranged to cover the cost of correcting the excursion.

In the event of a confirmed excursion per LC 12.1 of SUA-1580, HRI will notify the EPA or NMED and NRC by phone within 24 hours and by letter within 7 days. A written report also will be submitted to the NRC within 60 days of the excursion confirmation describing the excursion event, corrective actions taken, and the corrective action results. If a well is still on excursion status when the report is submitted, the report also will contain a schedule for submitting additional reports to the NRC describing the excursion event, corrective action taken, and the results obtained. In the case of a confirmed vertical excursion, the report also will include a projected completion date for characterization of the extent of the vertical excursion.

In the event of a vertical excursion in the Dakota Sandstone at the Crownpoint or Unit 1 project areas, HRI will sample the monitor wells to determine if any other overlying aquifers (sustaining yields greater than 570 L/day (Lpd) [150 gal/day (gpd)]) have been impacted (LC 10.14 of SUA-1580). The specific aquifers to be monitored will be identified in the 60-day excursion report.

2.1.3.4.4 Uranium Processing

Uranium processing at the CUP will include the following steps: (1) pumping recovered uranium solution through pressurized, down-flow IX columns where the uranium will be transferred onto loaded resin; (2) eluting the uranium from the loaded resin; and (3) precipitation, filtering, drying, and packaging into yellowcake. The following sections describe the uranium processing.

2.1.3.4.4.1 Pressurized, Down-Flow IX Columns

The recovered uranium solution containing uranyl dicarbonate complexes will be pumped to the processing facilities through a network of well field piping, collection headers, and trunk lines. In the processing facilities the recovered uranium solution will be pumped through the IX columns. The entire system will be pressurized. Uranium will be exchanged on the reacting sites of the loaded resin for chloride ion (if the loaded resin is in chloride form) according to the following reaction:

$$Na_2UO_2(CO_3)_2 + 2RCl \rightarrow R_2UO_2(CO_3)_2 + 2NaCl$$

where R is a reacting site of the loaded resin.

After uranium removal in the pressurized, down-flow IX columns, the process bleed will be removed. The process bleed will be treated using reverse osmosis (RO), with the resulting product water used for reinjection or disposed using an approved method.

After removing the process bleed, the uranium-depleted (barren) water will be refortified with sodium bicarbonate and/or gaseous carbon dioxide and piped back to the well fields for reinjection. The entire injection, production, IX, and reinjection process is effectively a closed system. This allows retention of residual carbon dioxide, oxygen, and radon during recirculation of the fortified groundwater.

Once loaded with complexed uranyl dicarbonate, the loaded resin will be transported to the CCP or licensed production facilities in Texas for processing into yellowcake.

2.1.3.4.4.2 Elution and Precipitation

Elution separates the uranium complexes from the loaded resin and regenerates the loaded resin capacity by replacing chloride and bicarbonate ions on the loaded resin exchange sites. The primary chemical reaction involved in elution is shown below.

$$R_2UO_2(CO_3)_2 + 2NaCl + Na_2CO_3 \rightarrow Na_4UO_2(CO_3)_3 + 2RCl$$

The loaded resin will be contacted with elution brine to strip the uranyl carbonate anions and regenerate the resin. The brine solution will be prepared by mixing the proper quantities of a saturated sodium chloride (salt) solution and saturated sodium carbonate (soda ash) solution in water. The elution process will consist of four stages: three eluant stages and one rinse stage. Uranyl carbonates will be recovered in the loaded eluant.

Loaded eluant which contains uranyl dicarbonate and tricarbonate will be acidified using hydrochloric acid (HCl) or sulfuric acid (H_2SO_4) to break down the uranyl carbonate complexes as shown below.

Hydrochloric Acid

$$Na_4UO_2(CO_3)_3 + 6HCl \rightarrow UO_2Cl_2 + 4NaCl + 3CO_2 + 3H_2O$$

$$Na_2UO_2(CO_3)_2 + 4HCl \rightarrow UO_2Cl_2 + 2NaCl + 2CO_2 + 2H_2O$$

Sulfuric Acid

$$Na_4UO_2(CO_3)_3 + 3H_2SO_4 \rightarrow UO_2SO_4 + 4NaCl + 3CO_2 + 3H_2O$$

$$Na_2UO_2(CO_3)_2 + 2H_2SO_4 \rightarrow UO_2\ SO_4 + 2NaCl + 2CO_2 + 2H_2O$$

In the next step hydrogen peroxide will be added to the solution to further oxidize the uranium even further and cause it to precipitate according to one of the following reaction:

Hydrochloric Acid

$$UO_2Cl_2 + H_2O_2 + xH_2O \rightarrow UO_4\ xH_2O + 2HCl$$

Sulfuric Acid

$$UO_2SO_4 + H_2O_2 + xH_2O \rightarrow UO_4\ xH_2O + H_2SO_4$$

The crystalline uranyl peroxide yellowcake slurry (UO_4 or yellowcake) may require pH adjustment and then will be allowed to settle. The supernatant liquid (barren eluant) will be decanted and stored in two storage tanks, reconcentrated with salt (NaCl) and sodium carbonate, and reused in the uranium stripping circuit or discarded using appropriate disposal methods. A part of this stream will be discarded periodically to the lined retention ponds periodically to keep accumulated impurities within operating guidelines. Carbon dioxide gas (CO_2) generated during acidification will be vented to the atmosphere.

2.1.3.4.4.3 Yellowcake Processing (CCP or Licensed Production Facilities in Texas)

The yellowcake will be dewatered using a filter press. The yellowcake will be dried using a batch-type vacuum dryer system. Equipment in the yellowcake processing facilities will include:

- a drying chamber equipped with an internal mixing auger and a mechanism for directly discharging the dried product into 208 L [55 gal] drums;

- a bag filter to capture the entrained solid particles present in the exiting vapor stream and return them to the drying chamber;
- a water-cooled condensing unit to cool and liquefy water evaporated from the yellowcake slurry;
- a vacuum pump; and
- a recirculating closed-loop, hot oil heating system that uses a propane or natural gas-fired or electric boiler to heat the oil.

Yellowcake drums awaiting shipment will be stored on curbed concrete pads inside the restricted area of the processing facilities. The drummed yellowcake product will be shipped via exclusive-use transport to a licensed conversion facility in Metropolis, Illinois. Water left over from the dewatering and drying will either be reused in the elution circuit or sent to the lined retention ponds.

2.1.3.4.4.4 Management of Process Bleed and Other Liquid Effluents

During operation HRI will withdraw a process bleed to maintain an inward hydraulic gradient within the well fields. As previously described, the process bleed will be treated using RO with the resulting product water reinjected or disposed using an approved method described in Section 2.1.3.7 of this ER.

2.1.3.5 Aquifer Restoration Activities

The primary goals of the aquifer restoration program are to:

- Restore the groundwater consistent with 10 CFR Part 40, Appendix A, Criterion 5(B)(5).
- Complete aquifer restoration concurrently with ISR uranium extraction in accordance with 10 CFR § 40.42.
- Provide sufficient restoration capacity to restore each well field in a phased approach as production concludes in depleted well fields.
- Minimize consumptive use of groundwater.
- Apply state-of-the-art technology based on successes and lessons learned from similar operations.

The following sections discuss the target restoration goals in greater detail. The aquifer restoration process will commence after uranium recovery in a well field is no longer economical and will continue through active restoration and post-restoration stability monitoring. Aquifer restoration will conclude with NRC and NMED approval of successful restoration within each well field.

2.1.3.5.1 Target Restoration Goal

Groundwater will be restored consistent with the groundwater protection standards contained in Criterion 5(B)(5) on a constituent-by-constituent basis using BPT. If the restoration activities are unable to achieve the background or MCL, whichever is greater, the secondary goal will be to return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR § 141.62 or 143.3.

The following are the restoration targets:

1. Restoration results in a return to preexisting conditions for all COC in all affected groundwater and in all restoration water quality monitor wells.

2. Where the baseline concentration of a COC is less than groundwater or drinking water standards, the appropriate established State or Federal criteria may be used to establish maximum permissible values for restoration purposes.

2.1.3.5.1.1 Target Restoration Values

Target restoration values (TRVs) representative of baseline water quality will be established for each well field by sampling representative production wells. HRI will measure baseline water quality by collecting multiple water samples from representative production wells as required by LC 10.21 and described in Section 6.2.1 of this ER and Section 8.6.3 of the COP.

HRI is committed to using the EPA's, "Statistical Analysis of Ground-Water Monitoring Data at Resource Conservation and Recovery Act (RCRA) Facilities, Interim Guidance", for the treatment of outliers. However, unlike RCRA facilities, a known local anomaly is present in the rock associated with ISR operations (uranium mineralization, which is typically lognormally distributed), a strong geochemical interface is known to be present, and radionuclide constituents are present in the groundwater that is associated with this anomaly. Radionuclides are expected in a uranium ore body, and it is not reasonable to extract them from the data if they fail the outlier test. HRI will work with regulatory authorities to demonstrate that the EPA-sponsored ProUCL statistical program provides more representative baseline values.

2.1.3.5.2 Aquifer Restoration Procedure

Restoration of the production zone will be achieved by a combination of groundwater sweep, RO, and brine concentration. The following describes each of the treatment methods.

2.1.3.5.2.1 Groundwater Sweep

During groundwater sweep, water will be pumped from the depleted well field without reinjection. The pumping will cause uncontaminated, native groundwater to flow into the production zone, thereby flushing the contaminants. All water removed during groundwater sweep will be processed to remove uranium and treated with barium chloride to remove radium. Additional treatment may be conducted to further purify the water. The purified water will be disposed according to an NRC-approved disposal plan.

2.1.3.5.2.2 Reverse Osmosis

RO is a water treatment process that splits a waste water stream by purifying one portion of the stream and concentrating contaminants in the other portion. The process works by pumping waste water under high pressure through low-permeability membranes. The water molecules pass through the membrane, while dissolved and suspended constituents do not. The treated water passing through the membrane is called product water and typically meets or exceeds drinking water standards. The product water will be reinjected back into the well field during aquifer restoration. The concentrated brine, representing 5-30% of the feed volume, will be disposed by either deep well disposal, evaporation in lined retention ponds, or further reduced in volume by additional brine concentration for disposal as solid 11e.(2) byproduct material at licensed disposal facility. HRI is also evaluating the use of high-efficiency RO (HERO) units that would further reduce the brine volume requiring disposal.

2.1.3.5.2.3 Brine Concentration

Brine from the RO treatment system may be further processed through a brine concentrator. A brine concentrator works by heating and evaporating the water in the brine, then condensing the water vapor as pure water. The resultant hyper-concentrated brine will consist of precipitated solids in the form of common salts. Systematic blow down of the solid yellowcake slurry will be directed to a lined retention pond. Typically, for each 379 L [100 gal] of brine treated, 375 L [99 gal] of distilled water and 4 L [1 gal] of solid 11e(2) byproduct material are formed.

2.1.3.5.3 Aquifer Restoration Demonstration

LC 10.28 of SUA-1580 requires that prior to the operation at the Church Rock Section 17, Crownpoint, or Unit 1 project areas, HRI will complete and submit to the NRC the results of a commercial-scale restoration demonstration at the Church Rock Section 8 project area. After production begins at the Section 8 project area, HRI immediately will begin work on the demonstration, outside of the actual production area, yet inside the monitor well ring, and within the target production zone. Key elements of the restoration demonstration will be as follows:

1. An isolated restoration demonstration pattern will be completed in the production zone, constructed to the same basic configuration as the proposed production well field pattern, and operated under the same conditions as the proposed ISR procedures.
2. The pattern will be operated under commercial activity conditions using fortified groundwater concentrations equal to or greater than will be used for production.
3. After the leaching phase, a complete chemical description of the recovered solution will be obtained and the restoration demonstration will be initiated.
4. Sample analysis of key COCs and fluids will be completed at least weekly during the restoration demonstration.
5. Restoration will continue until the groundwater is restored to levels consistent with Criterion 5(B)(5).
6. Progress reports will be submitted monthly to the NRC and NMED. With each progress report, HRI will calculate and submit the volume of groundwater affected, expressed in pore volumes. Factors to be considered include: aerial extent, formation thickness, and

porosity. Upon the completion of the restoration demonstration, the data, analysis, and conclusions will be compiled into a final report.

The restoration demonstration will be conducted at a large enough scale to determine the number of pore volumes that will be required to restore a production-scale well field.

2.1.3.5.4 Aquifer Restoration Progress and Stability Monitoring

Aquifer restoration rates will be monitored through analysis of waters produced from the formation. A sample will be collected weekly from the composite production line and analyzed for conductivity, chloride, and uranium. The data will be compiled monthly and reported biannually to the NMED and NRC. When the data indicate that restoration is at or near completion, each original baseline well will be sampled for calcium, sodium, bicarbonate, sulfate, chloride, conductivity, and uranium.

If the well field value for each COC is consistent with the groundwater target restoration goals, previously described, restoration will be considered to be complete and the stability period with begin. Stability will be determined by four sample sets taken at 3-month intervals from the original baseline wells and analyzed for COCs listed in Attachment B-7, Table 4 of the COP. Following successful stability monitoring, HRI will submit a final restoration report to the NMED and NRC for final approval. The restoration report will include the results of all stability monitoring.

2.1.3.6 D&D and Reclamation Activities

D&D will be initiated when the regulatory agencies concur that all of the groundwater within a well field has been restored consistent with appropriate regulations and the water quality is stable. As part of the decommissioning activities and requirements of LC 12.7 of SUA-1580, HRI will submit to the NRC for review and approval a detailed site reclamation plan at least 12 months before planned commencement of D&D. When approved, the plan will amend the license, initiate the D&D process, and provide NRC the detailed information required for evaluation of the proposed decommissioning plan.

The following sections describe the potential D&D and surface reclamation plans for the project.

2.1.3.6.1 Well Fields

Well field D&D will commence when the well field receives NRC and NMED approval for successful aquifer restoration and stability. Well field D&D will include plugging and abandoning wells and removal and decontamination of well field piping, fittings, and other surface equipment.

All wells will be plugged and abandoned in accordance with the procedures described in Section 10.3.3 of the COP. The procedures include removing any piping, pumps, and equipment suspended in the well casing, filling the casing from the total depth to just below the ground surface with approved cement or similar material via a tremmie pipe, cutting the casing approximately 1 m [3 ft] below the ground surface, and restoring and reseeding the disturbed area.

Well field equipment will also be removed, including, injection and production well pipelines, buried electrical cable, and well head covers. Trunk lines, feeder lines, valve manholes, and metering houses also will be removed. Wherever possible, equipment will be decontaminated for release for unrestricted use, including disposal in a nearby municipal landfill or re-use at another ISR facility. In the event that well field equipment cannot be decontaminated to meet standards for unrestricted use, it will be disposed as 11e.(2) byproduct material.

Following well field equipment removal and disposal, the affected areas will be recontoured, topsoil will be replaced, and the areas will be revegetated.

2.1.3.6.2 Topsoil Handling

Topsoil will be removed and stockpiled as necessary in the location of all new facilities (i.e., buildings, ponds). The stockpiles will be revegetated to prevent erosion. During D&D the topsoil will be replaced in the original location and vegetated with an NRC-approved seed mixture, discussed in Section 5.5 of this ER.

2.1.3.6.3 Final Contouring and Revegetation

After completing D&D, HRI will recontour the land surface to provide terrain consistent with the pre-construction land use. All disturbed areas will be reseeded with an NRC-approved seed mixture composed of native plant species. Mulch will be used in any area where water retention, soil temperature, or soil crusting prevent suitable seed germination and growth.

2.1.3.6.4 Procedures for Removing and Disposing of Structures and Equipment

Once ISR processing facilities are no longer required the buildings, equipment, pipelines, and associated materials will undergo D&D as discussed in the following sections.

2.1.3.6.4.1 Preliminary Radiological Surveys and Contamination Control

Any equipment or buildings that can be decontaminated to levels acceptable for unrestricted use will be sold and/or relegated to the surface owner to be used for other purposes. All other equipment, buildings, foundations, piping, and associated support facilities will be removed, and radiation surveys will be conducted over the associated areas. In the well fields, where gamma surveys correlate well with actual radiation concentrations in soil, gamma surveys will be conducted as each well field is decommissioned. Gamma survey results will be compared with background values, and soil samples will be obtained from locations that exhibit elevated gamma readings. Areas exhibiting elevated uranium and radium-226 levels will be decontaminated in accordance with release limits specified in 10 CFR Part 40, Appendix A, Criterion 6(6). Contaminated soil will be disposed as 11e.(2) byproduct material. All survey results will be subject to verification by NRC.

2.1.3.6.4.2 Removal of Process Buildings and Equipment

The majority of equipment in the process building will be reusable, as well as the building itself. Alternatives for the disposition of buildings and equipment will be evaluated, including removal to a new location for future use, removal to another licensed facility for either permanent use or disposal, or decontamination to meet unrestricted release criteria. All potentially contaminated equipment and materials at the satellite facilities and CCP such as tanks, filters, pumps, and piping will be inventoried, listed, and designated as discussed previously. Materials that cannot be decontaminated to meet release criteria will be treated as 11e.(2) byproduct material and disposed at a licensed facility. Cement foundation pads and footings will be broken up and transported to a solid waste disposal site or to a licensed disposal facility, if the residual materials do not meet release criteria in NRC Regulatory Guide 1.86.

2.1.3.6.4.3 Building Materials, Equipment, and Piping Released for Unrestricted Use

Salvageable building materials, equipment, pipe, and structures will be surveyed for alpha contamination, in accordance with NRC guidance. Surface decontamination will be conducted, in accordance with as low as reasonably achievable (ALARA). Decontamination will focus in particular on inaccessible portions of equipment and structures in which radiological materials could have accumulated, such as piping, traps, junctions, and access points. Nonsalvageable contaminated equipment, materials, and dismantled structural sections will be transported to a licensed facility for disposal.

2.1.3.7 Effluents and Waste Management

2.1.3.7.1 Gaseous and Airborne Particulate Emissions

2.1.3.7.1.1 Non-Radioactive Airborne Effluents

During the construction, operation, aquifer restoration, and decommissioning phases of the CUP, non-radioactive airborne effluents will be generated from fugitive dust and combustion engine exhaust. Fugitive dust will occur primarily during construction and decommissioning activities due to transportation on unpaved roads and land disturbance associated with the construction of buildings, well fields, roads, and support facilities. Combustion emissions will result from vehicular exhaust generated from workers commuting to and from the project areas, material transport to and from the project areas, and diesel emissions from drilling rigs, diesel-powered water trucks, and other equipment used during the construction phase. The preliminary emissions inventory for fugitive dust and combustion emissions is described in Section 4.6 of this ER.

2.1.3.7.1.2 Radioactive Airborne Effluents

Radioactive airborne effluents are regulated by NRC through 10 CFR Part 20, Appendix B. The primary potential airborne radioactive effluent is radon-222 gas, which is present in the production zone and can be carried to the surface in the recovered uranium solution. The second-most potentially significant airborne radiological hazard is yellowcake, which is natural uranium, although primarily a heavy metal toxicity hazard, as explicitly stated in 10 CFR § 20.1201(e). The potential airborne hazard from uranium primarily is present during the drying and packaging cycle for yellowcake in the dryer and packaging area of the CCP.

2.1.3.7.1.2.1 Radon Gas

Radon gas may be vented to the atmosphere at various points in the uranium production process. The points of discharge will depend on the technology used at the processing facilities and will be located to minimize the doses received by workers and the public. The use of alternate technologies introduce different sources of possible exposure by radon. Examples of these possible points of discharge include: (1) periodic radon release during loaded resin exchange in pressurized, down-flow IX columns; (2) radon release in waste water; and (3) limited non-routine release of radon from the pressurized reinjection system (e.g., during maintenance activities). HRI will take appropriate measures to monitor and abate radon exposure as required to protect both workers and the public at large. HRI will use pressurized, down-flow IX columns as part of a pressurized ISR system to abate radon exposure to ALARA limits based on the best available technology.

Minor release from the processing facilities will occur when individual pressurized, down-flow IX columns are opened for loaded resin transfer or elution. The amount of radon released will be limited to the fixed quantity of radon dissolved in the water contained in one pressurized, down-flow IX column. Radon escaping from the solution will be vented to the outside air from the vessels through the ventilation system in the ceiling of each processing facility. In-plant monitoring will verify that safe radon working levels are maintained in the processing facilities.

2.1.3.7.1.2.2 Airborne Yellowcake

HRI will use a vacuum dryer in its yellowcake drying and packaging system. The proposed vacuum dryer is designed to be a zero-emission device. As stated in the ISR GEIS, "radon gas is emitted from ISR well fields and processing facilities during operations and is the only radiological airborne effluent for those facilities that use vacuum dryer technology." Therefore, yellowcake emissions to the environment will be minimal at the CUP.

2.1.3.7.2 Liquid Effluents

The CUP will generate several types of liquid waste during all project phases. Liquid waste can be divided into two general categories: AEA-regulated waste and non-AEA-regulated waste. AEA-regulated waste includes wastes meeting the definition of 11e.(2) byproduct material as defined by 10 CFR § 40.4. Section 2.1 of the CUP FEIS describes the liquid effluents. For additional clarification, the following discussion separates liquid effluents into AEA-regulated and non-AEA-regulated liquid waste. AEA-regulated liquid waste at the CUP may include brine and excess product water from the treatment of process bleed and aquifer restoration water, decontamination waste water, spent eluate and other process liquids, and "affected" groundwater generated during well enhancement and maintenance activities. Non-AEA-regulated liquid wastes will include drilling fluids from wells, domestic sewage, liquid hazardous waste, and used oil. The following describes each of the liquid wastes and disposal options. Additional details are presented in Sections 4.13 and 5.13 of this ER and Section 4.0 of the COP.

2.1.3.7.2.1 AEA-Regulated Liquid Wastes

At the CUP brine will be generated by RO treatment of the process bleed and treatment of groundwater from aquifer restoration. Two stages of RO will be used in treating both the process bleed and restoration water. From the second RO phase RO brine will be discharged into lined retention ponds for evaporation or injected into a deep disposal well.

Product water will also be generated from the treatment of both the process bleed and groundwater from aquifer restoration. Most of the product water will be recycled back into the well fields. Excess product water that is not recycled back to operation or restoration activities will be discharged to the lined retention ponds. From the ponds, the excess product water may be used as plant makeup water or injected into the deep disposal wells.

Other 11e.(2) liquid waste includes spent eluate, liquid from drains in the processing facilities, contaminated reagents, loaded resin transfer wash water, filter backwash water, decontamination water, and fluids generated from work over and enhancement operations on injection or production wells. Other 11e.(2) liquid wastes will be evaporated in lined retention ponds or disposed through deep well injection.

The primary method of AEA-regulated liquid waste disposal is evaporation in lined retention ponds. The ponds will be designed and constructed in accordance with the requirements of the NRC Regulatory Guide 3.11 (NRC 2008). Lined pond design, construction, and inspection criteria are provided in Section 2.3 of the COP. All ponds will include double liners and leak detection systems. Daily inspections of the retention ponds and leak detection systems will guard against release of AEA-regulated liquid waste from the lined retention ponds.

The most commonly used method for disposal of AEA-regulated liquid waste is Class I deep disposal wells. These wells typically extend deeper than 1,525 m [5,000 ft], are below any underground sources of drinking water (USDW), and are completed in a horizon where groundwater is not suitable for drinking. An acceptable stratigraphic unit for deep well disposal will be a confined aquifer with total dissolved solids (TDS) concentration greater than 10,000 mg/L. A test well drilled by Mobil/Tennessee Valley Authority (TVA) Crownpoint found that two zones, the Abo and Yeso formations, meet the criteria for deep well disposal. Disposal of waste water using deep well disposal will require a Class I UIC permit from the NMED-GWQ or EPA.

2.1.3.7.2.2 Non-AEA-Regulated Liquid Waste

Non-AEA-regulated liquid wastes will include drilling fluids from wells, domestic sewage, liquid hazardous waste, and used oil. Drilling fluids will be regulated as Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) and disposed in temporary mud pits adjacent to the wells in accordance with NMOSE, NNWCA and EPA requirements.

Domestic sewage from the processing facility office areas will be serviced by a conventional septic tank/leach field systems permitted through the NMED Liquid Waste (Septic Tank) Program. The systems will receive waste water from restrooms, shower facilities, and miscellaneous sinks located throughout the office and change rooms.

Used oil and liquid hazardous waste such as expired laboratory reagants, solvents, cleaners, and degreasers will be stored in secure containers in designated used oil and hazardous waste storage areas. The containers will be compatible with the materials stored and labeled with contents. The used oil and hazardous waste storage areas will include secondary containment designed to contain 110% of the largest tank volume. Used oil and hazardous waste will be transported by an appropriately licensed transport company to an off-site treatment, storage and disposal or recycling facility licensed by the NMED Hazardous Waste Bureau (NMED-HWB).

2.1.3.7.3 Solid Wastes

The CUP will generate several types of solid wastes. The following discusses the sources and methods of accumulation and disposal of AEA-regulated solid waste and non-AEA-regulated solid waste.

2.1.3.7.3.1 AEA-Regulated Solid Waste

AEA-regulated solid waste will include filtrate and spent filter media, sludge from the brine concentrators, scale and sludge from equipment maintenance, contaminated soil, damaged or depleted IX resin, contaminated solids from ISR wells, contaminated PPE, and contaminated materials and equipment from D&D that cannot be decontaminated to levels acceptable for unrestricted use. Within each project area, HRI will maintain an area within the restricted area boundary for storing 11e.(2) byproduct material. These materials will be disposed at a licensed 11e.(2) byproduct material disposal facility. Prior to beginning active ISR operation, HRI will provide NRC with an executed 11e.(2) byproduct material disposal agreement with licensed disposal facility in compliance with NRC staff's interpretation of 10 CFR Part 40, Appendix A, Criterion 2 and required by LC 9.6 of SUA-1580.

2.1.3.7.3.2 Non-AEA-Regulated Solid Waste

Non-AEA-regulated solid wastes generated at the CUP will include construction debris, decontaminated materials and equipment, general office trash, boxes, miscellaneous wood packaging and products, steel, pipes, and solid hazardous waste. These materials will be stored in commercial-sized dumpsters and periodically disposed by a commercial waste disposal operation, except hazardous waste, which will be stored in secure containers in designated hazardous waste storage areas and transported by an appropriately licensed transporter. All non-AEA-regulated solid waste will be managed in accordance with existing regulations and disposed of in a landfill that has been permitted under subtitle D of RCRA or a hazardous waste recycling or disposal facility permitted though NMED or a nearby state.

2.1.3.8 Financial Assurance

Pursuant to 10 CFR Part 40, Appendix A, Criterion 9, HRI has provided a plan for adequate financial assurance for the project. NRC approved revised RAPs for each of the project areas in 2011. HRI will submit annual financial assurance updates to NRC for review and approval in accordance with LC 9.5 of SUA-1580.

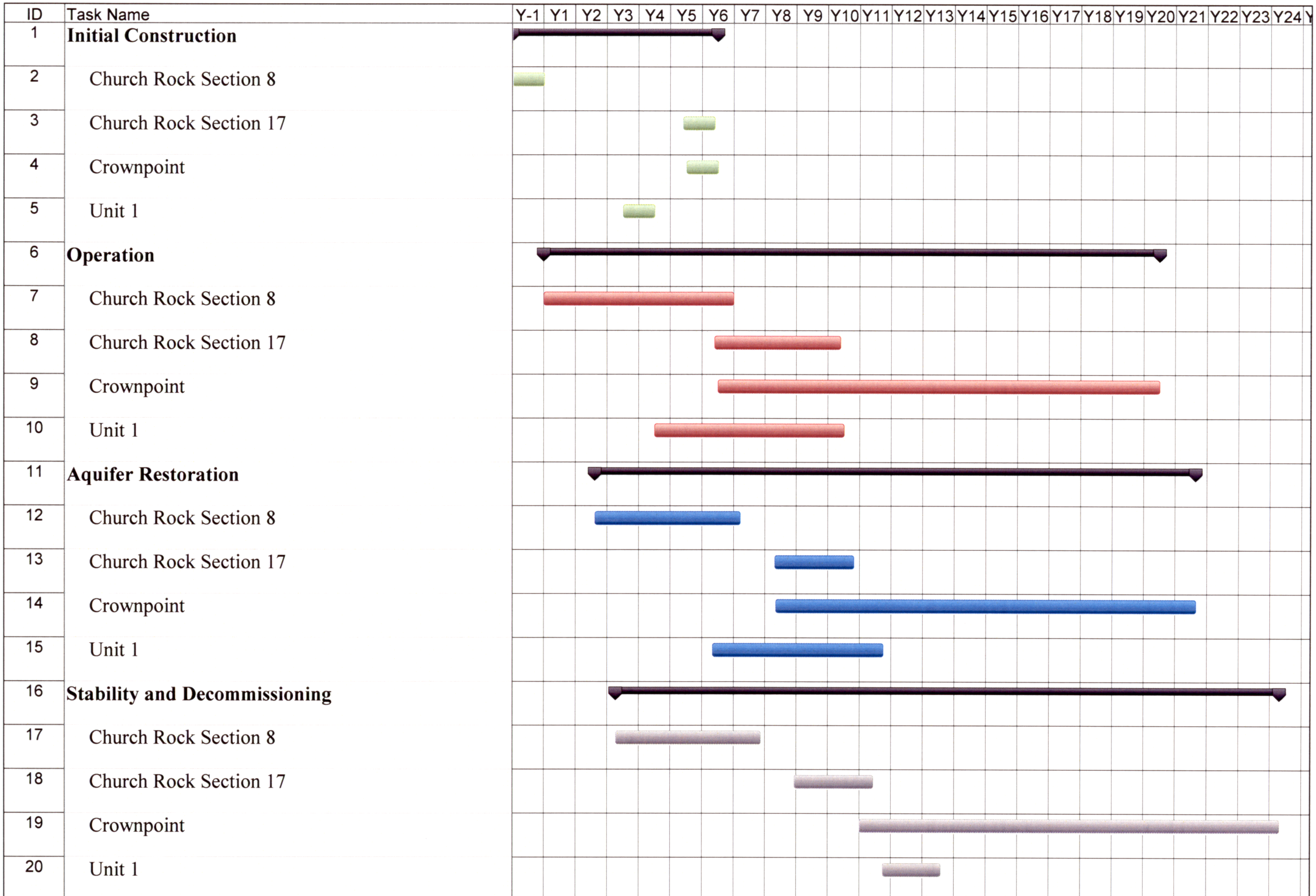

Figure 2.1-1. Proposed CUP Schedule

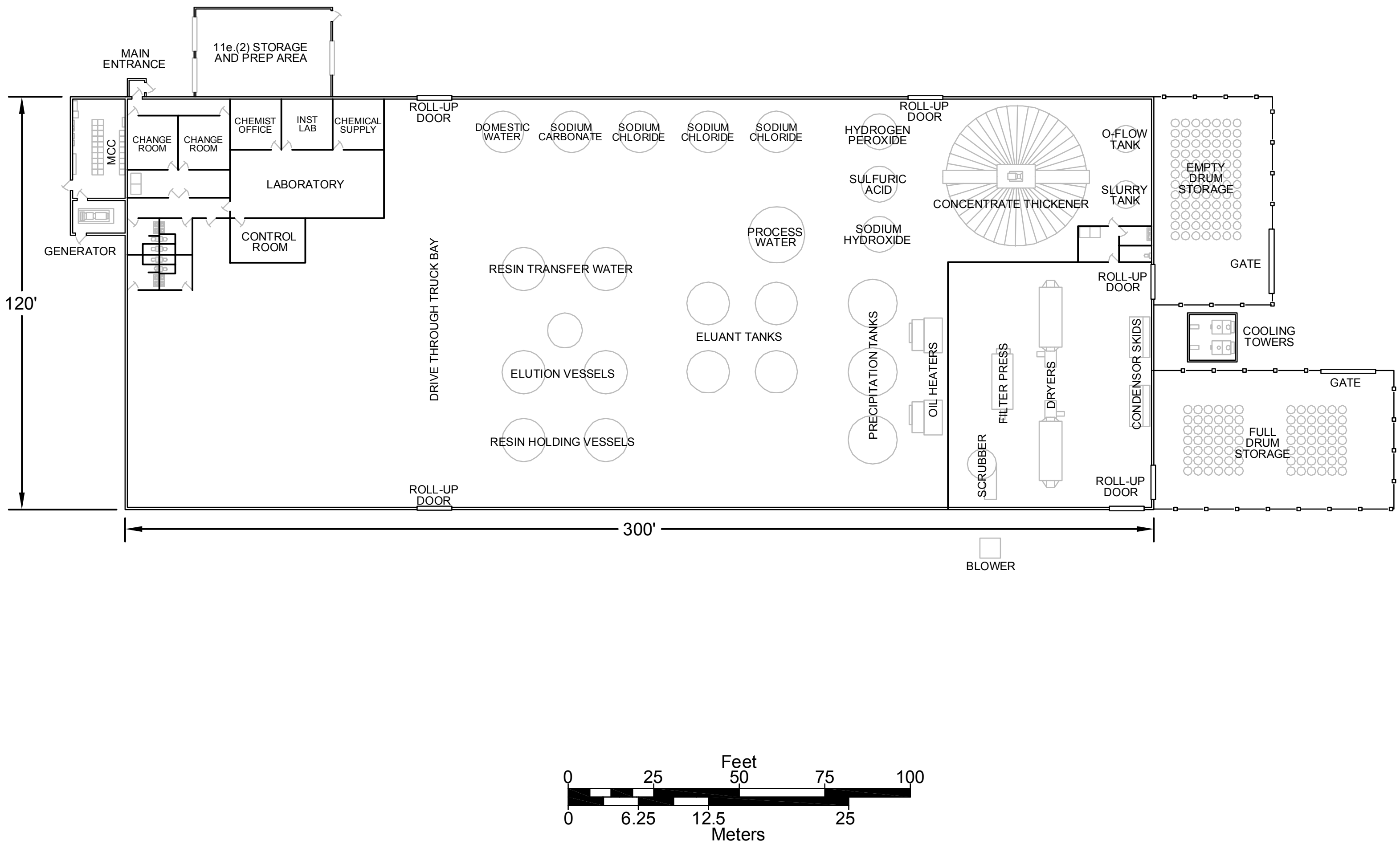

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Figure 2.1-2. Schematic of CCP.

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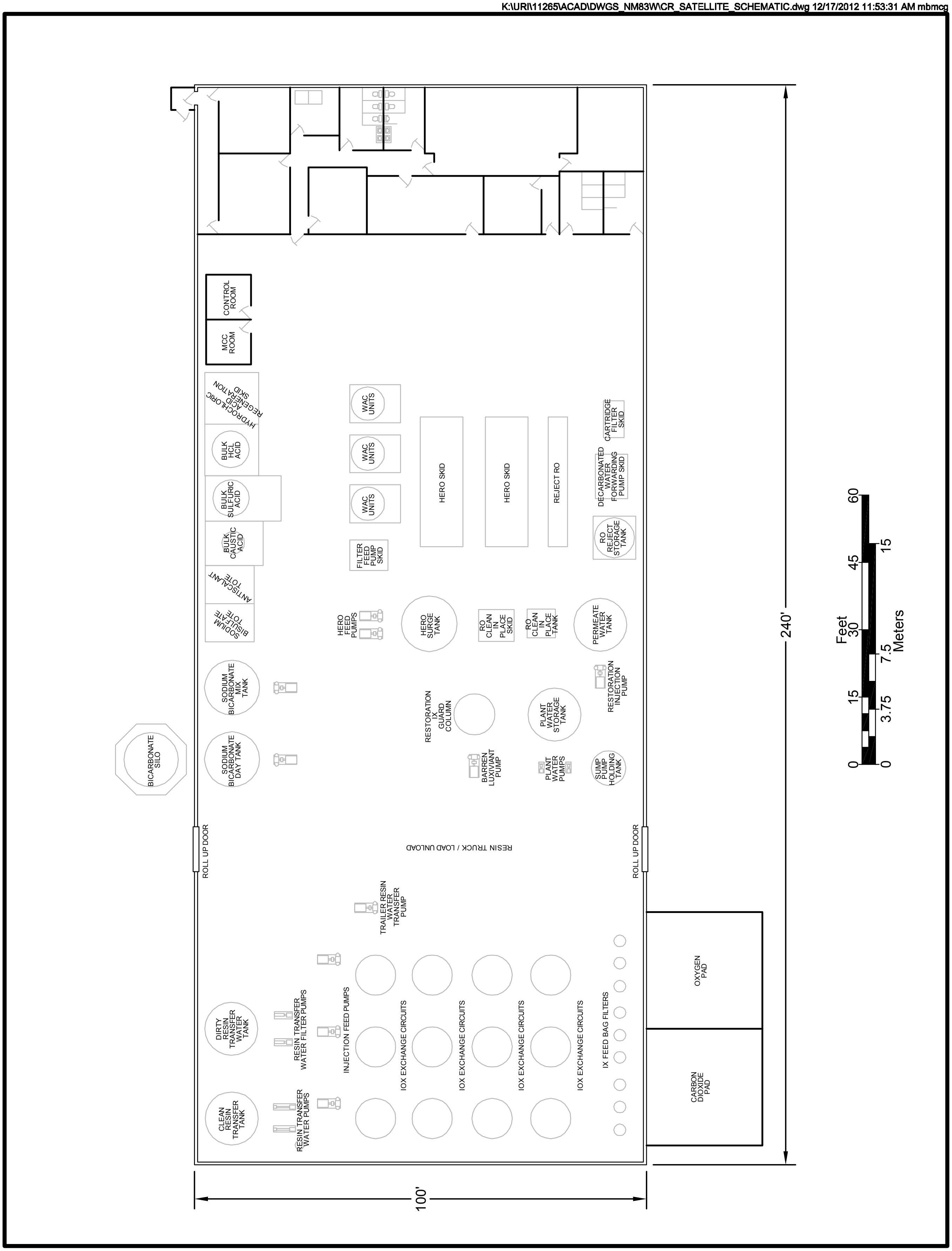


Figure 2.1-3. Typical Satellite Facility Schematic.

2.2 Cumulative Impacts

Detailed discussions on potential cumulative impacts related to the CUP are included in Section 4.13 of the CUP FEIS. Section 5 of the ISR GEIS includes general information regarding potential cumulative impacts in northwestern New Mexico. The discussions below are arranged by resource (in accordance with guidance provided in NUREG-1748). Discussions on reasonably foreseeable future actions (RFFAs) have been expanded. The following sections include summaries of the potential cumulative impacts presented in the CUP FEIS and the ISR GEIS as well as any potential cumulative impacts evaluated since the CUP FEIS was published. Due to the potential localized impacts to some of the resources related to the distance between the project areas, cumulative impacts for land use, transportation, surface water, and groundwater resources appear to be project area specific. Therefore, the cumulative impacts discussions for these resources are presented by project area. The cumulative impacts discussions for all other resources do not appear to be project area specific and therefore are combined to include the overall CUP.

2.2.1 Introduction

The Council on Environmental Quality (CEQ) NEPA regulations, as amended (40 CFR Parts 1500–1508) define cumulative impact as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions occurring over time." Cumulative impacts result from the incremental impacts of an action added to other past, present, and RFFAs, regardless of who is responsible for such actions. This section considers the cumulative effects analysis presented in Chapter 5 of the ISR GEIS and affirms that the potential cumulative effects of the CUP are within the range of cumulative effects considered in the ISR GEIS and other NEPA documents that address activities within the region of influence.

Establishing the appropriate "scope" of the cumulative effects portion of an impact study is a fundamental feature of planning and conducting such a study for an ISR project. The CEQ NEPA regulations in 40 CFR § 1508.25 indicate that "Scope consists of the range of actions …" to be considered in a NEPA compliance document. CEQ regulations in 40 CFR § 1508.25 identify the following three types of actions for consideration, which all pertain to ISR projects:

- Connected actions are closely related and should be discussed in the same environmental impact statement (EIS), supplemental EIS (SEIS), or EA. The multiple activities of an ISR project illustrate connected actions. Such actions are interdependent parts of a larger action (the overall ISR project) and depend on the larger action for their justification.
- Cumulative actions, when viewed with other proposed actions, have cumulatively significant impacts and should therefore be discussed in the same NEPA compliance document. Cumulative actions could include future planned expansion of the proposed ISR facility, proposals for other new ISR projects in the same geographic areas, and relicensing of nearby existing ISR projects.

- Similar actions, when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a way to evaluate their environmental consequences together, such as common timing, geography, or impacts on common resources. Similar actions could include other local or regional energy or industrial development projects or land usage activities that could impact the same resources potentially affected by the proposed ISR project.

2.2.2 Other Past, Present, and RFFAs Associated with the CUP

Following is a discussion of known past, present, and RFFAs within 80 km [50 mi] of the CUP that may cumulatively impact resources potentially impacted by the CUP. These include uranium, aggregate pits, potential precious metals projects, existing and potential future coal mines, humate mines, and oil and gas projects. The project facility type, project owner, location, and distance to the CUP are provided in Table 2.2-1. The locations of the past, present, and RFFAs are depicted on Figure 2.2-1.

2.2.2.1 Uranium Projects

Presently there are no operating uranium mines or mills in New Mexico (NRC 2012a). The CUP (SUA-1580) is the only facility in New Mexico currently licensed by the NRC. Five uranium recovery license applications are anticipated within 80 km [50 mi] of the CUP, and two other sites have been targeted for uranium exploration. In addition, there are three decommissioned mines, and two decommissioned uranium mill sites, and one decommissioned mine/mill site within 80 km [50 mi] of the CUP (Table 2.2-2). These sites are shown on Figure 2.2-1.

As indicated in Table 2.2-1, the closest potential uranium recovery facility is approximately 27 km [17 mi] from the nearest portion of the CUP (Figure 2.2-1). Three of the six decommissioned uranium sites are currently EPA superfund sites and are undergoing remediation. The Northeast Church Rock Mine (NECR) and the Northeast Church Rock Quivira Mine superfund sites are located approximately 3.2 km [2 mi] northeast of the Church Rock Sections 8 and 17 project areas. The other uranium superfund site is a decommissioned mill sites that is over 40 km [25 mi] from the nearest portion of the CUP (Figure 2.2-1).

2.2.2.2 Non-Uranium Related Projects

Other past, present, and RFFAs within 80 km [50 mi] of the CUP include aggregate (scoria, aggregate, and limestone) pits, precious metals, surface coal mines, humate mines, and oil and gas development.

While aggregates and precious metals have been produced in McKinley County, there are no pits within 24 km [15 mi] of the CUP (Table 2.2-1 and Figure 2.2-1). Aggregates are recovered using surface strip mining techniques.

Coal and humate (humic acid-rich carbonaceous shale or claystone) have been produced in McKinley County and are mined using surface strip mining techniques. Areas and strata of highest coal potential include: 1) the Fruitland Formation in the Star Lake area in the extreme northeast part of the county; 2) Menefee coals in the San Mateo and eastern Standing Rock coal fields northwest of Grants; 3) Crevasse Canyon coals in the Gallup coal field northeast and south of Gallup; and 4) Crevasse Canyon coals in the Crownpoint field (NMBGMR 2002). The nearest coal mine to the CUP is the El Segundo Mine, approximately 29 km [18 mi] east of the Crownpoint project area (Figure 2.2-1). El Segundo began coal production in 2008 and shipped 6.6 million tons in 2010 (Peabody Energy 2012a). The mine supplies coal to the Arizona Public Service for power generation. The Lee Ranch Mine is located approximately 48 km [30 mi] southeast of the Crownpoint project area. Lee Ranch was opened in 1984 and shipped 1.7 million tons of coal in 2011 (Peabody Energy 2012b). The mine supplies coal to Western Fuels Association and Tucson Electric Power, Arizona Public Service, Arizona Electric Power Cooperative, and Catalyst Paper. In 2011, the McKinley Mine focused on final reclamation activities and was inducted into the New Mexico Mining Association Mining Hall of Fame in recognition of the restoration efforts (Chevron 2012). Humate mined in New Mexico is typically sold as a soil conditioner. The closest humate mine is approximately 27 km [17 mi] west-southwest of the Church Rock Sections 8 and 17 project areas (Figure 2.2-1).

Conventional oil and gas have been produced from McKinley County, primarily from the Chaco Slope in the northeast portion of the county (NMBGMR 2002). Four stratigraphic units have been productive: 1) sandstones in the Cretaceous-age Menefee Formation of the Mesaverde Group; 2) the Cretaceous-age Hospah Sands of the Mancos Shale; 3) the Cretaceous-age Dakota Sandstone; and 4) the Jurassic-age Entrada Sandstone. According to the New Mexico Oil Conservation Division, approximately 31,000 bbl of oil and 227,000 mcf of conventional gas were produced in McKinley County in 2011 (NMOCD 2012). Most of the conventional oil and gas is produced from formations structurally above the target zones for uranium ISR in the CUP. Conventional oil and gas production areas within 80 km [50 mi] of the CUP are depicted on Figure 2.2-2. An abandoned oil refinery is located near I-40 northeast of Grants (Figure 2.2-1). This site is an EPA superfund site that is currently undergoing remediation. Coalbed natural gas (CBNG) is being produced from McKinley County with the principal target being Menefee coals in the far northeastern part of the county at depths exceeding 305 m [1,000 ft] (NMBGMR 2002). The coal seams are generally structurally above the target zones for uranium ISR in the CUP. Approximately 216,000 mcf of CBNG were produced in McKinley County in 2011 (NMOCD 2012).

2.2.2.3 EISs as Indicators of Present and RFFAs

One indicator of present and RFFAs in the area is the number of draft and final EISs prepared by federal agencies within a recent time period. A query of the EPA EIS database between January 1, 2008 and May 2, 2012 indicated that there are two final EISs and two associated draft EISs within McKinley and Cibola counties (EPA 2012a). Table 2.2-3 lists the specific project-related EISs for the region.

2.2.3 Concurrent Actions

2.2.3.1 Land Use

Although construction and operation of the CUP will have potential impacts on land use at each of the project areas, the potential impacts will be relatively small and temporary because of the limited disturbance areas, sequential, phased nature of construction and operation, D&D, and reclamation, which will return the project areas to previous land uses. As indicated in Section

4.13.8 of the CUP FEIS, the CUP will not make a significant contribution to cumulative land use impacts in the region. Potential project-specific cumulative land use impacts are discussed below.

2.2.3.1.1 Crownpoint

The primary uses of the land within the Crownpoint project area are rangeland (grassland and shrubland), transportation, industrial, and low intensity residential. There are 19 occupied dwellings located within the project area, with additional residences located within 3.2 km [2 mi] of the project area. No residents will be required to relocate due to activities within the Crownpoint project area. During construction livestock grazing will be prohibited within well fields, processing facilities and ponds. These areas will be fenced throughout the project. HRI anticipates production at the Crownpoint project area will last 14 years and aquifer restoration is expected to be complete within 13.3 years. Following decommissioning the land will return to the current land uses. No public right-of-way will be established during construction. The combination of existing land disturbance, new, temporary disturbance related to the Crownpoint project area, and disturbance from RFFAs is not expected to represent a potentially significant cumulative impact.

2.2.3.1.2 Unit 1

The project area comprises rangeland (grassland and shrubland) and single family dwellings. The Unit 1 project area is composed of allotted land administered by the BIA. There are 23 occupied dwellings located within the project area, with additional residences located within 3.2 km [2 mi] miles of the project area. During construction livestock grazing will be prohibited within well fields, processing facilities and ponds. These areas will be fenced throughout the project. Production in the Unit 1 project area is expected to last 6 years, while aquifer restoration will be complete in approximately 5.4 years. No residents will be required to relocate due to activities within the Unit 1 project area. The combination of existing land disturbance, new, temporary disturbance related to Unit 1, and disturbance from RFFAs is not expected to represent a potentially significant cumulative impact.

2.2.3.1.3 Church Rock Sections 8 and 17

The primary use of the land within the Church Rock Sections 8 and 17 project areas is rangeland with small areas of industrial, residential, and evergreen forest. There are three occupied dwellings located within the project areas, with additional residences located within 3.2 km [2 mi] of the project areas. No residents will be required to relocate due to activities within the Church Rock Sections 8 and 17 project areas. During construction livestock grazing will be prohibited within well fields, processing facilities and ponds. These areas will be fenced throughout the project. Production and aquifer restoration in the Church Rock Section 8 project area is expected to last 6 and 4.6 years, respectively. The Church Rock Section 17 project area is anticipated to continue production for 4 years. Aquifer restoration in the Church Rock Section 17 project is expected to be complete in 2.5 years. Following decommissioning the land will return to the current land uses. No public right-of-way will be established during construction. The combination of existing land disturbance, new, temporary disturbance related to the Church Rock

Sections 8 and 17 project areas, and disturbance from RFFAs is not expected to represent a potentially significant cumulative impact.

2.2.3.2 Transportation

The CUP will increase the passenger vehicle and heavy truck traffic on some roads in the vicinity of the CUP. According to Section 4.13.5 of the CUP FEIS, the transportation related contribution from the CUP to the cumulative impacts of other past, present, and RFFAs is not expected to be significant. In addition, there are no RFFAs that will combine with the CUP to significantly increase local transportation risks due to the distance between the CUP and RFFAs. Potential project-specific cumulative transportation impacts are discussed below.

2.2.3.2.1 Crownpoint

The primary access to the Crownpoint project area is south from CR 47 (Crownpoint Drive). Most of the potential transportation impacts will occur during construction and operation due to higher employee counts. During aquifer restoration and decommissioning passenger vehicle and heavy truck traffic will decrease along with potential transportation impacts as compared to the construction and operation phases. Overall, the increased traffic will not contribute significantly to cumulative impacts of other past, present, and RFFAs. Shipments of yellowcake, loaded resin, 11e.(2) byproduct material, hazardous waste, solid waste, and process chemicals will contribute to increasing transportation risks on roads accessing the Crownpoint project area. According to Section 4.13.5 of the CUP FEIS, the contribution from the CUP to the cumulative impacts of other past, present, and RFFAs is not expected to be significant. In addition, there are no RFFAs that will combine with the project area to significantly increase local transportation risks due to the distance between the Crownpoint project area and RFFAs.

2.2.3.2.2 Unit 1

The most significant impact will be to Navajo 11, which will be used to access the Unit 1 project area. Most of the potential transportation impacts will occur during construction and operation due to higher employee counts. During aquifer restoration and decommissioning passenger vehicle and heavy truck traffic will decrease along with potential transportation impacts as compared to the construction and operation phases. Overall, the increased traffic will not contribute significantly to cumulative impacts of other past, present, and RFFAs. Shipments of yellowcake, loaded resin, 11e.(2) byproduct material, hazardous waste, solid waste, and process chemicals will contribute to increasing transportation risks on roads accessing the Unit 1 project area. According to Section 4.13.5 of the CUP FEIS, the contribution from the CUP to the cumulative impacts of other past, present, and RFFAs is not expected to be significant. In addition, there are no RFFAs that will combine with the project to significantly increase local transportation risks due to the distance between the Unit 1 project area and RFFAs.

2.2.3.2.3 Church Rock Sections 8 and 17

The primary access to the Church Rock Sections 8 and 17 project areas is west from NM 566. Most of the potential transportation impacts will occur during construction and operation due to higher employee counts. During aquifer restoration and decommissioning passenger vehicle and heavy truck traffic will decrease along with potential transportation impacts as compared to the construction and operation phases. Overall, the increased traffic will not contribute significantly to cumulative impacts of other past, present, and RFFAs. Shipments of yellowcake, loaded resin, 11e.(2) byproduct material, hazardous waste, solid waste, and process chemicals will contribute to increasing transportation risks on roads accessing the Church Rock Sections 8 and 17 project areas. According to Section 4.13.5 of the CUP FEIS, the contribution from the CUP to the cumulative impacts of other past, present, and RFFAs is not expected to be significant. In addition, there are no RFFAs that will combine with the project to significantly increase local transportation risks due to the distance between the Church Rock Sections 8 and 17 project areas and RFFAs.

2.2.3.3 Geology and Soils

The regional geology and soils are described in Section 3.2 of this ER. The region's geology has been affected, and could be affected in the future, by underground uranium mining activities. The Church Rock Section 17 project area was developed previously as an underground mine and drilling and groundwater flow associated with any future projects could combine with preexisting mine workings to affect geology. According to Section 4.13.2 of the CUP FEIS, NRC staff does not believe that this combination will create a significant cumulative impact.

The region's soils also have been affected by underground uranium mining and could be affected in the future by both underground and ISR uranium recovery. At the Church Rock Sections 8 and 17 project areas, the site topography was changed by underground mining as a result of pond and shaft construction. Underground mining at the OCRM site (within the Church Rock Section 17 project area) also resulted in off-site impacts to soils as a result of the creation of a uranium mill and tailings pile north of the site. The mill has been dismantled and decommissioned and the tailings pile has been stabilized and reclaimed. Residual impacts from historical uranium recovery will be considered when determining background levels of radionuclides in the soil at the proposed project areas. According to 10 CFR Part 40, Appendix A, Criterion 6(6), radioactive contamination of soils associated with uranium recovery operations occurring at levels exceeding background by 5 pCi/g of radium-226 (the benchmark dose) contamination must be remediated. Radiological emissions from the spoilage on the Church Rock Section 17 project area from the OCRM were litigated and determined by the ASLBP (63 NRC 41 [2006] LBP-06-1) to be considered as background radiation; however, HRI has committed to the Navajo Nation to clean-up the Church Rock Section 17 project area prior to construction. HRI will characterize the site and remove or remediate spoilage with elevated radium-226 to standards acceptable to the Navajo Nation. These standards will be levels that do not pose any public or occupational health risks. According to Section 4.13.2 of the CUP FEIS, the CUP's contribution to cumulative impacts on soils is likely to be small and temporary.

2.2.3.4 Surface Water

The surface water bodies in the area are ephemeral in nature and there is a relatively low level of surface disturbance associated with the CUP. In addition, there are no RFFAs that would combine with the CUP to significantly impact surface water quality or quantity. As stated in Section 4.13.4 of the CUP FEIS, the CUP will not make a significant contribution to cumulative impacts on surface water in the region. Potential project-specific cumulative surface-water impacts are discussed below.

2.2.3.4.1 Crownpoint

Surface-water hydrology within the Crownpoint project area is described in Sections 3.4.1.2 of this ER. A man-made channel diverts storm water runoff along the southern boundary of the Crownpoint project area in a westerly direction away from three existing ponds. Results of modeling conducted by URI indicated that all three ponds would be inundated by the probably maximum flood (PMF) due to the limited capacity of the existing diversion channel. Section 5.4.1 of this ER describes the flood protection mitigation measures and indicates that HRI will not use the lowest pond and riprap will be added to the man-made diversion channel. Downstream use of surface water is limited to occasional livestock watering. It is unlikely that wetlands occur within the area due to the lack of surface water. Since the potential impacts to surface water within the Crownpoint project area will be SMALL during all phases of the project, the Crownpoint project will not make a significant contribution to cumulative impacts on surface water in the region.

2.2.3.4.2 Unit 1

Surface-water hydrology within the Unit 1 project area is described in Sections 3.4.1.2 of this ER. The surface-water features in the Unit 1 project area consist of two shallow arroyos roughly 20 feet deep. URI analyzed the potential impacts to surface water within the Unit 1 project area and determined that these impacts would be SMALL during all phases of the project. Downstream use of surface water is limited to occasional livestock watering. It is unlikely that wetlands occur within the area due to the lack of surface water. As such, the Unit 1 project will not make a significant contribution to cumulative impacts on surface water in the region.

2.2.3.4.3 Church Rock Sections 8 and 17

Surface-water hydrology within the Church Rock Sections 8 and 17 project areas is described in Sections 3.4.1.3 of this ER. Surface-water features within the Church Rock Sections 8 and 17 project areas include a small unnamed arroyo draining a small watershed that originates in the sandstone highlands to the north and five ponds with earthen embankments previously used as settling ponds by UNC in the 1970s. URI analyzed the potential impacts to surface water within the Church Rock Sections 8 and 17 project areas and determined that these impacts would be SMALL during all phases of the project. Downstream use of surface water is limited to occasional livestock watering. It is unlikely that wetlands occur within the area due to the lack of surface water. As such, the Church Rock Sections 8 and 17 projects will not make a significant contribution to cumulative impacts on surface water in the region.

2.2.3.5 Groundwater

Future actions that could contribute to cumulative impacts on groundwater in the region include potential conventional and ISR uranium recovery. The uranium deposit associated with the CUP extends from the Church Rock Sections 8 and 17 project areas to east-southeast of the Crownpoint project area. The depth of the uranium deposits in the vicinity of the project areas means that any future recovery activities probably will use underground or ISR techniques, as opposed to surface mining techniques. Since these deposits are in the Westwater Canyon aquifer, it is reasonable to assume that this aquifer will be most affected by future uranium recovery activities.

The primary goal for aquifer restoration is to restore the water to the groundwater protection standards presented in 10 CFR Part 40, Appendix A, Criterion 5(B)(5) on a constituent-by-constituent basis using BPT. If the restoration activities are unable to achieve background or MCL (whichever is greater) in Criterion 5(B)(5), HRI will return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR § 141.62 or 143.3, but only after demonstrating that there are no specific hazards and the restored constituent concentrations are ALARA.

Potential impacts to water supply wells surrounding existing NRC-licensed operating ISR facilities were evaluated by NRC staff in a report entitled "Data on Groundwater Impacts at the Existing ISR Facilities" (NRC 2009b). The report concluded the following:

> "Based on a review of historical licensing documentation, the number of excursions reported for the three existing NRC-licensed operating facilities and the duration of the excursions constitute a small percentage of the total number of samples analyzed over that period. The data indicate that excursions have been controlled by the pumping and injection processes. In some cases, the excursions continued for several years. The impact to groundwater was investigated for each long-term excursion and it was determined that the associated impact did not pose a threat to human health or the environment."

Potential project-specific cumulative groundwater impacts are discussed below.

2.2.3.5.1 Crownpoint and Unit 1

Groundwater hydrology within the Crownpoint and Unit 1 project areas is described in Section 3.4.3.2 of this ER. Proposed uranium ISR activities at the Crownpoint and Unit 1 project areas will change the chemistry of the groundwater in the exempted portions of the Westwater Canyon aquifer. During operation and aquifer restoration, modern techniques will make it highly unlikely that any adjacent, non-exempt portions of this aquifer will be affected adversely. If the town of Crownpoint experiences growth and continues to obtain its drinking water from the Westwater Canyon aquifer, the town wells will have increased influence on the direction of groundwater flow, water levels, and groundwater velocities in the Westwater Canyon aquifer. As indicated in the CUP FEIS (Section 4.13.3), the CUP has the potential to make a significant contribution to cumulative impacts on groundwater in the region, but license conditions attached to SUA-1580 will mitigate these potential impacts. In particular, LC 10.27 requires that HRI replace the town of Crownpoint water supply wells prior to the commencing operations at the Crownpoint project area.

2.2.3.5.2 Church Rock Sections 8 and 17

Groundwater hydrology within the Church Rock Sections 8 and 17 project areas are described in Section 3.4.3.3 of this ER. Proposed uranium ISR activities at the Church Rock Sections 8 and 17 project areas will change the chemistry of the groundwater in the exempted portions of the Westwater Canyon aquifer. Past actions that have contributed to cumulative impacts on groundwater in the region include underground uranium mining at the OCRM site, which dewatered the Westwater Canyon aquifer and the Brushy Basin "B" Sand aquifer in the area of the existing workings and may have had some dewatering effects on the Dakota Sandstone aquifer. Dewatering effects lowered water levels in these aquifers for some distance around the workings and may have oxidized some of the rock around the workings by exposing it to the atmosphere. When mining stopped, the workings flooded, and groundwater levels returned to pre-mining levels after several years. According to Section 4.13.3 of the CUP FEIS, water quality in the workings probably was degraded to some extent, but groundwater quality outside the mine workings does not appear to have been affected. As indicated in the CUP FEIS (Section 4.13.3), the CUP has the potential to make a significant contribution to cumulative impacts on groundwater in the region, but license conditions attached to SUA-1580 will mitigate these potential impacts.

2.2.3.6 Ecology

Much of the project areas and the region already have been affected by past actions including livestock grazing and uranium mining and milling. The amount of land that will be disturbed temporarily by the CUP (land disturbance will be the primary source of any potential impacts to ecological resources) is small relative to the amount of similar wildlife habitat available in the region. Also, the land disturbed by the CUP will be reclaimed and revegetated after successful aquifer restoration. Compared to past conventional uranium mining and milling operations in the area, the CUP will limit potential impacts by avoiding the ecologically damaging consequences of open-pit mining and/or ore tailings production. In addition, there are no RFFAs that will combine with the CUP to create significant cumulative impacts on ecological resources. As indicated in Section 4.13.7 of the CUP FEIS, the CUP will contribute to ecological impacts in the region, but the cumulative impacts of this contribution combined with other past, present, and future actions are not expected to be significant.

2.2.3.7 Air Quality and Noise

Since existing air quality in the vicinity of the CUP is good (generally in compliance with NAAQS), the CUP FEIS (Section 4.1) indicates that impacts of the CUP on air quality are expected to be small. There are no RFFAs that will combine with the CUP to significantly impact air quality. As stated in Section 4.13.1 of the CUP FEIS, the development of the CUP will not make a significant contribution to cumulative impacts on air quality in the region.

The CUP will generate some additional noise in the immediate vicinity of the CUP project areas. As a result of the natural conditions (e.g., remote location of the project area and the low population density) and the noise control proposed by HRI (see Section 5.7 of this ER) noise impacts will be SMALL. According to Section 4.13.1 of the CUP FEIS, the combination of existing background noise, noise from the CUP, and noise from RFFAs is not expected to represent a significant cumulative impact.

2.2.3.8 Cultural Resources

Section 3.8.3 of this ER provides a detailed discussion on the Section 106 (36 CFR § 800.3) process that is required for a NEPA analysis. NRC has completed the Section 106 process for the initial phase (5-year disturbance plan) of development in the CUP and cultural resources have been adequately addressed. The CUP will not contribute to effects on archaeological resources outside the project areas or traditional cultural properties (TCPs) located beyond the immediate vicinity of the CUP. As indicated in Section 4.13.11 of the CUP FEIS, significant effects to cultural resources will not result from the CUP.

2.2.3.9 Visual and Scenic Resources

The natural aridity and soil conditions of the area, coupled with livestock grazing, have resulted in overgrazed, rolling sparse grasslands interspersed with pinyon pines or junipers. Other actions, including uranium mining and milling, road construction, and urban and residential development, also have had visual impacts in the area. These past activities will continue to impact the regional visual and scenic resources. The CUP will contribute to visual and scenic resources impacts in the region but, as stated in Section 4.13.10 of the CUP FEIS, the cumulative impacts of this contribution combined with other past, present, and future actions are not expected to be significant.

2.2.3.10 Socioeconomics

As described in Section 4.13.9 of the CUP FEIS, the CUP will make a positive contribution to cumulative socioeconomic impacts in the region. The CUP will provide the long-term benefits of employment, wages, and tax revenues without major adverse impacts to housing or the local infrastructure. Impacts that will occur to the local infrastructure (e.g., the need to replace BIA and Navajo Tribal Utility Authority (NTUA) water supply wells in Crownpoint) will be mitigated by LC 10.27 of SUA-1580 that requires HRI to replace these wells. In terms of present and future actions, no other large projects or developments have been identified in the region that could combine with the CUP to create adverse socioeconomic impacts.

2.2.3.11 Public and Occupational Health and Safety

As indicated in Section 4.13.6 of the CUP FEIS, the CUP will make a minor contribution to cumulative impacts in terms of public and occupational health and safety impacts. Annual doses to the population within 80 km [50 mi] of the project areas from air releases have been estimated as part of the MILDOS-AREA calculations. The total annual population dose was estimated for the period in time of greatest releases from the project areas. Two population dose estimates were calculated: one for the Crownpoint/Unit 1 project areas and one for the Church Rock Sections 8 and 17 project areas. As the area of impact is similar for both calculations, the results were combined with a total population dose calculated at less than 0.01 mSv/yr [1 mrem/yr]. Population dose resulting from ISR operations represent less than 1% of the dose from natural background sources.

According to the CUP FEIS, the CUP will result in a negligible increase in cumulative impacts in the area due to past uranium mining and milling. The uranium ISR process, by its nature, results in small amounts of 11e.(2) byproduct material and very limited environmental releases of radioactive particulate material. HRI will use a vacuum dryer, which reduces the total releases of radon gas and radioactive particulates to nearly zero, and a pressurized process circuit with a feedback system to return radon to the production zone, which will reduce environmental radon releases. The expected exposures from the remaining possible sources of radon are a very small fraction of the allowable limits for exposure of the public.

The CUP will have the potential to impact local emergency services. HRI will coordinate with emergency service providers in the area to ensure that personnel are trained to respond adequately to the accidental releases of radioactive materials or accidents involving radioactive material.

The CUP will contribute to public and occupational health and safety impacts in the region but, as described in Section 4.13.6 of the CUP FEIS, the cumulative impacts of this contribution combined with other past, present, and future actions are not expected to be significant.

2.2.3.12 Waste Management

Section 4.13 of this ER provides a detailed discussion of potential waste management impacts related to the CUP. Liquid and solid wastes are divided into two general categories: AEA-regulated waste and non-AEA-regulated waste. AEA-regulated waste will include liquids and solids meeting the definition of 11e.(2) byproduct material as defined by 10 CFR § 40.4. AEA-regulated liquid wastes may include brine, excess product water, decontamination waste water, spent eluate and other process liquids. AEA-regulated solid waste will include process solids (e.g., filter media), contaminated soil, and parts, equipment, debris, and PPE that cannot be decontaminated for unrestricted use. Non-AEA regulated waste generated at the project areas will include solid waste (e.g., office trash, boxes, miscellaneous wood packaging and products, steel, and pipes), used oil, hazardous waste (e.g., fluorescent light bulbs, cleaners and degreasers), TENORM (drilling fluids and drill cuttings from monitor wells and from the construction and development of production and injection wells prior to operation), and domestic sewage.

The treatment and disposal methods described in Section 4.13 of the ER are effective at separating wastes to reduce waste volumes destined for disposal at an approved facility, thereby reducing waste-related environmental impacts. Specific SUA-1580 license conditions associated with waste management are described in Section 4.13 of the ER. Since State permitting actions, NRC license conditions, and NRC inspections ensure proper practices will be used, the potential CUP waste management impacts will be small. The CUP will contribute to waste management impacts in the region, but these impacts combined with other past, present, and future actions are not expected to be significant.

2.2.3.13 Environmental Justice

The environmental justice analysis described in Section 4.12 of the CUP FEIS is, to a great extent, a cumulative analysis in that it considers the local community's previous experience with natural resource development activities, particularly uranium mining and milling. The NRC staff requirements and recommendations will reduce the severity and likelihood of impacts. As indicated in Section 4.13.12 of the CUP FEIS, no cumulative environmental justice impacts are anticipated. According to a decision by the ASLBP (LBP-99-30), the CUP will not impose any adverse impacts on the communities of Crownpoint and Church Rock.

Table 2.2-1. Past, Present, and RFFAs within 80 km [50 mi] of the CUP

Commodity	Owner	Facility Type	County	Distance from CUP[1] (Air km)	Status
Aggregate					
Hard Rock Pit (Scoria)	Bill's Enterprises	Surface Pit	McKinley	39	Active
Jim Stephens Pit (Scoria)	Jim Stephens, Inc.	Surface Pit	McKinley	42	Active
Prewitt-Elkins Material Source (Limestone)	FNF Construction	Surface Pit	McKinley	43	Active
San Antone Quarry (Limestone, Aggregate)	Gallup Sand and Gravel LLC	Surface Pit	McKinley	26	Active
Tinaja Pit (Limestone)	C & E Concrete, Inc.	Surface Pit	Cibola	70	Active
Coal					
El Segundo Mine	Peabody Natural Resources	Surface Strip Mine	McKinley	29	Active
Lee Ranch Mine	Peabody Natural Resources	Surface Strip Mine	McKinley	48	Active
McKinley Mine	Chevron	Surface Strip Mine	McKinley	35	Reclamation
Humate					
Black Springs (Jaramille)	Anasazi Stone, LLC	Surface Strip Mine	McKinley	72	Active
Pueblo Alto	Mesa Verde Resources	Surface Strip Mine	McKinley	60	Active
Star Lake Menefee	Menefee Mining Corporation	Surface Strip Mine	McKinley	69	Active
Star Lake Mesa Verde	Mesa Verde Resources	Surface Strip Mine	McKinley	62	Active
U-Mate	U-Mate International, Inc.	Surface Strip Mine	McKinley	28	Active
Power Plant					
Escalante	Tri-State Generation and Transmission	Coal Fired	McKinley	29	Active
Precious Metals					
Eric # 1	Mr. Robert March	--	Cibola	52	Exploration
Uranium					
Ambrosia Lake	Rio Algom Mining, LLC	Mill	McKinley	39	Decommissioned/ LTSM
Elizabeth Claims	Neutron Energy	TBD	McKinley	44	Exploration
Homestake Mill	Homestake Mining Company	Mill	Cibola	53	Decommissioned/ Superfund Site
Juan Tafoya	Neutron Energy	Conventional	McKinley	75	App. Pending
Grants Ridge	Uranium Energy Corporation	Heap Leach	McKinley	47	App. Pending
La Jara Mesa	Laramide Resources	Conventional	Cibola	55	App. Pending
Mt. Taylor	Rio Grande Resources	Conventional	McKinley	54	App. Pending
Northeast Church Rock Mine/Mill	United Nuclear Corporation	Conventional/Mill	McKinley	5	Decommissioned Superfund Site
NE Church Rock Quivira Mine	Rio Algom Mining, LLC	Conventional	McKinley	5	Decommissioned Superfund Site
Old Church Rock Mine/Mill	United Nuclear Corporation	Conventional/Mill	McKinley	0	Decommissioned
Roca Honda	Roca Honda Resources, LLC	Conventional	McKinley	56	App. Pending
Section 6	Ree-Co Uranium LP	TBD	McKinley	28	Exploration
Section 27	United Nuclear Corporation	Conventional	McKinley	44	Decommissioned
Oil Refinery					
Prewitt Refinery	British Petroleum and El Paso Natural Gas	Oil Refinery	McKinley	36	Abandoned Superfund Site

[1] Distance calculated from the nearest project area boundary
TBD – To be determined
LTSM - Long-term surveillance and maintenance
See Figure 2.2-1 for project locations
Sources: NMENRD 2012a, NMENRD 2012b

Table 2.2-2. Past, Present and RFFA Uranium Facilities within 80 km [50 mi] of the CUP.

Facility Name	Owner	Facility Type	Status	Estimated Reserves (mm Tons)
Ambrosia Lake	Rio Algom Mining, LLC	Mill	Decommissioned/ LTSM Disposal	--
Elizabeth Claims	Neutron Energy	TBD	Exploration	--
Homestake Mill	Homestake Mining Company	Mill	Decommissioned/ Superfund Site	--
Juan Tafoya	Neutron Energy	Conventional	App. Pending	4.2
Grants Ridge	Uranium Energy Corporation	Heap Leach	App. Pending	Unknown
La Jara Mesa	Laramide Resources	Conventional	App. Pending	10.4[1]
Mt. Taylor	Rio Grande Resources	Conventional	App. Pending	100
Northeast Church Rock Mine/Mill	United Nuclear Corporation	Conventional/Mill	Decommissioned Superfund Site	--
NE Church Rock Quivira Mine	Rio Algom Mining LLC	Conventional	Decommissioned Superfund Site	--
Old Church Rock Mine/Mill	United Nuclear Corporation	Conventional/Mill	Decommissioned	--
Roca Honda	Roca Honda Resources, LLC	Conventional	App. Pending	15.8[1]
Section 6	Ree-Co Uranium LP	TBD	Exploration	--
Section 27	United Nuclear Corporation	Conventional	Decommissioned	--

[1] Measured and indicated plus inferred
TBD – To be determined
LTSM - Long-term surveillance and maintenance
Sources: Investors Hub 2012, Laramide Resource Ltd 2012, Rio Grande Resource 2012, Strathmore Minerals Corp. 2012

Table 2.2-3. Draft and Final EISs Related to the CUP (in Chronological Order from January 2008 to May 2012)

Date	Statement
July 10, 2009	Rinconada Communication Site, Designation of Site to Serve Present and Future High Power Communication Needs and to Permit the Development of a Radio Transmission Facility within Site, Mt. Taylor Ranger District, Cibola National Forest, Cibola County, NM. Draft EIS.
April 2, 2010	McKinley County Easement - Forest Roads 191 and 191D, Implementation, Cibola National Forest, McKinley County, NM. Draft EIS.
May 6, 2011	Rinconada Communication Site, Designation of Site to Serve Present and Future High Power Communication Needs and to Permit the Development of a Radio Transmission Facility within Site, Mt. Taylor Ranger District, Cibola National Forest, Cibola County, NM. Final EIS.
July 8, 2011	McKinley County Easement - Forest Roads 191 and 191D, Implementation, Cibola National Forest, McKinley County, NM. Final EIS.

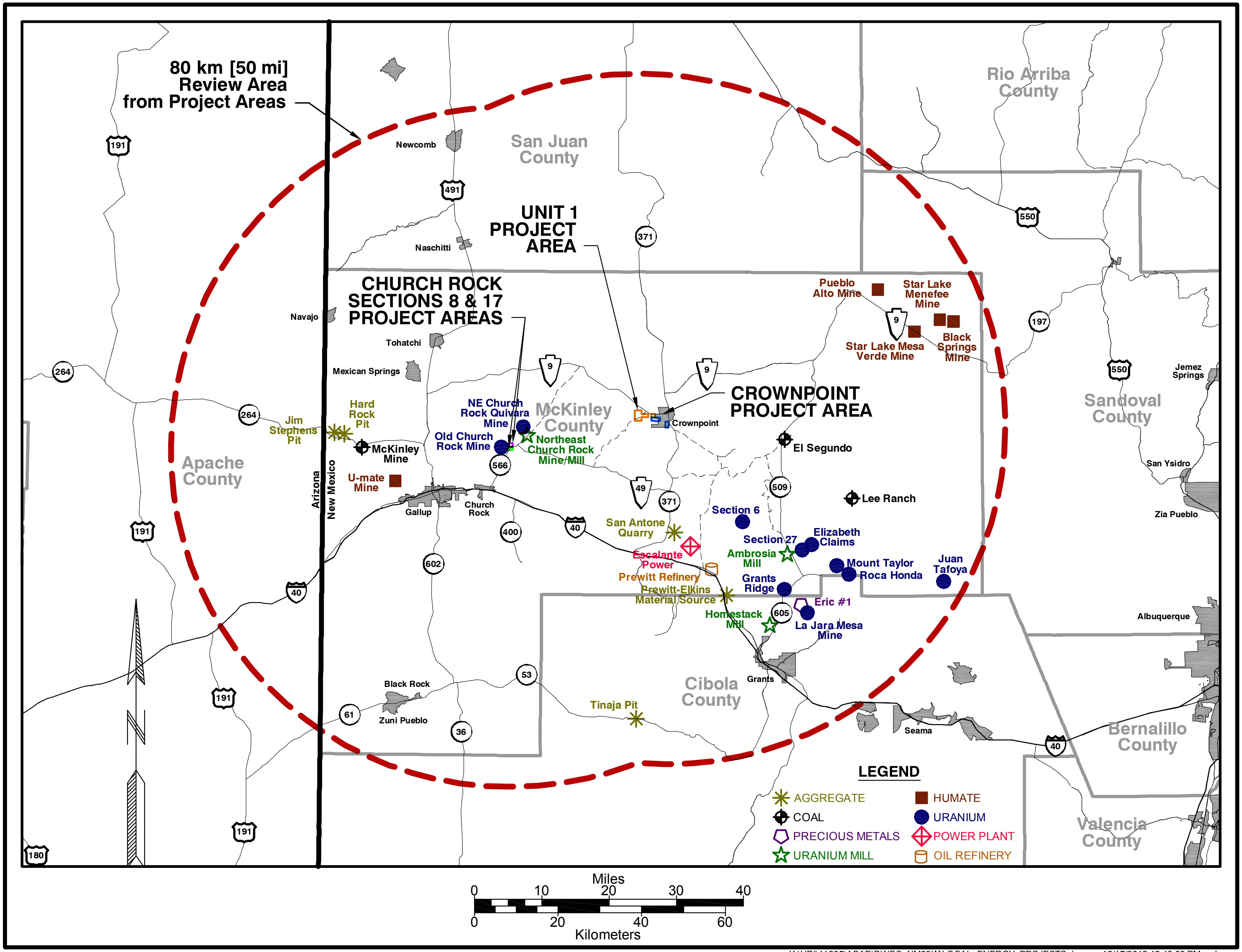
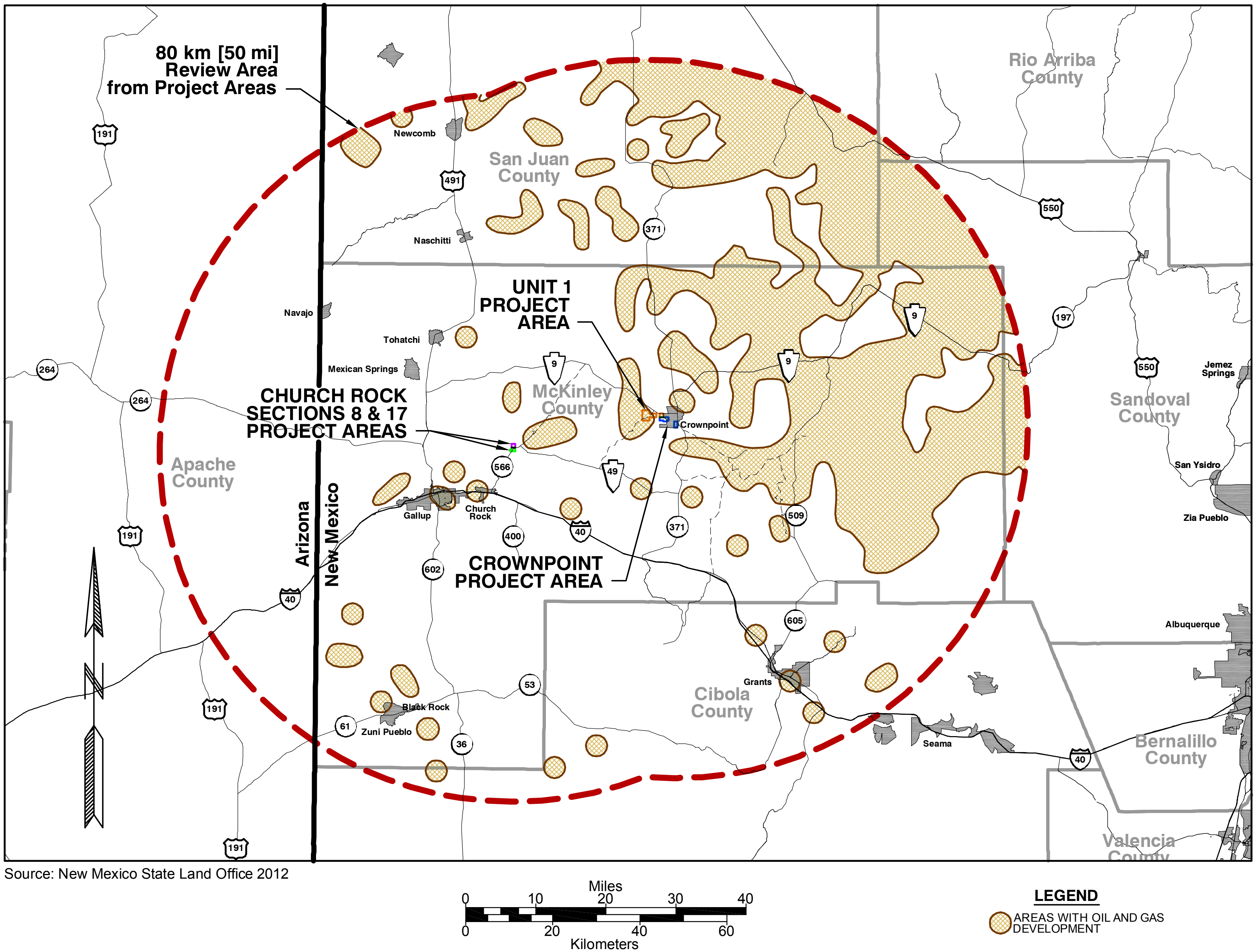


Figure 2.2-1. Past, Present, and RFFAs within 80 Km [50 mi] of the CUP.



Source: New Mexico State Land Office 2012

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Figure 2.2-2. Oil and Gas Development within 80 km [50 mi] of the CUP.

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 Land Use

Section 3.6 of the CUP FEIS provides a general discussion of regional and project area land use. The following provides additional details regarding agriculture and recreation within McKinley County obtained since the CUP FEIS was published in 1997. In addition, a detailed discussion of each project area is presented, including land use classifications and residences within and surrounding the project areas. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to land use.

3.1.1 Regional

3.1.1.1 General Setting

As described in Section 3.6 of the CUP FEIS, the project areas are located in McKinley County, New Mexico. The general locations of the project areas are shown on Figure 1.2-1. The CUP is located in the Northwestern New Mexico Uranium Milling Region as defined by the ISR GEIS.

McKinley County encompasses approximately 14,153 km^2 [5,463 mi^2] and had a 2010 population of 71,492 (USCB 2012a). Much of the land ownership in McKinley County is referred to as "checkerboard." These areas resemble a patchwork of Indian and non-Indian land. Surface ownership in McKinley County is primarily Indian or Tribal Trust land. Table 3.1-1 presents the land status of McKinley County.

3.1.1.2 Agriculture

Section 3.5.1 of the ISR GEIS describes that the majority of the land in McKinley County is used for agricultural purposes (85%) with 83% of agricultural land used for livestock grazing. Results of the 2007 Census of Agriculture show that the number and average size of farms within McKinley County has changed since 2002, while the farm land area has remained the same. Between 2002 and 2007 the number of farms in McKinley County increased from 150 to 2,624, while the average farm size decreased from 8,555 ha [21,132 ac] to 489 ha [1,209 ac] (USDA 2012). The change in number and size of farms is due to changes in the 2007 agricultural census versus previous agricultural censuses. In the 2007 agricultural census, Native American farmers living on reservations were enumerated as individual proprietors rather than as one large tribal farm. In addition, record high prices for many agricultural commodities which increased sale values, resulted in the large increase in the number of farms reported (Slutz 2010).

In 2007, livestock and crop sales generated $7.8 million for McKinley County (USDA 2012). The county ranks first in the state for numbers of sheep, cattle and horses. According to the most recent agricultural census data (2007), there are about 42,000 sheep, 34,000 cows, 15,500 goats and 6,000 horses in McKinley County.

3.1.1.3 Recreation

Recreation in McKinley County and surrounding areas includes camping, fishing, and cultural and historic areas. Recreation areas in the vicinity of the CUP are depicted on Figure 3.1-1 and include Red Rocks State Park, Chaco Culture National Historic Park, Bluewater Lake State Park, and the Cibola National Forest.

3.1.2 Crownpoint

The Crownpoint project area is located adjacent to the town of Crownpoint (2010 population 2,278). The project area is approximately 92 km [57 mi] northeast of Gallup (2010 population 21,678) and approximately 90 km [56 mi] northwest of Grants (2010 population 9,182). Nearby hospitals include the Crownpoint Health Care Facility in Crownpoint, Cibola General Hospital in Grants, and Gallup Indian Medical Center and Rehoboth McKinley Christian Health Care Services in Gallup.

Surface ownership within the Crownpoint project area is depicted on Figure 3.1-2 and includes BLM, tribal trust, and land owned by HRI. Areas of existing disturbance within the project area include roads and the existing facilities and settling ponds. CR 47 (Crownpoint Drive) accessing the facility also provides access to several public buildings serving the Crownpoint community.

Land use within the project area is depicted on Figure 3.1-3 and has not changed since the CUP FEIS was published. Within the project area, land uses include rangeland (grassland and shrubland), transportation, industrial, and low intensity residential. The following describes the land use categories (USGS 2012a).

- Grasslands/Herbaceous: Areas dominated by upland grasses and forbs. These areas are not subject to intensive management, but they often are utilized for grazing.
- Shrubland: Areas dominated by shrubs. These areas are not subject to intensive management, but they often are utilized for grazing.
- Commercial/Industrial/Transportation: Includes infrastructure (e.g., roads, railroads, etc.).
- Low Intensity Residential: Includes areas with a mixture of constructed materials and vegetation. These areas most commonly include single-family housing units.

There are 19 occupied dwellings located within the project area, with additional residences located within 3.2 km [2 mi] of the project area but outside the town of Crownpoint. These are depicted on Figure 3.1-4. In addition, since the project area is adjacent to the town of Crownpoint, there are additional residences and businesses in close proximity to the project area.

3.1.3 Unit 1

The Unit 1 project area is located approximately 3.2 km [2 mi] west of the town of Crownpoint. Surface ownership within the project area includes allotments held in trust for the use of individual Navajo (Figure 3.1-5). The allotments are administered through the BIA.

Land use within the project area is depicted on Figure 3.1-6. The project area comprises rangeland (grassland and shrubland) with several single family dwellings. Existing disturbance within the project area includes Navajo 11, unpaved, and two-track roads. As described in Section 3.6.3 of the CUP FEIS, Mobil Oil completed exploratory drilling throughout Unit 1 and a commercial scale ISR well field in Sections 15 and 16 in the late 1970s. Aquifer tests were conducted and baseline water quality samples were collected; however, the well field was never operated. The wells have since been plugged and abandoned in accordance with NMOSE and NNWCA, as discussed in Section 3.4 of this ER.

There are 23 dwellings within the Unit 1 project area, with additional dwellings located within 3.2 km [2 mi] of the project area as shown as Figure 3.1-4. The town of Crownpoint is also within the 3.2 km [2 mi] area surrounding the project area.

3.1.4 Church Rock Sections 8 and 17

The Church Rock Sections 8 and 17 project areas are located approximately 10 km [6 mi] north of the town of Church Rock (2010 population 1,128). Other populated areas near the project areas include Gallup (18 km [11 mi] southwest of the project areas) and Grants (100 km [62 mi] southeast of the project areas).

Surface ownership within the project areas is provided on Figure 3.1-7 and includes private land owned by HRI and Tribal Trust land. The status of Church Rock Section 8 was litigated extensively to determine if it was “Indian county.” In 2010, the U.S. Court of Appeals for the 10th Circuit ruled that Church Rock Section 8 is not “Indian country”.

Land use in the project areas is depicted on Figure 3.1-8 and includes rangeland with small areas of industrial, residential, and evergreen forest. Existing disturbance within the Church Rock Section 17 project area includes the remnants of the OCRM and various unpaved roads. The OCRM was an underground uranium mine operated by United Nuclear Corporation (UNC) until 1982. Remaining portions of the mine that are visible today include the mine shafts, ponds, and one building.

Three dwellings are present within the Church Rock Section 17 project area, and several more dwellings are located within 3.2 km [2 mi] of the project areas as depicted on Figure 3.1-9.

Table 3.1-1. McKinley County Land Status

	Total Area	**Federal**	**State**	**Trust Land**	**Private**
km^2	14,153	2,018	684	8,415	3,036
ha	1,415,419	201,779	68,375	841,527	303,738
Portion of Total	100%	14.3%	4.8%	59.5%	21.5%

Source: McKinley County 2005

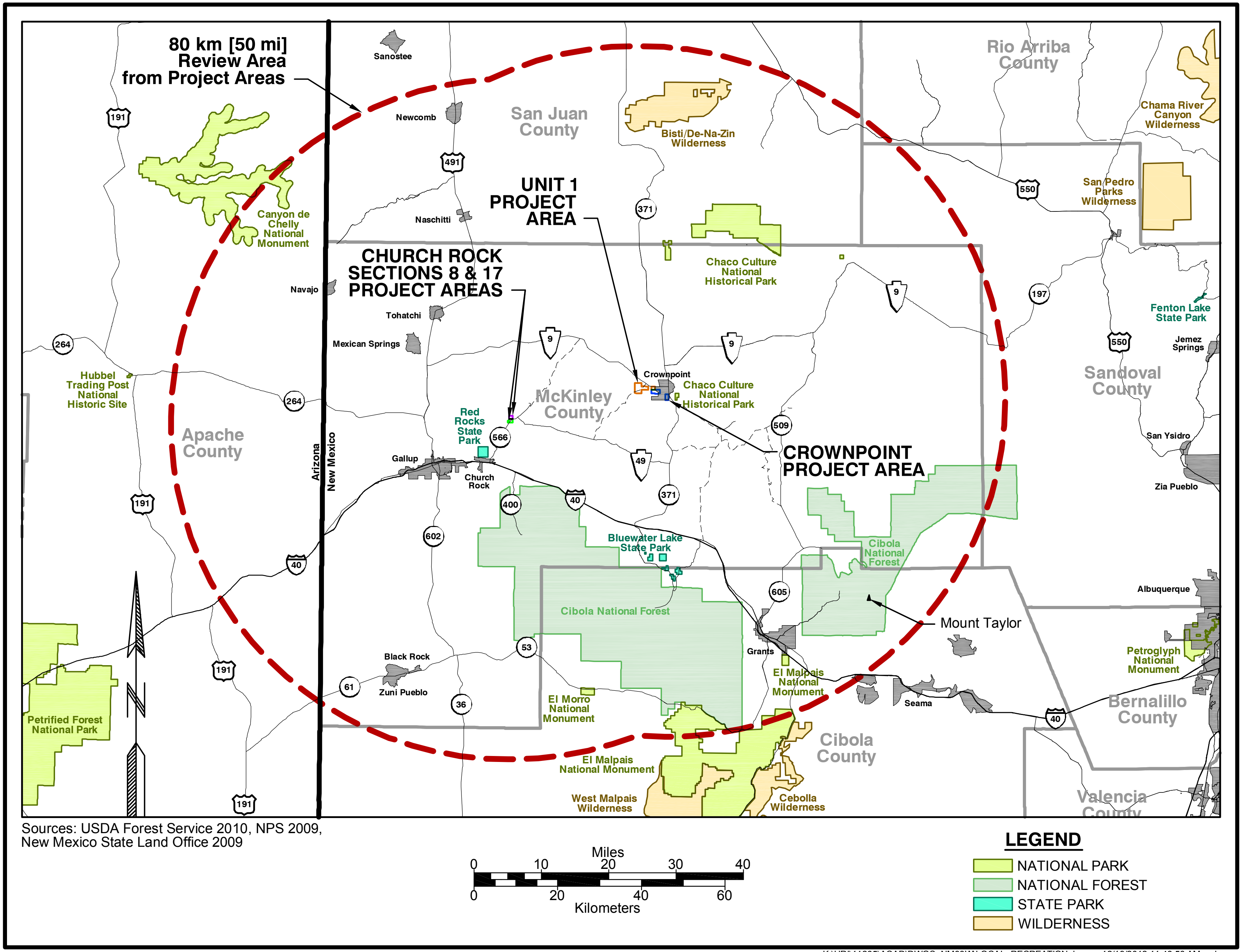

Figure 3.1-1. Major Recreation Areas near the CUP.

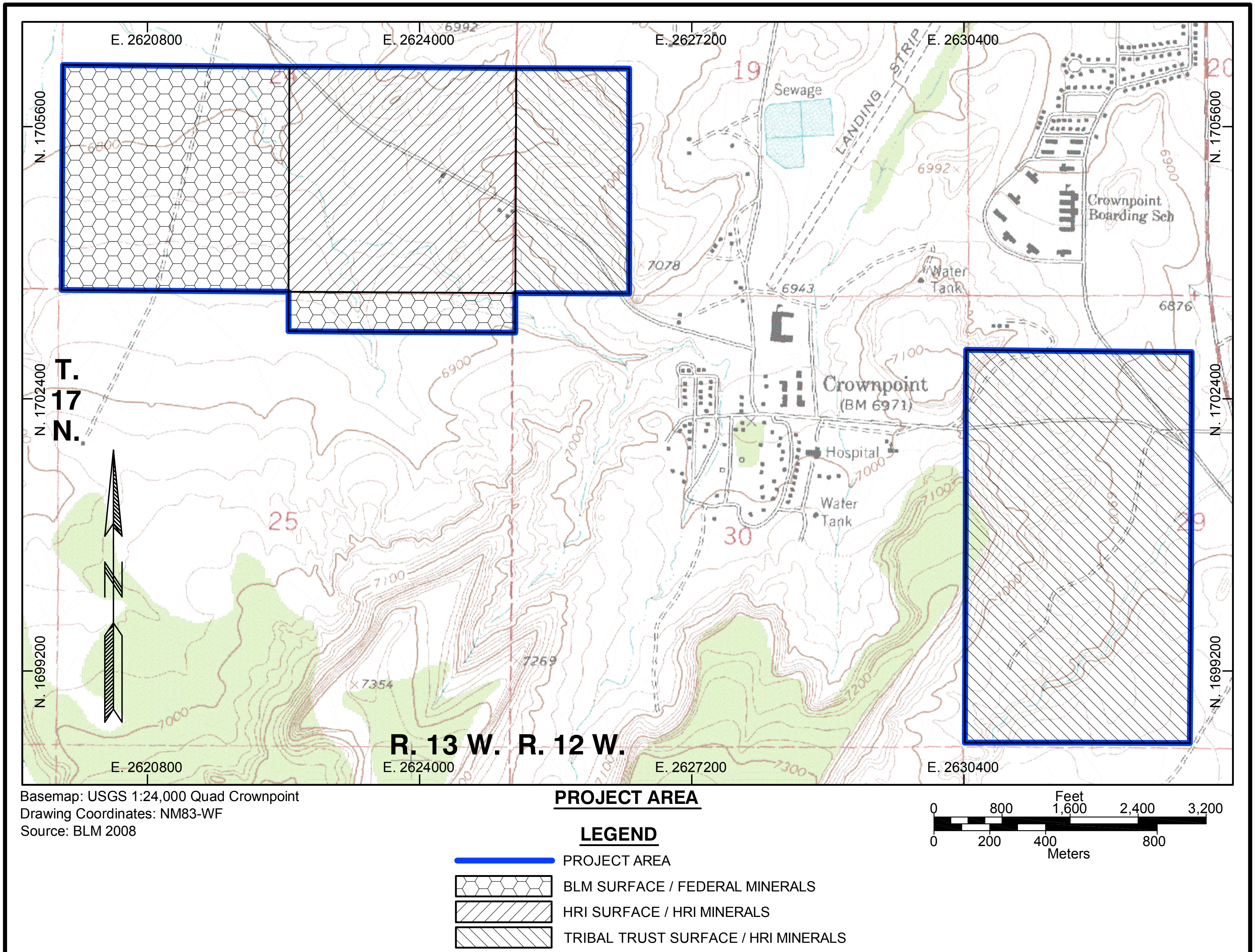

Figure 3.1-2. Surface and Mineral Ownership within the Crownpoint Project Area.

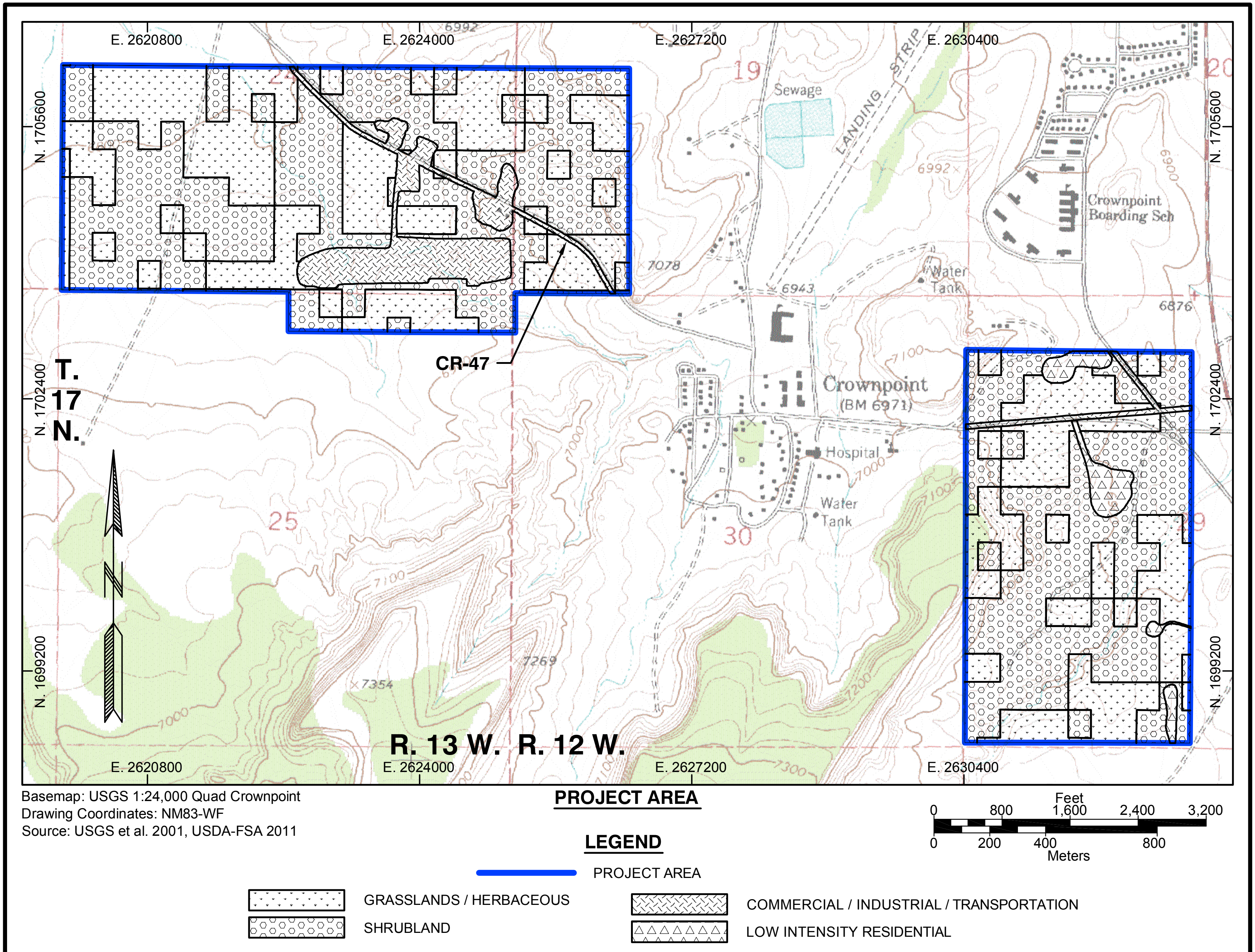

Figure 3.1-3. Land Use within the Crownpoint Project Area.

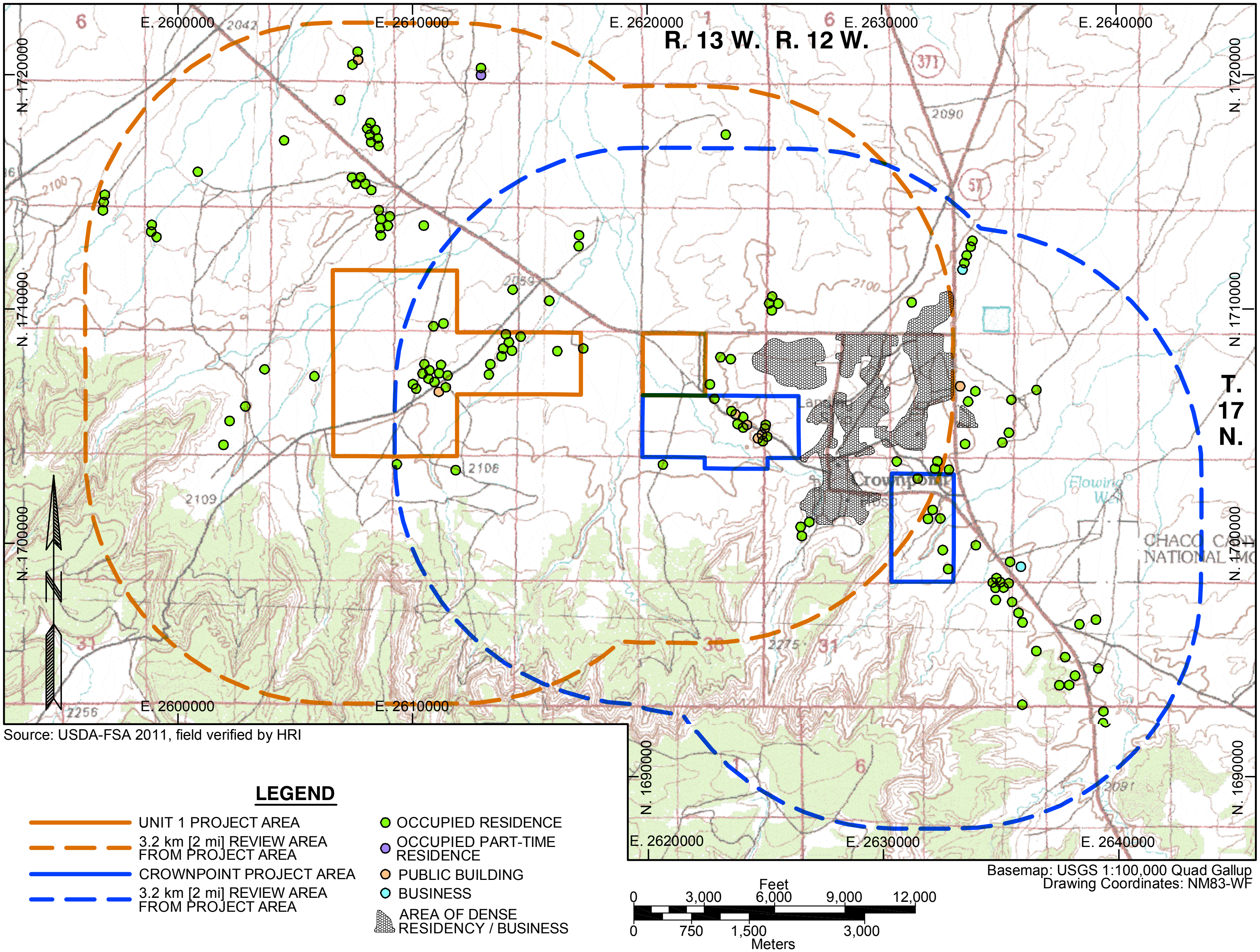

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Figure 3.1-4. Dwellings within 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas.

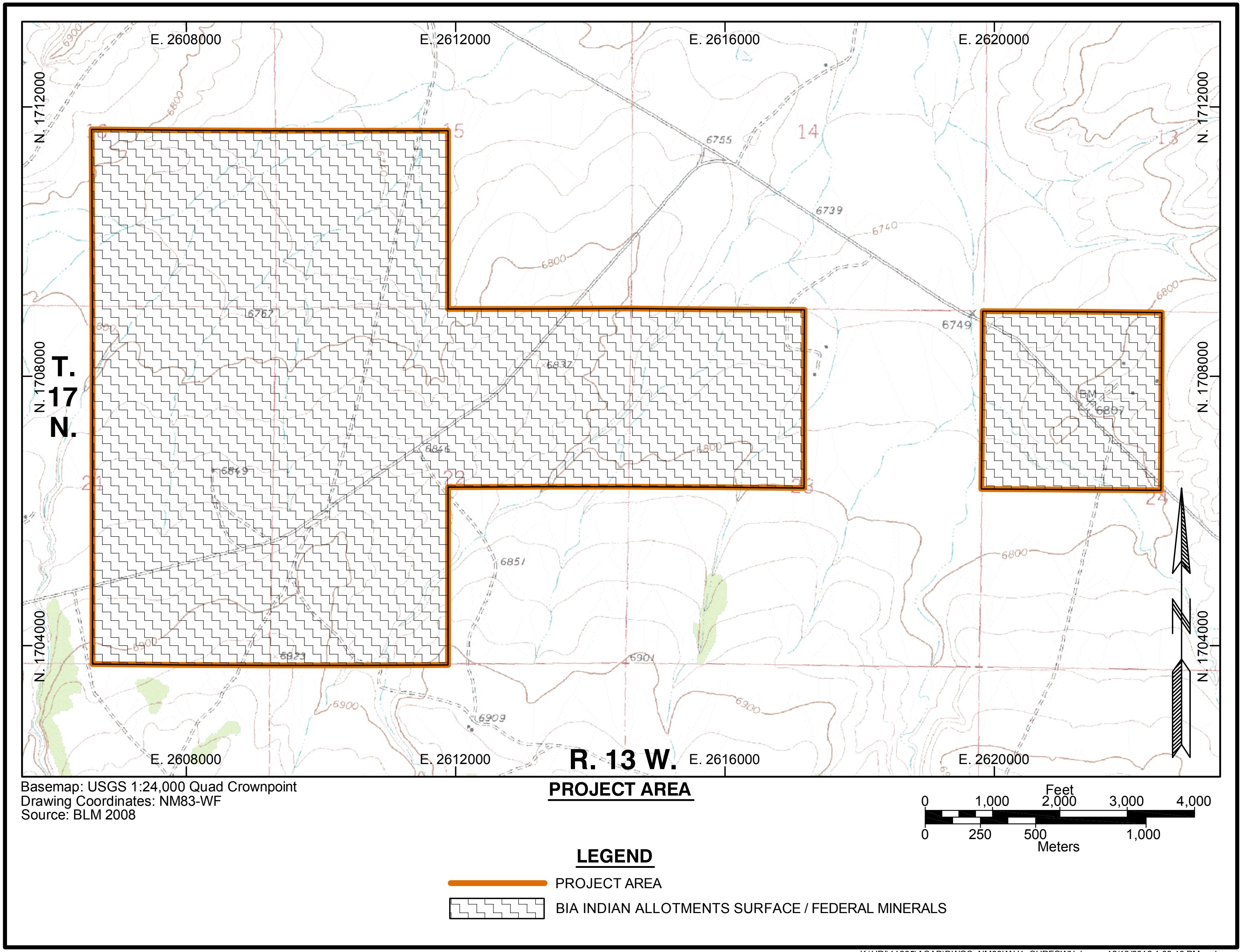

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Figure 3.1-5. Surface and Mineral Ownership within the Unit 1 Project Area.

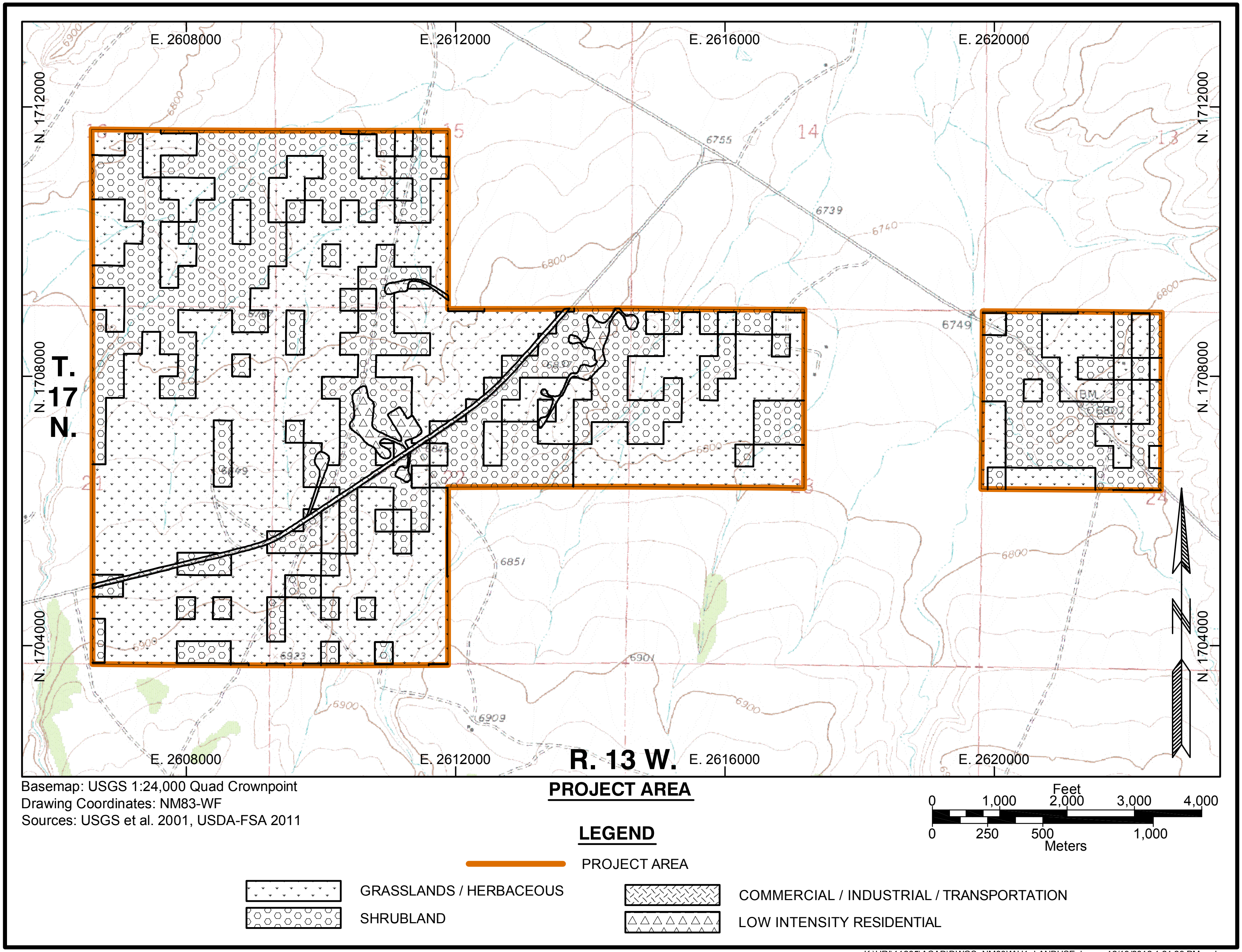

Figure 3.1-6. Land Use within the Unit 1 Project Area.

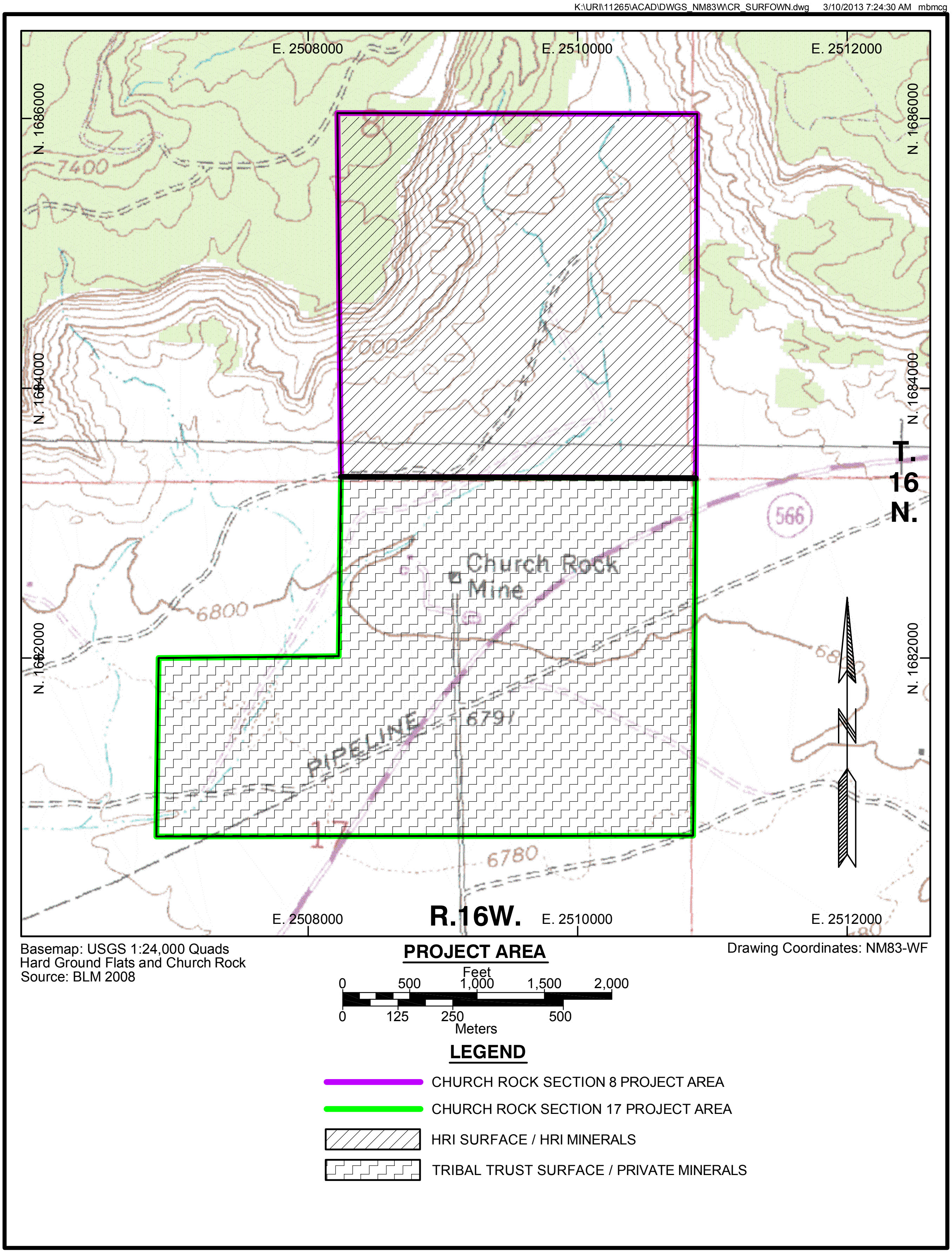

Figure 3.1-7. Surface and Mineral Ownership within the Church Rock Sections 8 and 17 Project Areas.

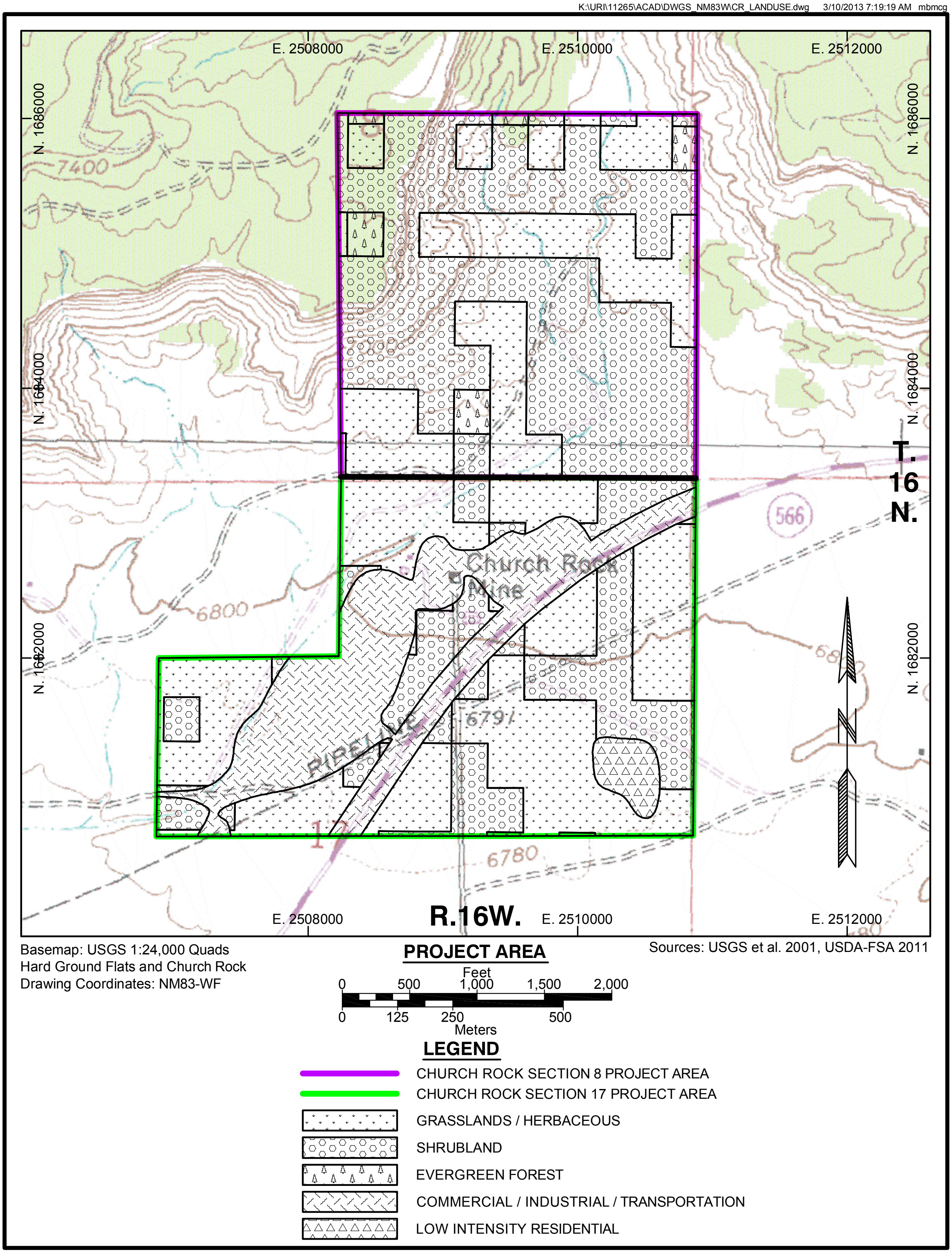

Figure 3.1-8. Land Use within the Church Rock Sections 8 and 17 Project Areas.

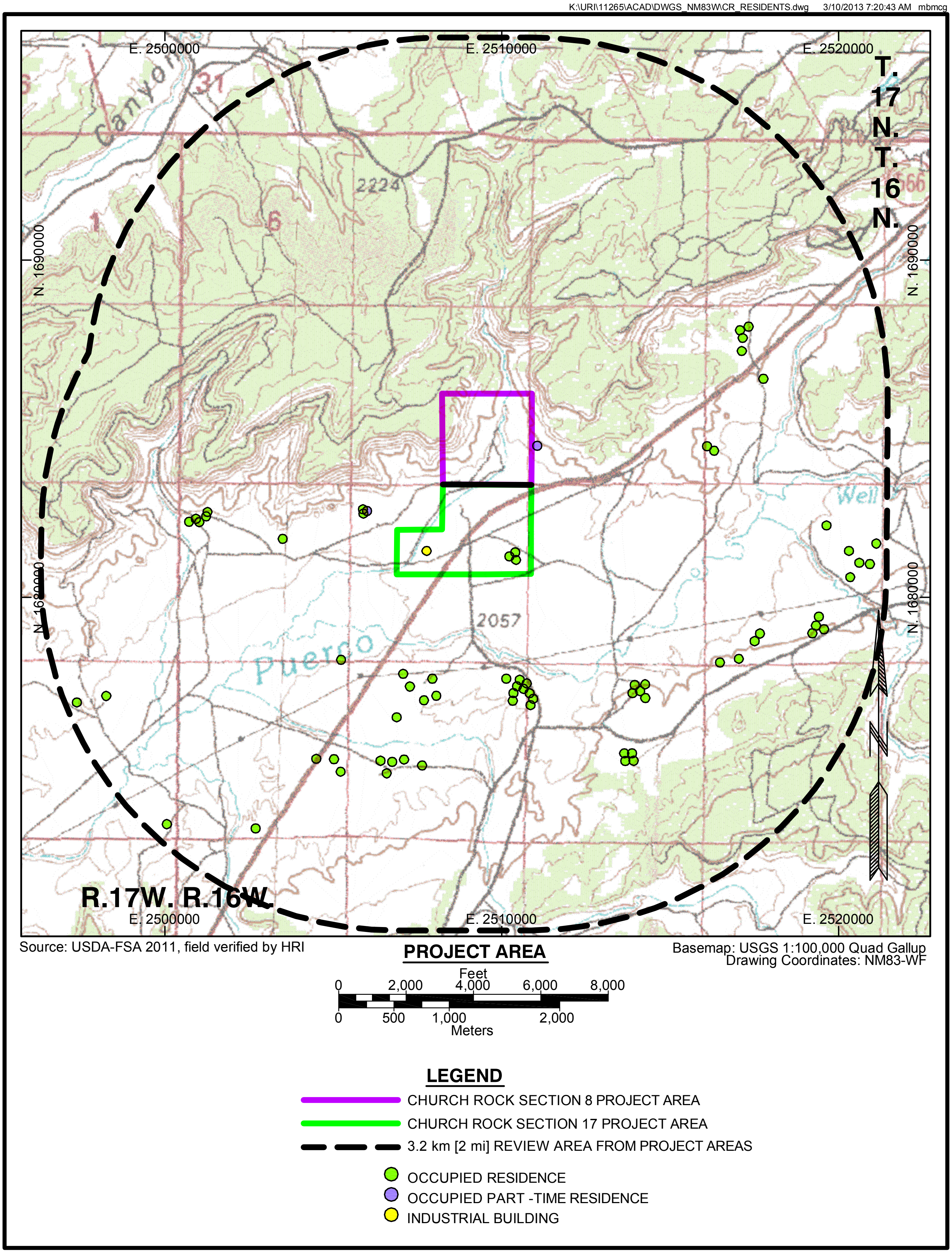

Figure 3.1-9. Dwellings within 3.2 km [2 mi] of the Church Rock Sections 8 and 17 Project Areas.

3.2 Transportation

Since the publication of the CUP FEIS, HRI's proposed transportation plan has been modified to include transporting loaded resin to licensed production facilities in Texas or the CCP. In the CUP FEIS processing loaded resin at the CCP was described in the Proposed Action (Alternative 1), while processing at alternative sites, including Texas, was evaluated under Alternative 2. Regional roads and truck accidents were discussed in Section 3.4 of the CUP FEIS. The ISR GEIS (Section 3.5.2) provides general information on regional roads and traffic counts in northwestern New Mexico. The following presents the access routes to each of the project areas, proposed material shipment transportation routes, and the most current traffic data. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to transportation.

3.2.1 Local Roads and Highways

Transportation routes within 80 km [50 mi] of the CUP include Interstate highways, non-Interstate U.S. Highways, state highways, county roads, Navajo-BIA roads, and local roads. Local transportation routes in the vicinity of the Crownpoint/Unit 1 project areas and Church Rock Sections 8 and 17 project areas are depicted on Figures 3.2-1 and 3.2-2, respectively. Table 3.2-1 provides details on surfacing, number of lanes, speed limits, and road maintenance of nearby roads. The following discusses the primary access routes to each of the project areas.

3.2.1.1 Crownpoint

The primary access to the Crownpoint project area is south from CR 47 (Crownpoint Drive). Beginning at I-40 exit 53, the primary access road will be reached by the following route:

- Drive north on NM 371 for approximately 45 km [28 mi]
- Turn left and drive west on Navajo 9 for about 3.2 km [2 mi]
- Turn left and drive south on CR 47 (Crownpoint Drive) for 1.3 km [0.8 mi]
- Turn right at the primary access road.

3.2.1.2 Unit 1

The primary access to the Unit 1 project area is from Navajo 11. Beginning at I-40 exit 53, the primary access road will be reached by the following route:

- Drive north on NM 371 for approximately 45 km [28 mi]
- Turn left and drive west on Navajo 9 for about 6 km [3.5 mi]
- Turn left and drive southwest on Navajo 11 for approximately 2 km [1 mi]
- Turn right at the primary access road

3.2.1.3 Church Rock Sections 8 and 17

The primary access to the Church Rock Sections 8 and 17 project areas is west from NM 566. Beginning at I-40 exit 33, the primary access road will be reached by the following route:

- Drive northwest on NM 118 (I-40 Frontage) for approximately 6 km [4 mi]
- Turn right and drive north on NM 566 for about 11 km [7 mi]
- Turn left at the primary access road (both project areas will be accessed by the primary access road)

3.2.2 Material Shipment Transportation Routes

Material shipments to and from the project areas are described in detail in Section 4.2 of this ER. The following presents representative transportation routes that may be used by the CUP. Shipments of process chemicals and fuel and hazardous waste will access the project areas from the primary access routes described in Section 3.2.1. Solid waste from the project areas will likely be transported to the Red Rock regional landfill approximately 10 km [6 mi] northeast of Thoreau (approximately 40 km [25 mi] south of the Crownpoint/Unit 1 project areas and approximately 52 km [32 mi] southeast of the Church Rock Sections 8 and 17 project areas).

Loaded Resin Shipment

Loaded resin will be transported from the satellite facilities to the CCP or licensed production facilities in Texas. The anticipated transportation routes to the CCP from the Unit 1 and Church Rock Section 8 satellite facilities are described below:

From Unit 1 satellite facility (total distance approximately 5 km [3 mi]):

- Drive northeast on Navajo 11 for 1.6 km [1 mi]
- Turn right and drive east on Navajo 9 for about 2.4 km [1.5 mi]
- Turn right onto CR 47 (Crownpoint Drive) for 1.3 km [0.8 mi]
- Turn right at the CCP primary access road

From Church Rock Section 8 satellite facility (total distance approximately 66 km [41 mi]):

- Drive north on NM 566 for 2.4 km [1.5 mi]
- Turn right and drive east on Navajo 11/49 for about 19 km [12 mi]
- Continue east on Navajo 49 for approximately 19 km [12 mi]
- Turn left and drive north on NM 371 for approximately 20 km [12.5 mi]
- Turn right and drive east on Navajo 9 for about 2.4 km [1.5 mi]
- Turn right onto CR 47 (Crownpoint Drive) for 1.3 km [0.8 mi]
- Turn right at the CCP primary access road

The proposed transportation routes to the licensed production facilities in Texas (Kingsville Dome or Rosita) from the satellite facilities are described below. The anticipated transportation routes are shown on Figure 3.2-3.

From Church Rock Section 8 satellite facility to licensed Kingsville Dome production facility (total distance approximately 1,770 km [1,100 mi]):

- Drive south on NM 566 for approximately 11 km [7 mi]
- Turn left and drive east on NM 118 (I-40 Frontage) for about 6 km [4 mi]
- Turn onto I-40 east for approximately 200 km [124 mi] to Albuquerque, New Mexico
- Take I-25 south for approximately 360 km [225 mi] to Las Cruces, New Mexico
- Take I-10 east for approximately 885 km [550 mi] to San Antonio, Texas
- Take I-410 west for approximately 47 km [29 mi] around San Antonio
- Take I-37 south for approximately 200 km [125 mi]
- Take US 77 south for approximately 56 km [35 mi]
- Turn left onto Farm to Market Rd 1118 for approximately 8 km [5 mi]
- Turn right onto Kingsville Dome primary access road

From Church Rock Section 8 satellite facility to licensed Rosita production facility (total distance approximately 1,770 km [1,100 mi]):

- Drive south on NM 566 for approximately 11 km [7 mi]
- Turn left and drive east on NM 118 (I-40 Frontage) for about 6 km [4 mi]
- Turn onto I-40 east for approximately 200 km [124 mi] to Albuquerque, New Mexico
- Take I-25 south for approximately 362 km [225 mi] to Las Cruces, New Mexico
- Take I-10 east for approximately 885 km [550 mi] to San Antonio, Texas
- Take I-410 west for approximately 47 km [29 mi] around San Antonio
- Take I-37 south for approximately 134 km [83 mi]
- Take US 59 south for approximately 64 km [40 mi]
- Turn left onto County Rd 407 for about 18 km [11 mi]
- Turn right onto County Rd 333 for 0.8 km [0.5 mi]
- Turn right onto Rosita primary access road

From Crownpoint/Unit 1 satellite facilities to licensed Kingsville Dome production facility (total distance approximately 1,770 km [1,100 mi]):

- From satellite facilities drive east on Navajo 9
- Turn right and drive south on NM 371 for about 45 km [28 mi]

- Turn onto I-40 east for approximately 153 km [95 mi] to Albuquerque, New Mexico
- Take I-25 south for approximately 360 km [225 mi] to Las Cruces, New Mexico
- Take I-10 east for approximately 885 km [550 mi] to San Antonio, Texas
- Take I-410 west for approximately 47 km [29 mi] around San Antonio
- Take I-37 south for approximately 200 km [125 mi]
- Take US 77 south for approximately 56 km [35 mi]
- Turn left onto Farm to Market Rd 1118 for approximately 8 km [5 mi]
- Turn right onto Kingsville Dome primary access road

From Crownpoint/Unit 1 satellite facilities to licensed Rosita production facility (total distance approximately 1,770 km [1,100 miles]):

- From satellite facilities drive east on Navajo 9
- Turn right and drive south on NM 371 for about 45 km [28 mi]
- Turn onto I-40 east for approximately 155 km [95 mi] to Albuquerque, New Mexico
- Take I-25 south for approximately 362 km [225 mi] to Las Cruces, New Mexico
- Take I-10 east for approximately 885 km [550 mi] to San Antonio, Texas
- Take I-410 west for approximately 47 km [29 mi] around San Antonio
- Take I-37 south for approximately 134 km [83 mi]
- Take US 59 south for approximately 64 km [40 mi]
- Turn left onto County Rd 407 for about 18 km [11 mi]
- Turn right onto County Rd 333 for 0.8 km [0.5 mi]
- Turn right onto Rosita primary access road

Yellowcake Shipment

Dried yellowcake will be transported to a licensed conversion facility in Metropolis, Illinois for further processing. The anticipated transportation route is shown on Figure 3.2-4. The distance from the CCP to the conversion facility is approximately 2,255 km [1,400 mi]. The anticipated transportation route is described below:

- Drive north on CR 42 (Crownpoint Drive) for 1.3 km [0.8 mi]
- Turn right and drive east on Navajo 9 for 3.2 km [2 mi]
- Turn right and drive south on NM 371 for approximately 45 km [28 mi]
- Turn onto I-40 east for approximately 1,795 km [1,115 mi] to Memphis, Tennessee
- Take I-55 north for approximately 217 km [135 mi]
- Take I-57 north for approximately 113 km [70 mi]
- Take I-24 east for approximately 60 km [37 mi] to Metropolis, Illinois

11e.(2) Byproduct Material Shipment

11e.(2) byproduct material will be transported from the project areas to a licensed disposal facility. HRI plans to ship 11e.(2) byproduct material to Denison's White Mesa Uranium Mill in Blanding, Utah. The anticipated transportation routes are depicted on Figure 3.2-5 and described below.

From Church Rock Sections 8 and 17 project areas (total distance approximately 345 km [215 mi]):

- Drive south on NM 566 for approximately 11 km [7 mi]
- Turn right on NM 118 (I-40 Frontage) for approximately 6 km [3.5 mi]
- Turn onto I-40 west for approximately 8 km [5 mi]
- Take US 491 north for approximately 11 km [7 mi]
- Turn onto NM 264 west for approximately 80 km [50 mi]
- Turn onto US 191 north for approximately 225 km [140 mi] to Blanding, Utah

From Crownpoint and Unit 1 project areas (total distance approximately 385 km [240 mi]):

- From satellite facilities drive west on Navajo 9 for approximately 60 km [38 mi]
- Turn left on US 491 south for approximately 13 km [8 mi]
- Turn onto NM 264 west for approximately 80 km [50 mi]
- Turn onto US 191 north for approximately 225 km [140 mi] to Blanding, Utah

3.2.3 Traffic

The average annual daily traffic (AADT) on the major traffic corridors near the CUP is presented in Table 3.2-2. The table shows that traffic on I-40 and U.S. 491 is about 4 to 20 times higher than the traffic on local roads near the project areas. I-40 is a major east-west route running between North Carolina and California. U.S. 491 runs north/south and serves the Four Corners region.

Section 3.4.2 of the CUP FEIS provides truck accident statistics for the roads in the vicinity of the CUP. Truck accident data from 1990 to 1994 were used to calculate the probability of an accident resulting from the CUP. Updated truck accident data were unavailable from the New Mexico Department of Transportation (NMDOT) and Navajo Nation Department of Transportation (NNDOT). Section 4.2 of this ER provides a discussion of truck accident frequencies in the vicinity of the CUP.

Table 3.2-1. Local Roads and Highways in the Vicinity of the Project Areas

Route	Surfacing Type	Number of Lanes	Speed Limit (mph)	Road Maintenance
I-40	Asphalt	4 (Divided)	75	Federal Government
U.S. 491 (U.S. 666 in CUP FEIS)	Asphalt	4 (Divided)	55	Federal Government
NM 118 (I-40 Frontage)	Asphalt	2	55	State of New Mexico
NM 371	Asphalt	2	55/40	State of New Mexico
NM 566	Asphalt	2	55	State of New Mexico
Navajo 9	Asphalt	4/2	55/35	Navajo BIA
Navajo 11 (Rocky Canyon Road)	Gravel	2	Not Posted	Navajo BIA
Navajo 49	Asphalt	2	55	Navajo BIA
Navajo 11/49	Asphalt	2	55	Navajo BIA
CR 47 (Crownpoint Drive) (Church Road in CUP FEIS)	Asphalt/Gravel	2	30	Navajo BIA

Table 3.2-2. Traffic Data for Roads in the Vicinity of the Project Areas

Route	AADT (veh/day) 2010	Percent Trucks (%)
I-40	20,144	38
U.S. 491 (U.S. 666 in CUP FEIS)	21,417	7
NM 118 (I-40 Frontage)	1,326	19
NM 371	3,158	19
NM 566	4,999	22
Navajo 9	3,077	Not Available
Navajo 11 (Rocky Canyon Road)	250	Not Available
Navajo 49	1,263	Not Available
Navajo 11/49	Not Available	Not Available
CR 47 (Crownpoint Drive) (Church Road in CUP FEIS)	Not Available	Not Available

Sources: NMDOT 2012, NNDOT 2012

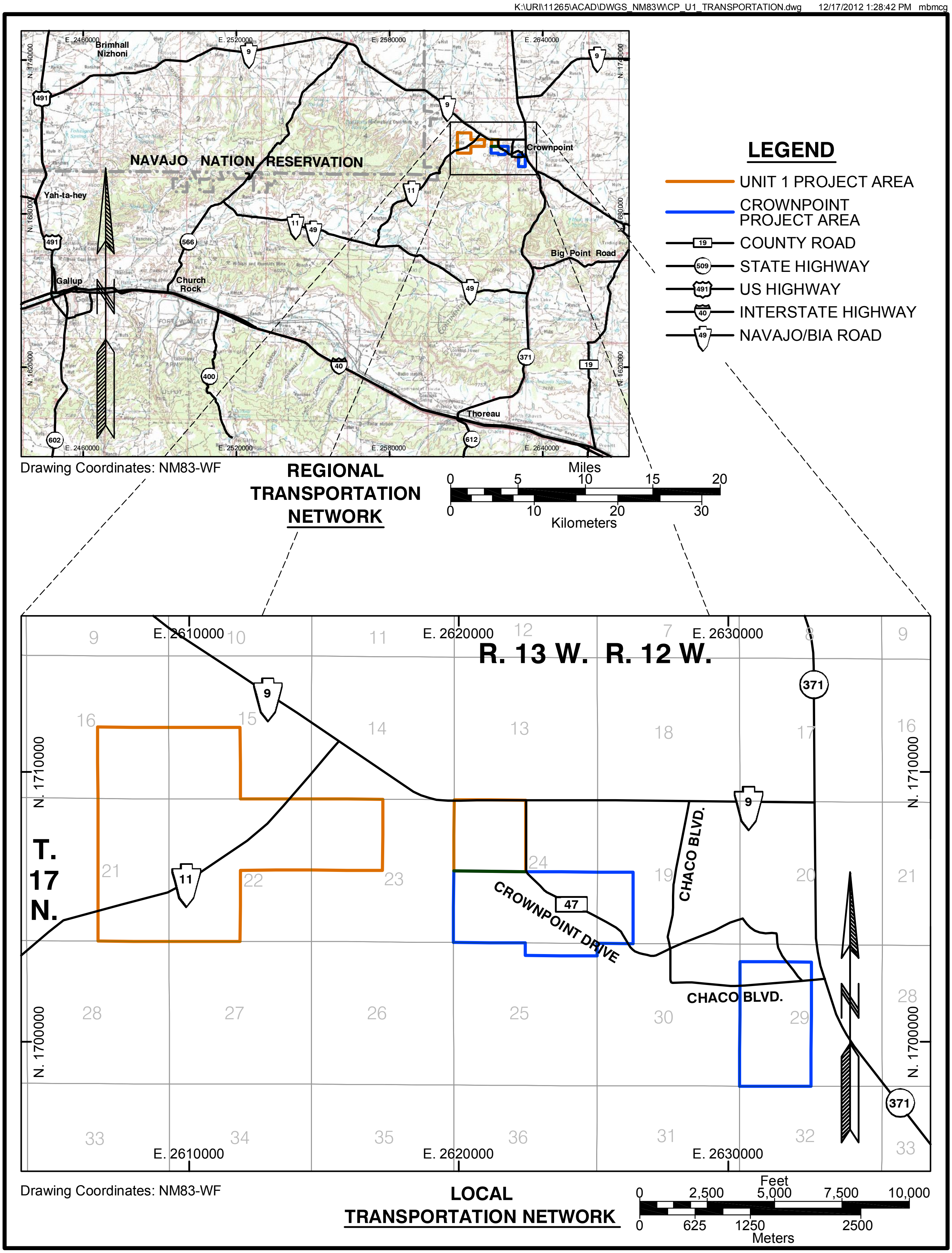

Figure 3.2-1. Crownpoint and Unit 1 Project Areas Existing Transportation Network.

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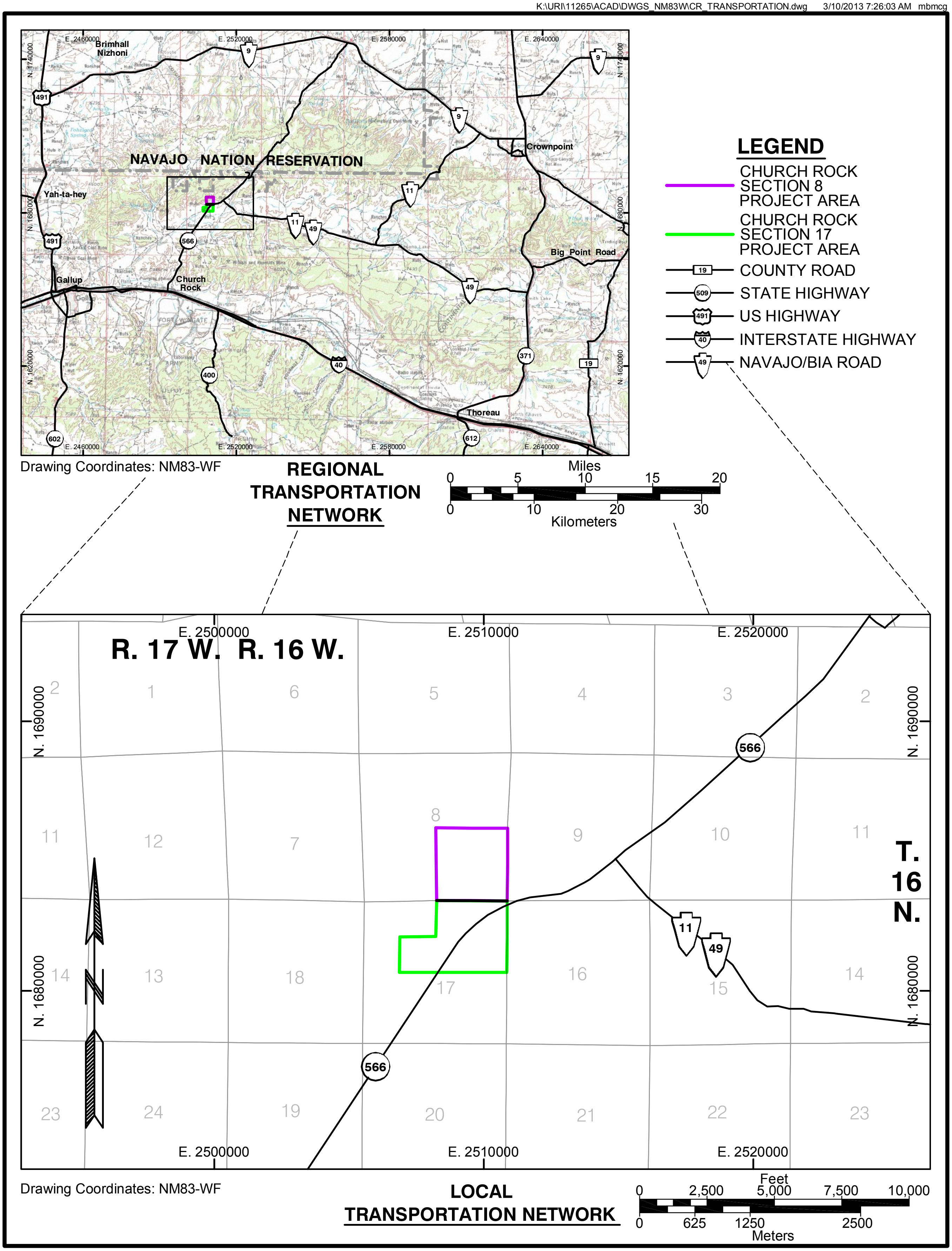

Figure 3.2-2. Church Rock Sections 8 and 17 Project Areas Existing Transportation Network.

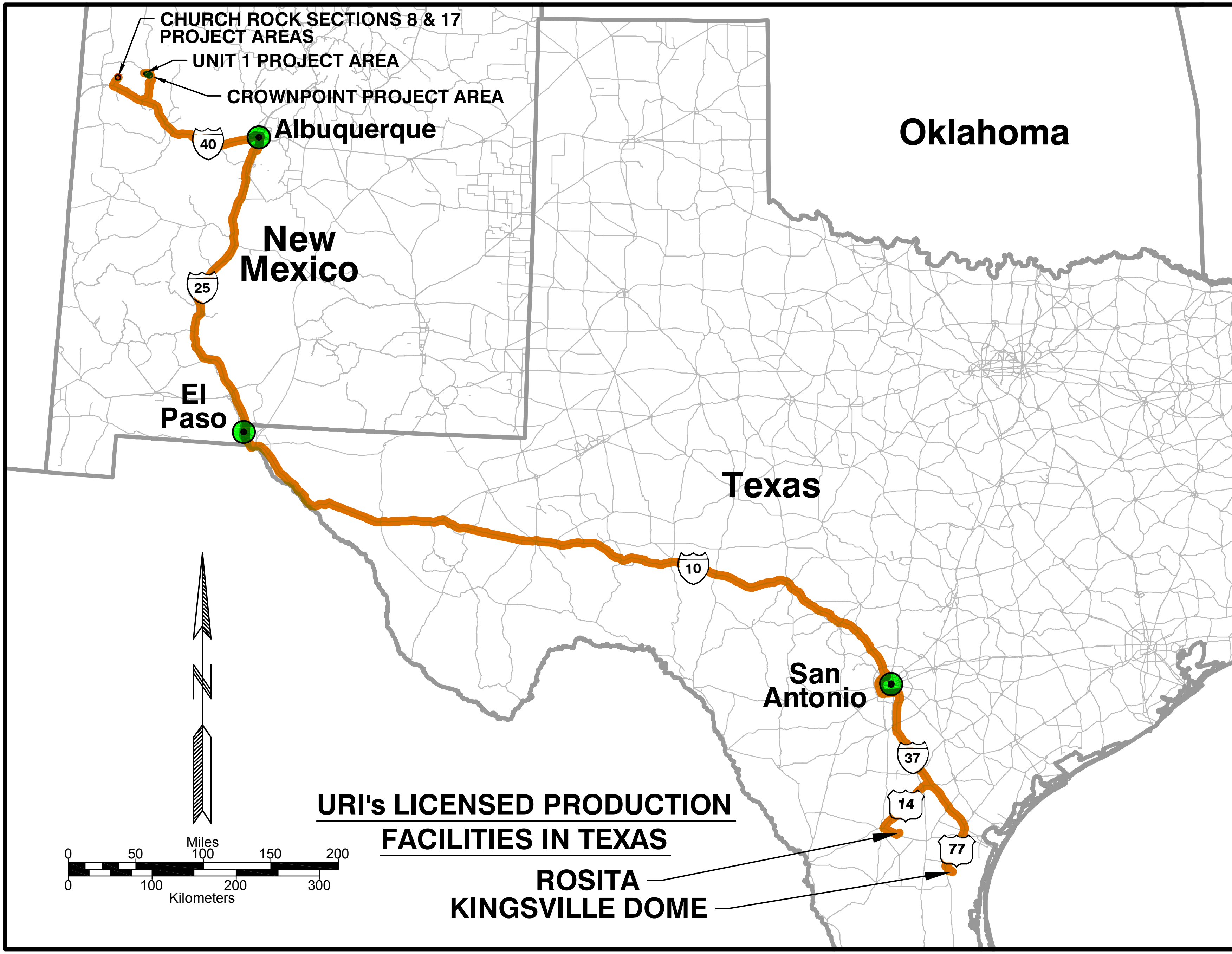

Figure 3.2-3. Anticipated Transportation Routes for Loaded Resin Shipments from Satellite Facilities to Licenced Production Facilities in Texas.

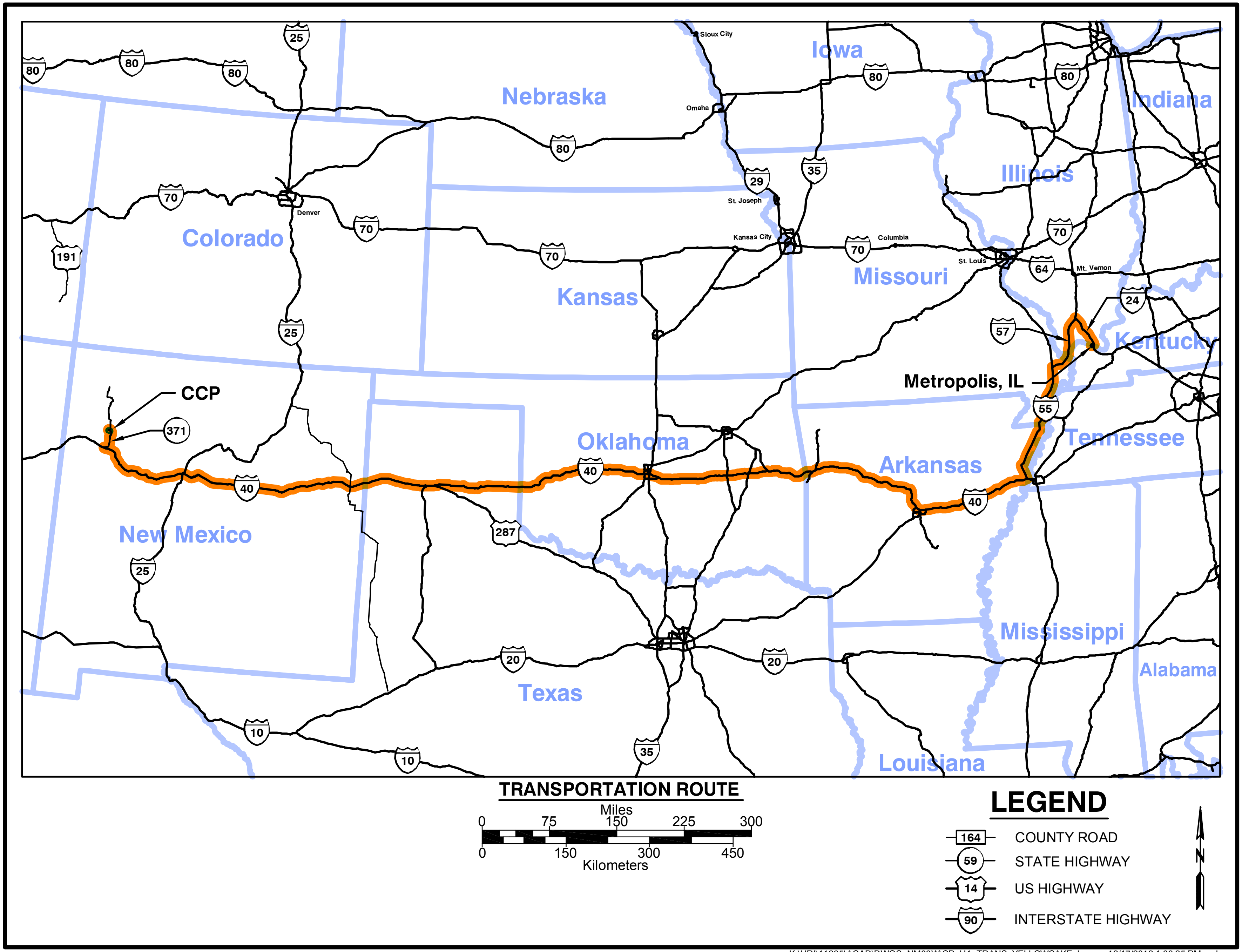

Figure 3.2-4. Anticipated Yellowcake Transportation Route.

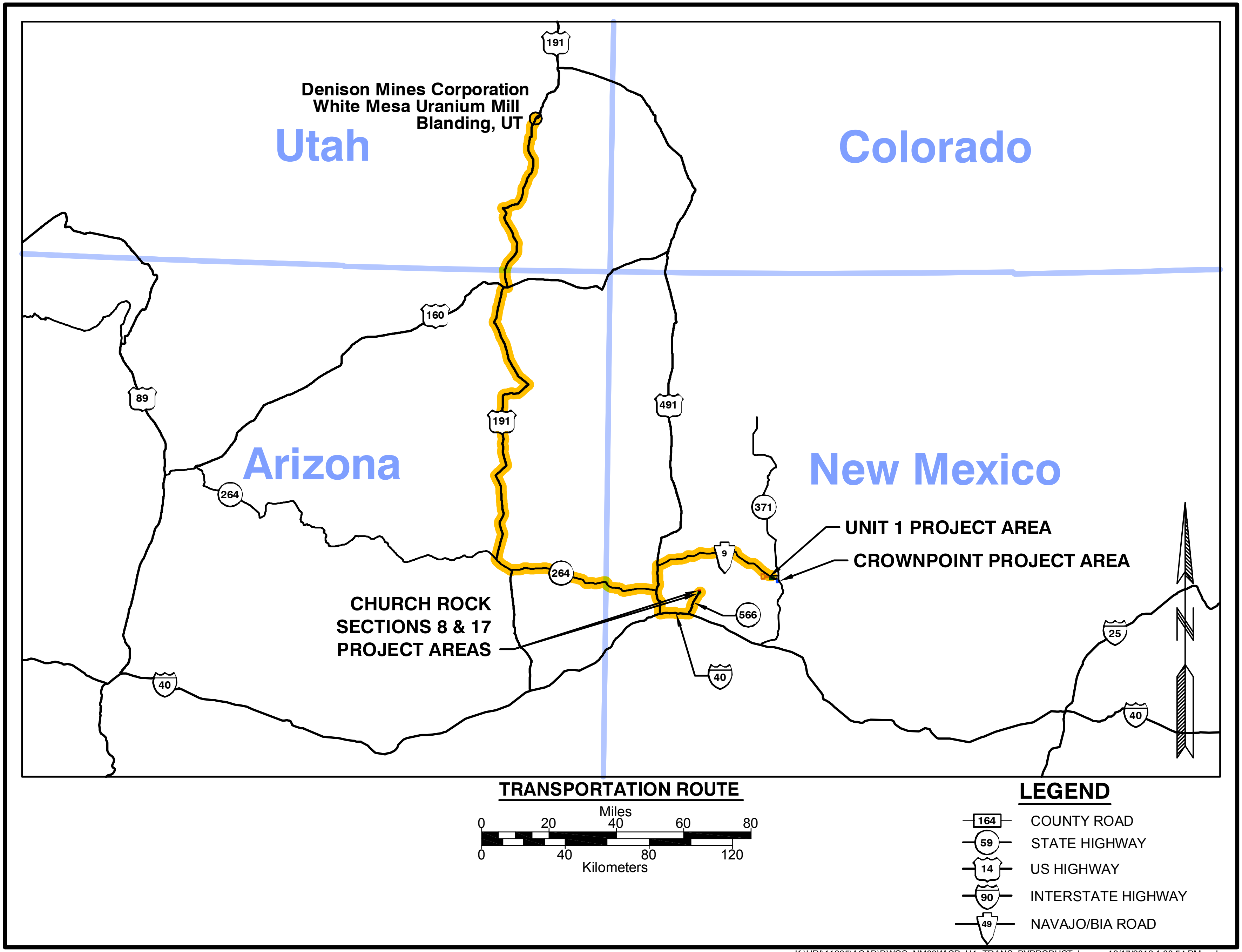

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Figure 3.2-5. Anticipated 11e.(2) Byproduct Material Transportation Route.

3.3 Geology and Soils

Geology and soils are discussed in Section 3.2 of the CUP FEIS and Section 3.5.3 of the ISR GEIS. Since the publication of the CUP FEIS and ISR GEIS there have been no new regional geological data in the form of stratigraphy or structure collected or presented in an accredited report such as a publication by the USGS. HRI has not completed any site investigations since the publication of the CUP FEIS. The following sections summarize the regional and project geology as described in the CUP FEIS and ISR GEIS. In addition, the results of the U.S. Department of Agriculture (USDA) soil survey completed in 2008 and clarification of the presence of the Pipeline Fault believed to exist near the Church Rock Sections 8 and 17 project areas are presented. This section also includes a seismology evaluation. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to geology and soils.

The project areas are located within the Grants Uranium Belt (or, as referenced in the ISR GEIS, the Grants Uranium District), which is one of the largest uranium producing units in the world. The ISR GEIS indicates that more than 150,000 metric tons [165,000 tons] of U_3O_8 were extracted between 1948 and 2002, with the majority of uranium extracted between 1950 and 1958.

3.3.1 Regional Setting

3.3.1.1 Structural Geology

The San Juan Basin is the dominant structural feature in the region. Several minor structural features are also present, including the Zuni Uplift and the Chaco Slope. The project areas are located northeast of the Zuni Uplift located on the Chaco Slope, a major southern subdivision of the San Juan Basin. The San Juan Basin is a structural depression that occupies a major portion of the Colorado Plateaus and is underlain with over 3,000 m [10,000 ft] of sedimentary strata. The general dip of the strata is toward the center of the basin with outer margins marked with elongated domes, uplifts, and synclinal depressions. The elevation relief in the vicinity of the project areas ranges from 600 to 2,600 m [2,000 to 8,500 ft].

3.3.1.2 Stratigraphy

The stratigraphic sequence in the region ranges from Precambrian to Holocene, while the major stratigraphic units include the Morrison Formation, Dakota Sandstone, Mancos Shale, and the Mesaverde Group. The surficial geology of the region is presented in Figure 3.3-1. A stratigraphic column of the Church Rock, New Mexico area is presented in Figure 3.3-2 and is typical of the regional stratigraphy. This stratigraphic column extends from the Permian to the Upper Cretaceous age and depicts the various formations, members and associated lithologies. The Morrison Formation, which is host to the major uranium deposits in the Grants Uranium District, is composed of the Recapture, Westwater Canyon, and Brushy Basin members. Most of the deposits are within the main sandstone bodies of the Westwater Canyon Member.

The Recapture Member is the bottom-most member of the Morrison Formation and ranges in thickness from 0 to 45 m [0 to 150 ft]. The Recapture is regarded as one of the most variable stratigraphic units in the area, and it occurs as a sequence of interbedded siltstone, mudstone and sandstone strata. Individual stratum thickness ranges from a few inches to several feet, and most sandstone beds are typically less than 5 m [15 ft] thick. The Recapture is believed to interfinger with the underlying Cow Springs Sandstone.

The Westwater Canyon Member consists of interbedded fluvial arkosic sandstone, claystone, and mudstone strata and ranges from 30 to 75 m [100 to 250 ft] in thickness. The mudstone units of the Westwater Canyon range from thin partings to up to 6 m [20 ft] thick. These mudstones have limited lateral continuity, and only the thickest units are laterally extensive. As described previously, the Westwater Canyon Member is host to the major uranium deposits that occur in the coarse-grained, poorly sorted sandstone units.

The Brushy Basin Member overlies the Westwater Canyon Member and ranges from approximately 0 to 30 m [0 to 100 ft] thick. The Brushy Basin is mainly composed of varicolored claystone interbedded with sandstone lenses that have similar composition to the sandstones of the Westwater Canyon. The mudstones of the Brushy Basin are largely derived from volcanic ash falls and therefore contains a large amount of bentonite.

3.3.1.3 Seismology

Seismology is not specifically discussed in the CUP FEIS or the ISR GEIS; however, it was provided to NRC as part of the license application. The following section describes the seismology of the region including a seismic risk analysis.

3.3.1.3.1 Seismic Hazard Review

The seismic hazard review was based on analysis of available literature and historical seismicity for the CUP. Appendix A to 10 CFR Part 40 presents criteria relating to the operation of uranium mills and the disposition of tailings or waste. Criterion 4 of Appendix A lists site and design criteria that must be adhered to whether tailings or wastes are disposed of above or below grade. Criterion 4(e) deals with seismic hazards and states that, “The impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in the criterion, the term ‘capable’ fault has the same meaning as defined in section III(g) of Appendix A of 10 CFR Part 100.”

There are no capable faults mapped within or near the CUP, according to the USGS (2012b). The closest capable faults to the CUP are located approximately 95 km [60 mi] south of the project areas or over 110 km [70 mi] east of the project areas.

3.3.1.3.2 Seismicity

Within the region, the Rio Grande Rift Zone is the major source of seismic activity. The Rio Grande Rift Zone begins in southern Colorado and terminates in northern Mexico generally trending southwesterly as it flanks Santa Fe on the west and Albuquerque on the east. The Rio Grande Rift Zone separates the Colorado Plateau in the west from the interior of the North

American craton on the east. The tectonic activity in the Rio Grande Rift Zone is quiescent and characterized by many quaternary faults (within the last 1.65 million years), some of which are classified as capable faults as defined in Section III(g) of Appendix A of 10 CFR Part 100.

Magnitude is an instrumentally determined measure of the size of an earthquake and the total energy released. Intensity is a qualitative measure of the degree of shaking an earthquake imparts on people, structures, and the ground. For a given earthquake, intensities can vary depending upon the distance from the epicenter. Table 3.3-1 presents a summary and general description of the Modified Mercalli Intensity Scale and equivalent Richter magnitude.

Areas that do not have capable faults exposed at the surface, such as the CUP, are generally thought not to be capable of having earthquakes with magnitudes over 6.5. Earthquakes with a magnitude of 6.5 or less generally do not result in ground surface rupture as shown in Table 3.3-1. Figure 3.3-3 indicates the probability that a 6.5-magnitude or greater earthquake will occur within 50 years. The figure shows that the probability of a 6.5-magnitude or greater earthquake in the project areas ranges from 0.001 to 0.004. A 6.5-magnitude earthquake would usually result in little damage in specially built structures but could cause considerable damage to ordinary buildings and severe damage to poorly built structures. Underground pipes would generally not be broken and ground cracking would not occur or would be minor.

There are no capable faults known to be present within 100 km [62 mi] of the project areas. Therefore, the most significant seismic hazard for the project is considered to be the randomly occurring or “floating” earthquake. This is the maximum credible type of earthquake estimated for the project areas, based on available literature, geologic information of the surrounding area, and historical data.

3.3.1.3.3 Historic Seismicity near the CUP

Figure 3.3-4 depicts the earthquakes that have been recorded in New Mexico from 1990 to 2006. The figure shows that there were two earthquakes east of the project areas (within 100 km [62 mi]) during the time period. The largest earthquake (3.0 magnitude) occurred in late 2004, while the other earthquake (2.5 magnitude) occurred in mid-2006.

3.3.1.3.4 Seismic Risk and Probabilistic Seismic Hazard Analysis

The Uniform Building Code (UBC) contains information and guidance on designing buildings and structures to withstand seismic events. The most current UBC Seismic Zone Map (International Code Council 1997) divides New Mexico into three seismic zones (Zones 0, 1, and 2B). These zones are based on the probability of a certain level of horizontal acceleration in 50 years (Figure 3.3-5) in terms of percent of gravitational acceleration (%g).

The UBC criteria are as follows:

Zone	Effective Peak Acceleration (%g)
0	<5
1	5 to 10
2A	10 to 15
2B	15 to 20
3	20 to 30
4	>30

The UBC based these criteria on the assumption that there was a 90% probability that the above values would not be exceeded in 50 years, or roughly a 100% probability that the values would be exceeded in 475 to 500 years. As depicted on Figure 3.3-5 the project areas are in UBC Seismic Zone 1, which suggests that there is a 90% probability that an earthquake with an acceleration of 5 to 10%g would not occur within any 50-year period. Such acceleration, however, is less than would be suggested through newer building codes. Recently, the UBC has been replaced by the International Building Code (IBC), which is based on probabilistic analyses as discussed below.

The IBC uses a probabilistic 2,500-year map for the basis of building designs versus the 500-year map used by the UBC. The 2,500-year probability is equivalent to a 2% probability of exceedance in 50 years. Figure 3.3-6 shows the peak horizontal acceleration for the 2, 5 and 10% probability of exceedance in 50 year maps for New Mexico. These maps correspond to the 2,500, 1,000 and 500-year maps, respectively. The figure indicates that the approximate estimated peak horizontal acceleration in the project areas for the 2,500 event is about 13%g or less than a 6.0-magnitude earthquake

3.3.2 Crownpoint

3.3.2.1 Stratigraphy

The stratigraphy in the Crownpoint project area is presented in Figure 3.3-7. The Recapture Member (termed the Recapture mudstone unit in the Crownpoint project area) is the underlying confining unit and has been confirmed to have a thickness of approximately 75 to 80 m [250 to 260 ft]. The top of the Westwater Canyon Member within the project area is approximately 560 m [1,840 ft] below the ground surface. The Westwater Canyon Member consists of alternating fine- to medium-grained sandstones, with a number of mudstone layers ranging from a few centimeters to about 9 m [30 ft] thick. The Brushy Basin Member, which is the overlying confining unit, averages from 20 to 35 m [67 to 112 ft] in thickness near the Crownpoint project area. The Brushy Basin Member is composed primarily of claystones and shales interbedded with a few thin and discontinuous sandstone lenses. These sedimentary rocks in the Crownpoint project area dip approximately 1 to 2 degrees north-northeast.

Uranium deposits within the Westwater Canyon Member at the Crownpoint project area average about 4 m [11 ft] thick with the stacked production zones having a combined thickness of about 37 m [120 ft]. The combined dimensions of the ore bodies in the Crownpoint and Unit 1 project areas exceed 8 km [5 mi] in length and their widths range from 290 to 760 m [950 to 2,500 ft].

3.3.2.2 Soils

Section 3.2.2 of the CUP FEIS includes a discussion of the soils identified during surveys completed by TVA in 1979. Since the publication of the CUP FEIS there have been three additional USDA Natural Resource Conservation Service (NRCS) soil surveys of McKinley County. Recent soil surveys are more specific and localized in soil classification. While the 1979 TVA soil survey identified three soil units within the Crownpoint project area, the NRCS soil survey depicts nine soil units (Figure 3.3-8). Both the TVA and the more recent NRCS soil surveys indicate a correlation between landscape position and the soil complex type. The landscape of the Crownpoint project area is generally divided into three basic terrain types: (1) low-lying areas with gentle slopes (0-3%); (2) moderate slopes (1-10%) adjacent to flood plains and valley floors, mesas, and breaks; and (3) steep slopes associated with rough, broken and steep topography such as canyon walls and escarpments (10-80%). The following describes the main NRCS soil units identified within the Crownpoint project area.

The Sparank-San Mateo-Zia (0-3% slopes) and the Notal Hamburn (0-2% slopes) complexes are generally found in the low-lying areas such as flood plains, valley floors and stream terraces; these soil complexes comprise clay loams and silty loams and usually have horizons up to 165 cm [65 in] deep. The Penistaja-Tintero (1-10% slopes), Marianolake-Skyvillage (1-8% slopes), and the Hagerwest-Bond fine sand loams (1-8% slopes) generally exist on slopes adjacent to flood plains and valley floors, mesas, and breaks and are primarily composed of sandy loam with a small amount of clay loam near the margins of shallower slopes. The Hospah-Skyvillage-Rock outcrop complex (2-35% slopes) is the predominant soil complex within the project area and usually partitions the steep rock outcrops from the moderate to gentle-sloping areas. The Hospah-Skyvillage-Rock outcrop complex consists of surficial clay-loam cobbles, which are underlain with a shallow clay horizon (less than 51 cm [20 in]).

3.3.3 Unit 1

3.3.3.1 Stratigraphy

The Unit 1 project areas geologic units and soils are very similar to those in the Crownpoint project area. Exploration data in the Unit 1 project area indicate that the Recapture Member is on average about 75 m [250 ft] thick, the Westwater Canyon about 72 m [236 ft] thick, and the Brushy Basin Member about 47 m [153 ft] thick.

3.3.3.2 Soils

The recent USDA soil survey indicates that there are six soil units within the Unit 1 project area as depicted on Figure 3.3-6. The Hagerwest-Bond fine sandy loams (1-8% slopes) are the predominant soil within the project area and are located on hills or mesas. The Notal-Hamburn complexes (0-2% slopes) are generally found on stream terraces on valley floors and comprise clay loams up to 165 cm [65 in] deep. The Norkiki-Kimnoli complexes (1-8% slopes) consist of sandy loams generally found on slopes of mesas. The Razito-Shiprock complexes (3-8% slopes) are generally found on dunes of mesas or valley sides and are composed of loamy sand.

3.3.4 Church Rock Sections 8 and 17

3.3.4.1 Stratigraphy

A stratigraphic column of the Church Rock Sections 8 and 17 project areas is similar to the Church Rock, New Mexico area stratigraphic column presented in Figure 3.3-2. In the Church Rock Sections 8 and 17 project areas, the Westwater Canyon Member is found at depths ranging 140 to 230 m [460 to 760 ft] with an average thickness of around 80 m [263 ft]. The confined overlying Brushy Basin Member is composed of two separate mudstone beds with an intervening sandstone layer and has a total thickness of 19 m [63 ft]. The underlying confining unit, the

Recapture Member, has a thickness ranging from 45 to 60 m [150 to 200 ft] in the project areas (CUP FEIS).

Strata at the Church Rock Sections 8 and 17 project areas dip generally northward at approximately 3 degrees. There are some accounts of jointing and fracturing in the subsurface sandstones and one hypothetical fault believed to exist in the area. The fracture zone is thought to coincide with Pipeline Canyon. The potential location of the fault is approximated as trending southwestward into the Church Rock Section 17 project area. According to the CUP FEIS, a more recent detailed geologic map discredits the existence of the fault. Investigations by HRI, including pump tests, borehole logs, and seismic reflection readings further suggest that the fault is not present within the project areas. Furthermore, in the ASLBP ruling on the Intervenor's Motion that vertical excursions could occur through the purported fault, the ASLBP denied the Motion even calling into question the existence of the fault as well as citing evidence that indicates a lack of hydraulic connection between the production zone aquifer (Westwater Canyon) and the overlying and underlying aquifers.

Mineralization occurs in the Cretaceous Dakota Sandstone as well as the Upper Jurassic Westwater Canyon Member, and the Westwater "A" sandstone. Mineral resources present at the Church Rock Sections 8 and 17 project areas occur in roll fronts and in elongated tabular deposits. Mineralization varies in thickness, but averages about 3 m [9 ft] thick, with the combined thickness of stacked ore bodies averaging about 24 m [80 ft]. The overall estimated dimensions of the ore body in the Church Rock Sections 8 and 17 project areas is about 1,600 m [5,300 ft] long and up to 300 m [1,000 ft] wide.

3.3.4.2 Soils

Soil surveys completed by HRI and discussed in Section 3.2.4 of the CUP FEIS indicate that the project area includes several soil units including the El Rancho and Mikim. The Mikim occurs in alluvial fans and at the toe of slopes and is a fine loam, while the El Rancho is a clay loam to sandy loam occurring on terraces and valley bottoms. The NRCS soil surveys of McKinley County indicate that there are six soil units (excluding the uranium-mined lands) within the Church Rock project areas. NRCS soil units are presented on Figure 3.3-10. The difference between the soil survey conducted by HRI and the NRCS soil survey is that older soil surveys were more general while more recent surveys provide greater detail and follow NRCS technical guidance.

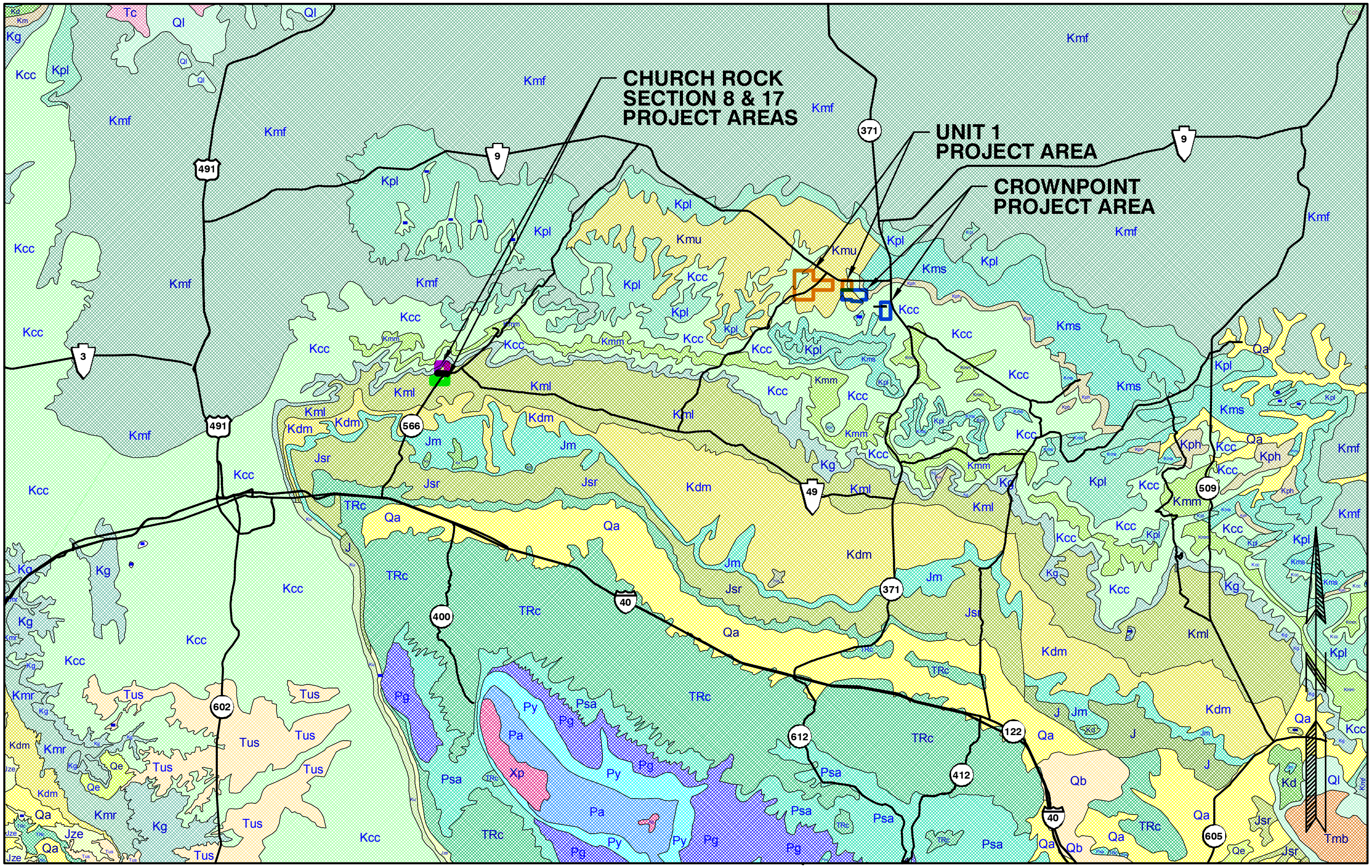
Like the Crownpoint and Unit 1 project areas, there is a correlation between terrain characteristics and soil units. In the case of the Church Rock Sections 8 and 17 project areas, terrain consists of drainages with gentle terraces and valley sides and steep-slope rock outcrops. Three soil complexes are found in the gentle low-lying drainage/valley-type terrain areas: Sparank-San Mateo-Zia complex (0-3% slopes), Mentmore loam (1-8% slopes) and Zia sandy loam (1-5% slopes). The Sparank-San Mateo-Zia and Mentmore loam soils are generally deep-horizon soils (165 cm [65 in] deep) and consist primarily of clay loams, while the Zia sandy loam is a deeply developed sandy loam. These three soil types and formerly mined land are found in the majority of the Church Rock Sections 8 and 17 project areas. The remaining areas include three rock outcrop complexes, the Rock outcrop-Eagleye-Atchee complex (35-70% slopes), the Vessilla-Rock outcrop complex (2-15% slopes), and the Eagleye-Atchee Rock outcrop complex (2-35% slopes). The Rock outcrop-Eagleye-Atchee complex is most common of the three rock outcrops and is composed of shallow (less than 51 cm [20 in]) silty clay loams.

Table 3.3-1. General Terms regarding Earthquake Intensity and Magnitude

Mercalli Intensity	Equivalent Richter Magnitude	Description
I	1.0 – 2.0	Felt by very few people; barely noticeable.
II	2.0 – 3.0	Felt by a few people, especially on upper floors.
III	3.0 – 4.0	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	4.0	Felt by many indoors, few outdoors. May feel like heavy truck passing by.
V	4.0 – 5.0	Felt by almost everyone, some people awakened. Small objects moved. Trees and poles may shake.
VI	5.0 – 6.0	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.
VII	6.0	Slight to moderate damage in well-built ordinary structures. Considerable damage to poorly built structures. Some walls may fall.
VIII	6.0 – 7.0	Little damage in specially built structures. Considerable damage to ordinary buildings, severe damage to poorly built structures. Some wall collapse.
IX	7.0	Considerable damage to specially built structures, buildings shifted off foundations. Ground cracked noticeably. Underground pipes broken. Wholesale destruction. Landslides.
X	7.0 – 8.0	Most masonry and frame structures and their foundations destroyed. Ground badly cracked. Wholesale destruction. Landslides.
XI	8.0	Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground.
XII	8.0 or greater	Total damage. Waves seen on ground. Objects thrown up into air.

Sources: Michigan Tech University 2012

Figure 3.3-1. Regional Surficial Geology.



GEOLOGIC UNITS

Source: USGS 2005

J	middle and upper Jurassic rocks, unidivided	Kml	Mancos Shale, lower part	Py	Yesa Formation
Jm	Morrison Formation	Kmm	Mulatto Tongue of Mancos Shale	Qa	alluvium
Jsr	San Rafael Group	Kmr	Rio Salado Tongue of Mancos Shale	Qb	basalt and andesite flows and vent deposits
Jze	Zuni and Entrada Sandstones	Kms	Satan Tongue of Mancos Shale	Qe	eolian deposits
Kcc	Crevasse Canyon Formation	Kmu	Mancos Shale, upper part	Ql	landslide deposits and colluvium
Kch	Cliff House Sandstone	Kph	Hosta Tongue of Point Lookout Sandstone	Tc	Chuska Sandstone
Kd	Dakota Sandstone	Kpl	Point Lookout Sandstone	Tmb	basalt and andesite flows, Miocene
Kdm	intertongued Dakota-Mancos sequence	Ku	undivided, Upper Cretaceous	Tnb	basalt and andesite flows, Neogene
Kg	Gallup Sandstone	Pa	Abo Formation	TRc	Chinle Group
Km	Mancos Shale	Pg	Glorieta Sandstone	Tus	upper Tertiary sedimentary units
Kmf	Menefee Formation	Psa	San Andres Formation	Xp	plutonic rocks, Lower Proterozoic

Miles: 0 4 8 12 16
Kilometers: 0 8 16 24

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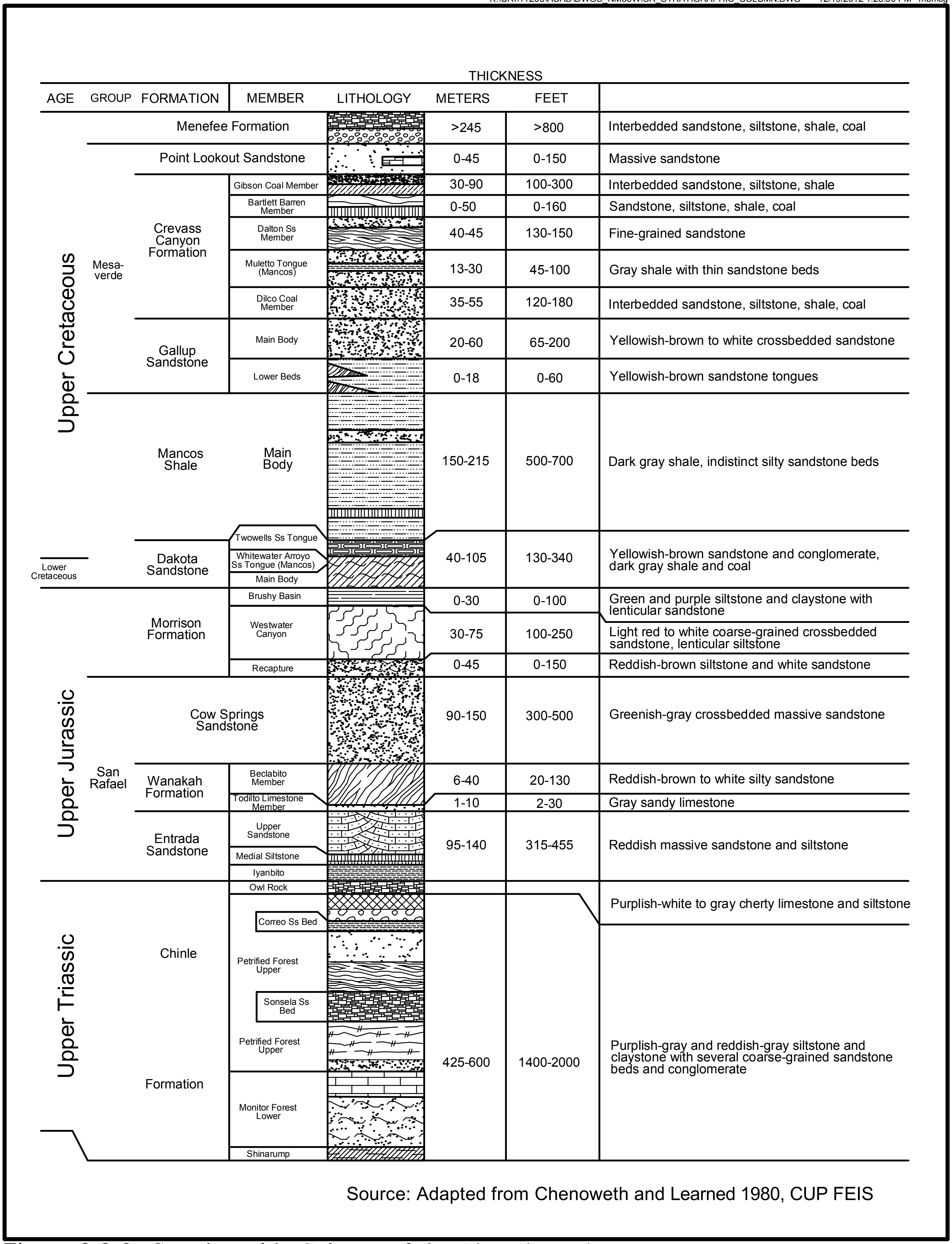

Figure 3.3-2. Stratigraphic Column of the Church Rock, New Mexico Project Area.

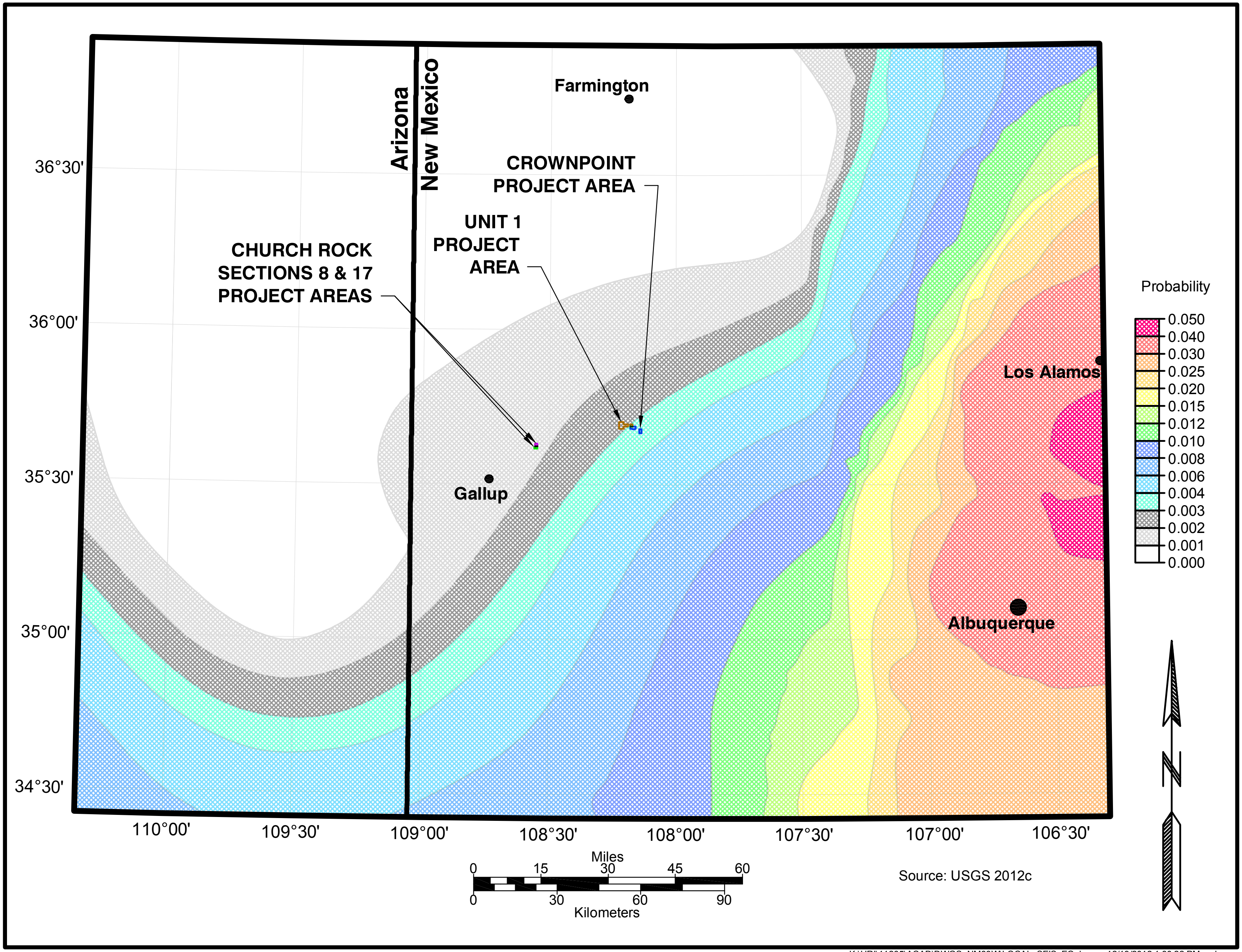

Figure 3.3-3. Probability of Earthquake with Magnitude ≥ 6.5 within 50 years.

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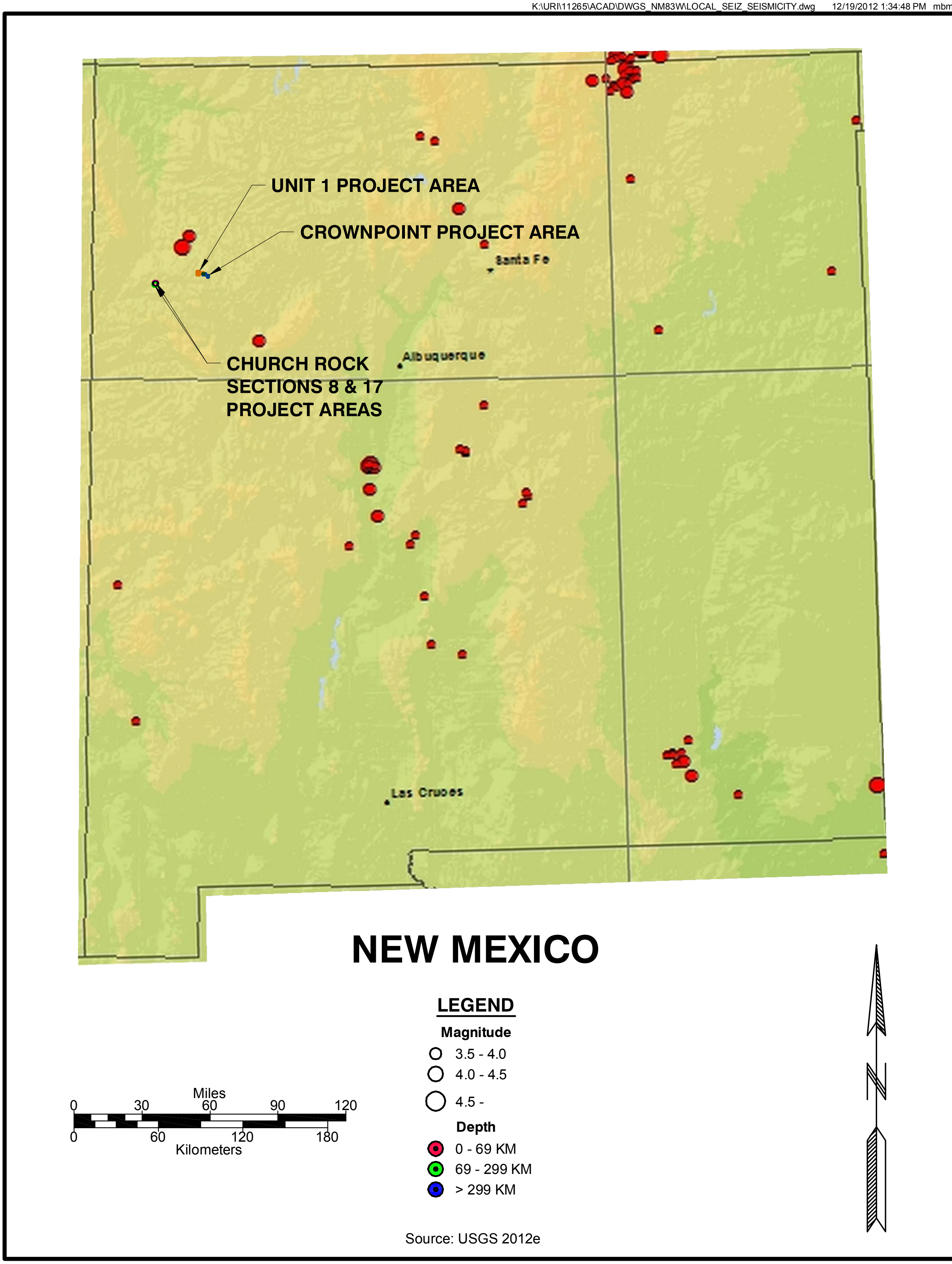


Figure 3.3-4. Seismicity of New Mexico, 1973 - Current.

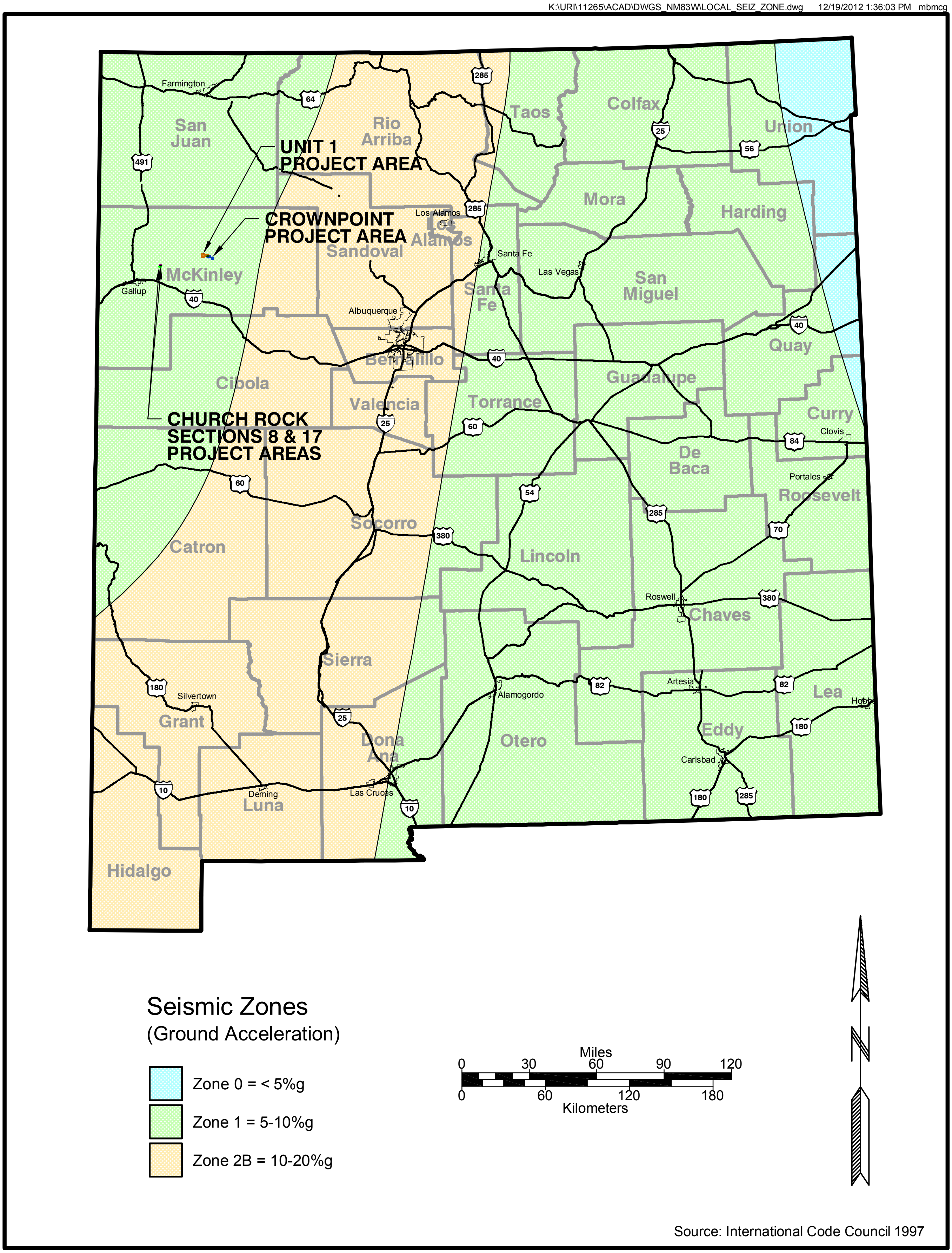


Figure 3.3-5. UBC Seismic Zone Map.

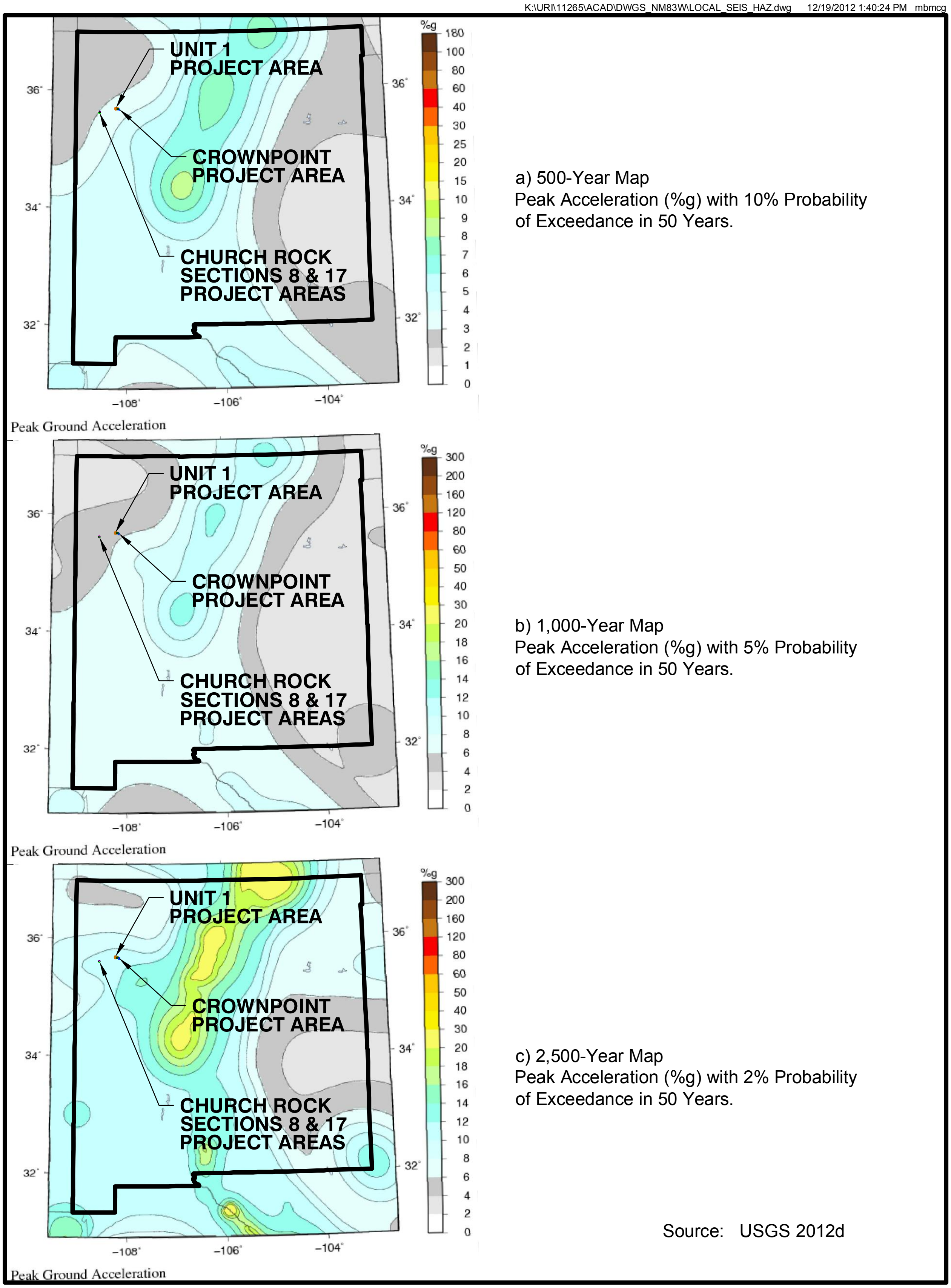


Figure 3.3-6. Seismic Hazard at the Project Areas.

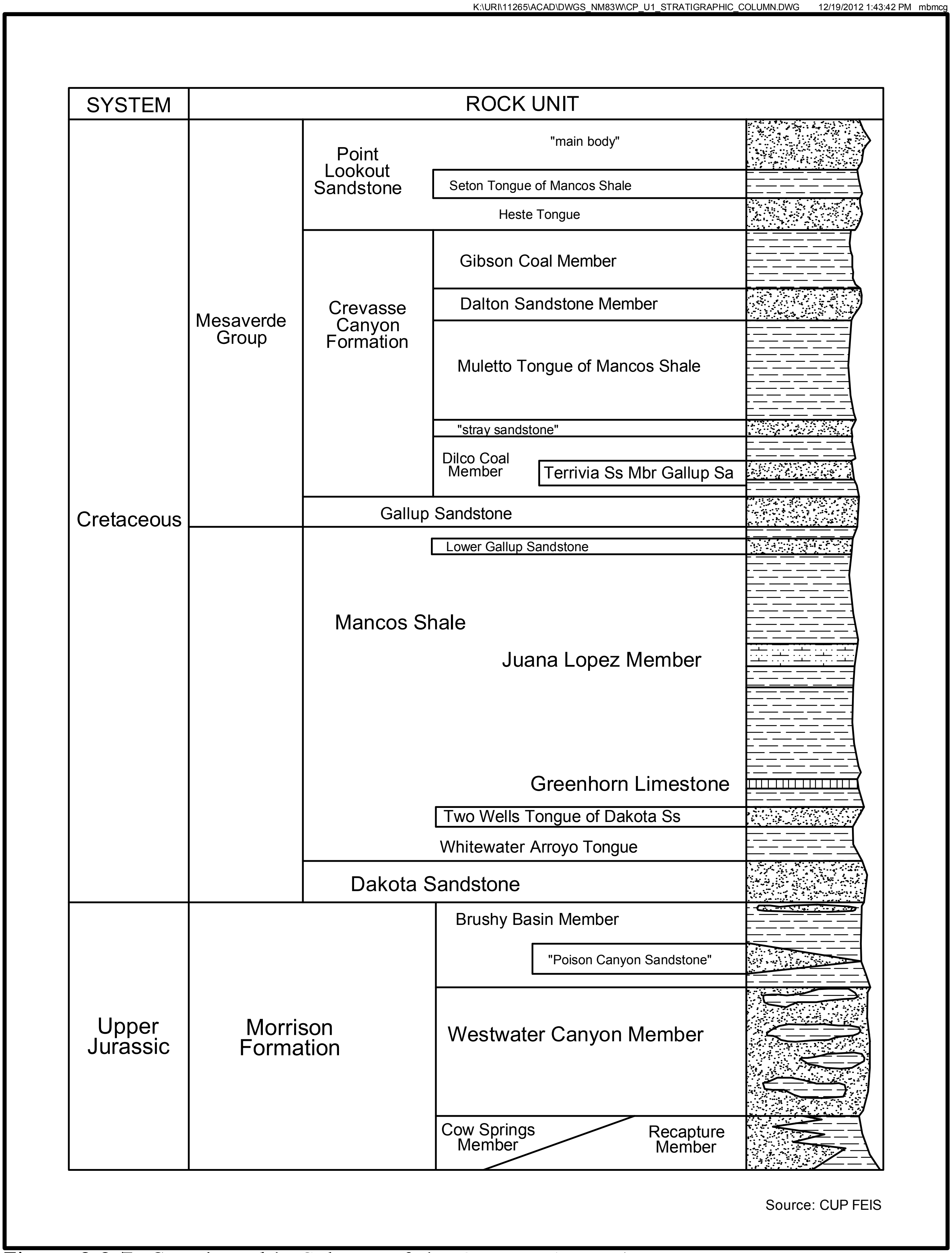
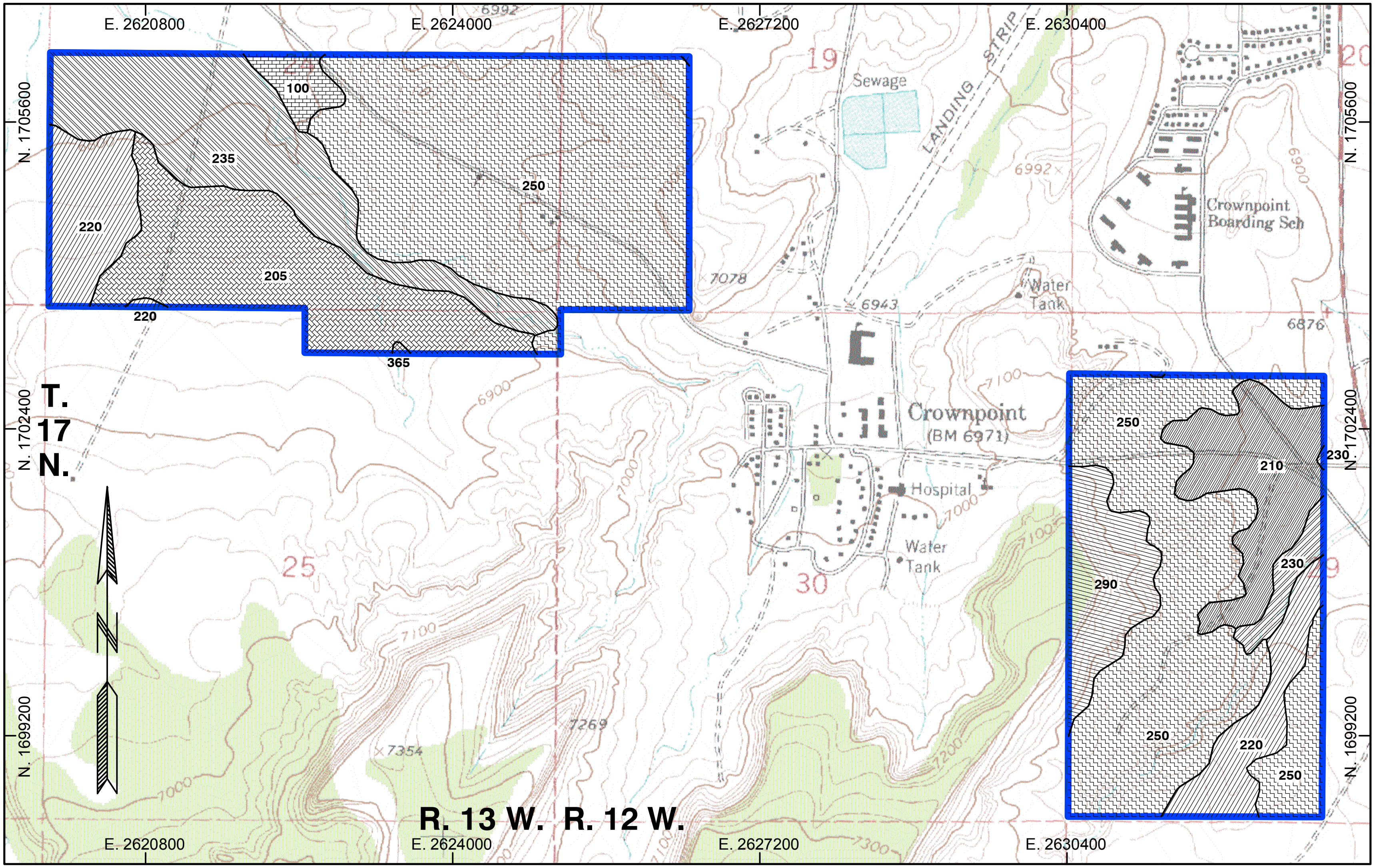


Figure 3.3-7. Stratigraphic Column of the Crownpoint and Unit 1 Project Areas.

Figure 3.3-8. Soil Units within the Crownpoint Project Area.



Basemap: USGS 1:24,000 Quad Crownpoint
Drawing Coordinates: NM83-WF
Source: USDA-NRCS 2008

Feet: 0, 800, 1,600, 2,400, 3,200
Meters: 0, 200, 400, 800

LEGEND

PROJECT AREA

SOIL UNITS

- **100** Norkiki-Kimnoli complex, 1 to 8 percent slopes
- **205** Penistaja-Tintero complex, 1 to 10 percent slopes
- **210** Marianolake-Skyvillage complex, 1 to 8 percent slopes
- **220** Hagerwest-Bond fine sandy loams, 1 to 8 percent slopes
- **230** Sparank-San Mateo-Zia complex, 0 to 3 percent slopes
- **235** Notal-Hamburn complex, 0 to 2 percent slopes
- **250** Hospah-Skyvillage-Rock outcrop complex, 2 to 35 percent slopes
- **290** Rock outcrop-Westmion-Skyvillage complex, 30 to 80 percent slopes
- **365** Vessilla-Rock outcrop complex, 2 to 15 percent slopes

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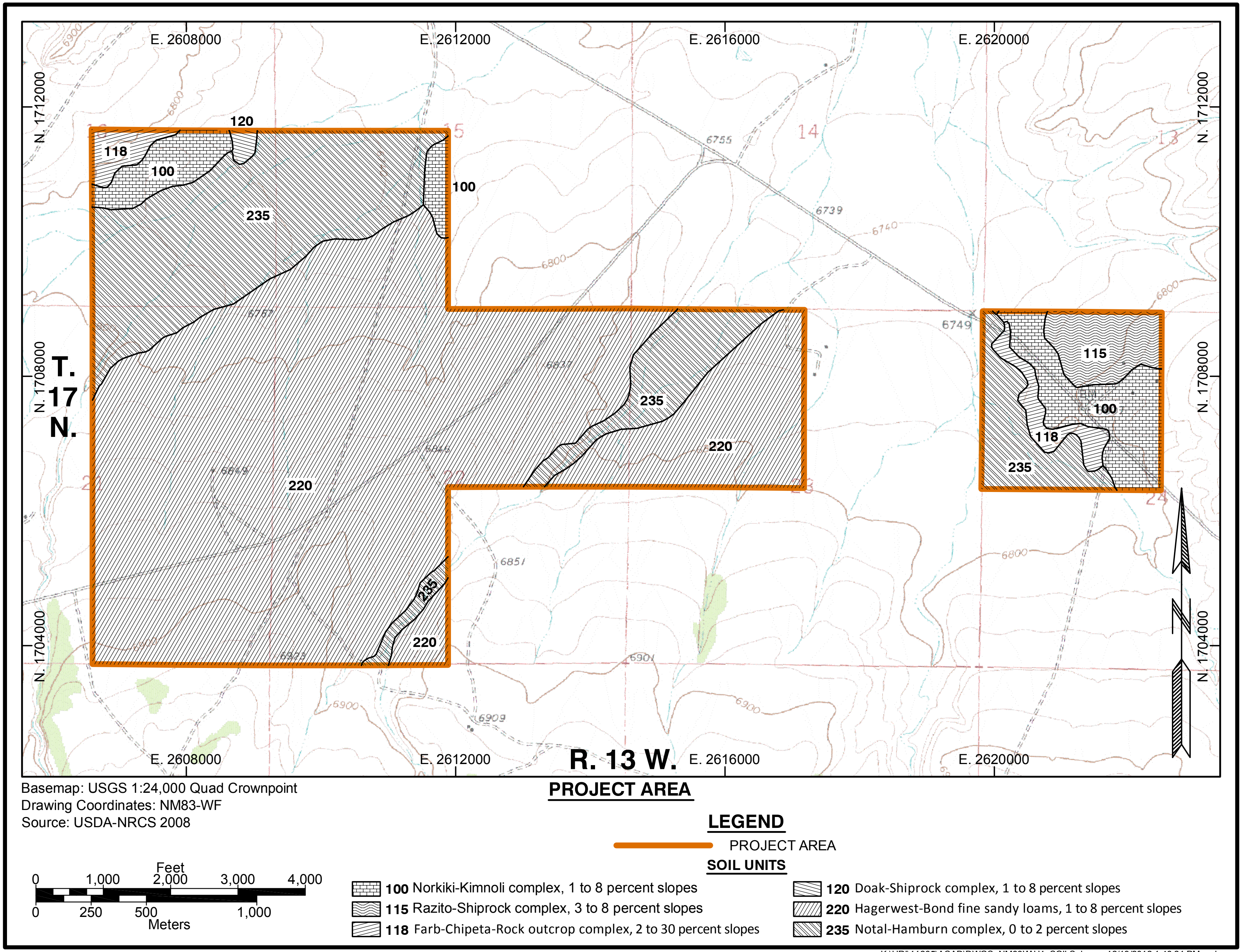

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Figure 3.3-9. Soil Units within the Unit 1 Project Area.

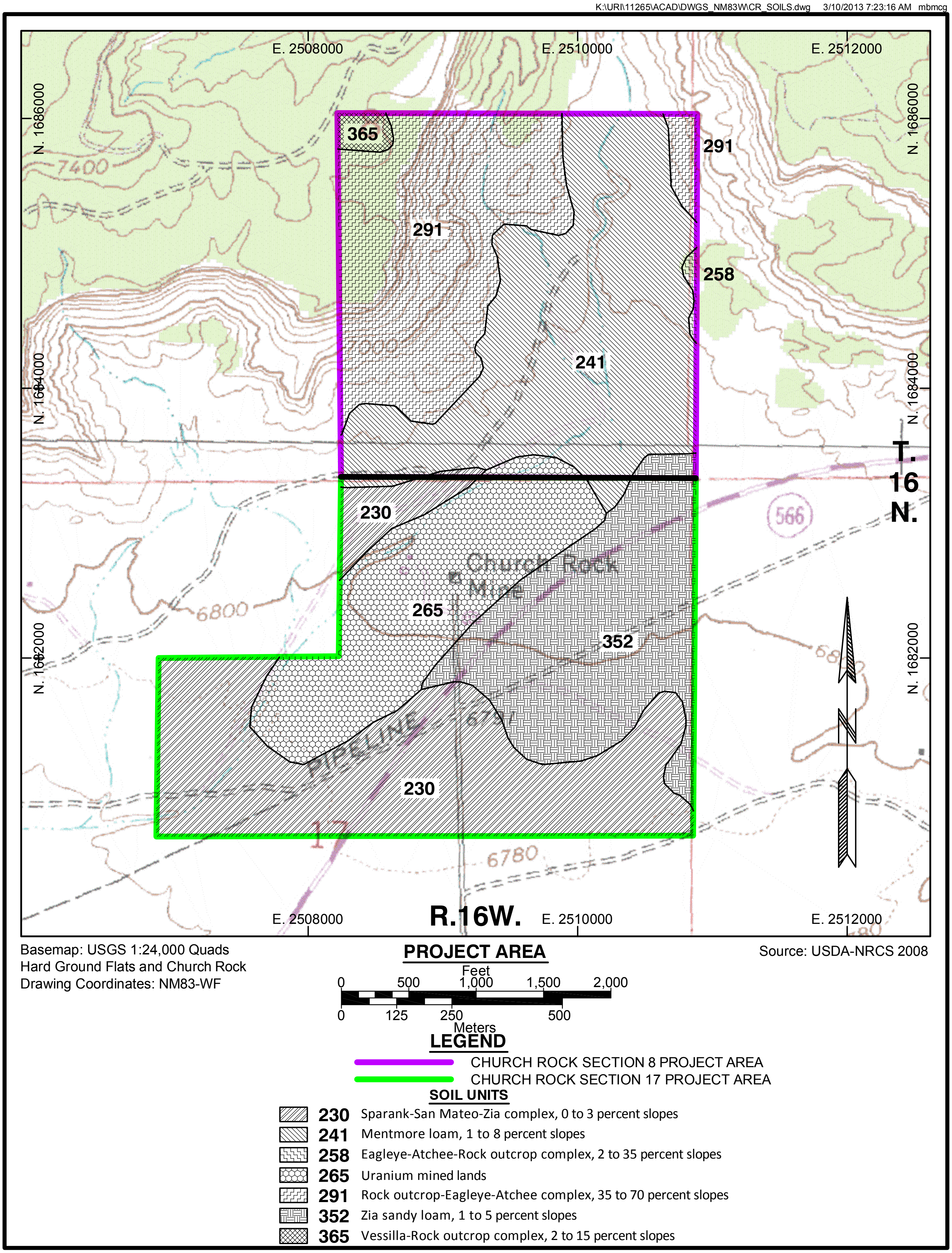


Figure 3.3-10. Soil Units within the Church Rock Sections 8 and 17 Project Areas.

3.4 Water Resources

3.4.1 Surface Water

Section 3.3.1 of the CUP FEIS provides a general discussion of the regional surface water resources as well as a discussion of surface water resources within and surrounding each of the project areas. The following presents a general discussion of regional surface water and a detailed discussion of the watersheds encompassing the project areas. In addition, the results of the surface water hydrologic analyses for the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas are provided. The Crownpoint and Unit 1 analyses were completed as part of the license application but are not included in the CUP FEIS. A hydrologic analysis of the Church Rock Sections 8 and 17 project areas was completed as part of the license application; however, since the publication of the CUP FEIS the unnamed arroyo within the Church Rock Sections 8 and 17 project areas has changed. Due to these changes, the surface water hydrology was re-analyzed and the results of the analysis are discussed in Section 3.4.1.3.1 of this ER. This section also provides information on surface water features within and 2-miles surrounding each of the project areas per NUREG-1569. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to water resources.

3.4.1.1 Regional Surface Water

A discussion of regional surface water resources is provided in Section 3.3.2.1 of the CUP FEIS. In addition, Section 3.5.4.1 of the ISR GEIS provides a description of the regional watersheds. The following summarizes the regional surface water resources.

Western New Mexico's semiarid climate results in characteristically high surface evaporation rates. The average annual pan evaporation rates from the Western Regional Climate Center (WRCC 2012) for Farmington, Laguna and Shiprock, New Mexico are 1.7 m [66.8 in], 1.7 m [66.2 in], and 1.9 m [73.2 in], respectively. Farmington is located approximately 110 km [70 mi] north of the project areas, Laguna is approximately 100 km [65 mi] southeast of the project areas, and Shiprock is approximately 130 km [80 mi] northwest of the project areas. These three sites form an approximate triangle around the project areas. Significant runoff is observed in the region only infrequently because most of the runoff collects, infiltrates, or evaporates locally.

There are two main watersheds encompassing the CUP: the Upper San Juan, Chaco (Hydrologic Unit Code (HUC) 14080106) and the Little Colorado River, Upper Puerco (HUC 15020006). The Rio Grande/Elephant Butte, San Jose watershed (HUC 13020207) is located southeast of the CUP. Regional watersheds are depicted on Figure 3.4-1.

The Crownpoint and Unit 1 project areas are located within the Upper San Juan, Chaco watershed, which is drained by the Chaco River and its tributaries. This watershed is approximately 11,900 km^2 [4,600 mi^2]. The Chaco River drains to Rio San Juan north of the Crownpoint and Unit 1 project areas. There are no perennial streams within the Upper San Juan watershed.

The Church Rock Sections 8 and 17 project areas lie within the Little Colorado River, Upper Puerco watershed. The Puerco River is the primary stream within the Upper Puerco watershed.

This watershed is approximately 4,900 km^2 [1,900 mi^2] and drains west to the Little Colorado River. A USGS gaging station (09395350) on the Puerco River operated from October 1977 through January 1983 and from May 1989 through October 1992. The recorded average daily flows are presented in Figure 3.4-2. There are no perennial streams within the Upper Puerco watershed.

3.4.1.2 Crownpoint and Unit 1

Due to the proximity of the Crownpoint and Unit 1 project areas, the discussion regarding surface water resources for these project areas is combined in this section. Surface water hydrology within the Crownpoint and Unit 1 project areas is described in Sections 3.3.2.2 and 3.3.2.3 of the CUP FEIS, respectively. As described in the CUP FEIS, runoff occurs during the peak precipitation period (July through October) and during snowmelt occurring on site and in the sandstone highlands to the south. Surficial deposits commonly intercept and absorb much of the precipitation and snowmelt, resulting in minimal runoff.

3.4.1.2.1 Surface Water Features

Within the Crownpoint project area a man-made channel diverts storm water runoff along the southern boundary of the project area in a westerly direction away from three existing ponds. The diversion channel and ponds were part of the existing facilities acquired by HRI from Conoco/Westinghouse. As part of the license application HRI conducted a hydrologic analysis to determine the capacity of the diversion channel and berms. A component of the hydrologic analysis was an estimate of the peak flow rate based on a probable maximum precipitation (PMP) event. The PMP was calculated at 23 cm [8.9 in] in a 24-hour period. The estimated peak flows were found to range from 324 to 555 m^3/sec [11,428 to 19,599 ft^3/sec (cfs)] across the project area based on hydraulic modeling using the ACOE HEC-1 model. Additional details on the hydrologic analysis are presented in Table 2.3-1 of the COP. In addition to the peak flow analysis, the ACOE HEC-2 water surface profile model was used to determine the PMF water surface profile and channel velocities. The HEC-1 and HEC-2 modeling results indicated that all three ponds would be inundated by the PMF due to the limited capacity of the existing diversion channel. Section 5.4.1 of this ER describes the flood protection mitigation measures and indicates that HRI will not use the lowest pond and riprap will be added to the diversion channel.

The surface water features in the Unit 1 project area consist of two shallow arroyos roughly 6 m [20 ft] deep. The arroyos run from south to north and are separated by a ridge. As described in Section 3.3.2.3 of the CUP FEIS, TVA previously analyzed several watersheds, including the Unit 1 project area. The calculated mean annual discharges for the various drainage basins within the project area were found to range from 6 to 11 mm [0.25 to 0.42 in].

A more detailed hydrologic analysis of the Unit 1 project area was completed by HRI in 1996 to further assess runoff quantities. A rational method calculation, as described in Section 2.3.3 of the COP, was used to estimate the peak flows in the arroyos in the vicinity of the project area during the PMP event. Table 2.3-2 of the COP provides existing hydrologic characteristics of the Unit 1 drainage areas depicted on Figure 2.3-1 of the COP. The peak flow from the PMP event was calculated to be 27 m^3/sec [946 cfs] in the east arroyo and 19 m^3/sec [657 cfs] in the west arroyo.

3.4.1.2.2 Surface Water Quality

Due to the infrequent nature of runoff events within the project areas, no baseline surface water quality data have been collected.

3.4.1.2.3 Surface Water Use

There are no surface water rights or reservoirs within 2 miles of the Crownpoint and Unit 1 project areas.

3.4.1.3 Church Rock Sections 8 and 17

Surface water hydrology within the Church Rock Sections 8 and 17 project areas is described in Section 3.3.2.4 of the CUP FEIS. The Church Rock Sections 8 and 17 project areas are located near Pipeline Canyon, a tributary to the Puerco River. All of the water courses within the North Fork drainage are ephemeral. As with the Crownpoint and Unit 1 project areas, runoff in the Church Rock Sections 8 and 17 project areas results infrequently from rainfall and snowmelt occurring on site and within the small watershed to the north. The Church Rock Sections 8 and 17 project areas are crossed by a small unnamed arroyo draining a small watershed that originates in the sandstone highlands to the north.

3.4.1.3.1 Surface Water Features

Existing surface features within the Church Rock Section 17 project area include five ponds with earthen embankments previously used as settling ponds by UNC in the 1970s. The ponds were decontaminated by UNC, prior to HRI acquiring the project area. HRI's 2011 aerial topography of the Church Rock Section 17 project area indicates that the ponds range in depth from 2 to 4 m [7 to 13 ft]. The ponds have remained unused since HRI acquired the property.

As discussed in Section 3.3.2.4 of the CUP FEIS, HRI conducted an analysis of the surface hydrology at the Church Rock Sections 8 and 17 project areas. The analysis indicated that during the PMP event, the unnamed arroyo would not flood a significant portion of the project areas. Discussions with the NMED led to the use of the 25- and 100-year frequency storms as the criteria for evaluation of the project areas flooding potential (EH&A 1993). The results of the analysis are presented in Table 3.24 of the CUP FEIS. Calculated peak flow rates for the 25-year frequency storm event range from 44 to 55 m^3/sec [1,557 to 1,953 cfs], while the 100-yr frequency storm event discharge rates range from 55 to 78 m^3/sec [1,959 to 2,767 cfs].

Since the CUP FEIS was published in 1997, natural erosion within the unnamed arroyo crossing the Church Rock Sections 8 and 17 project areas has caused the depth of the arroyo to increase at the northernmost portion of the project areas from 5 to 8 m [17 to 25 ft], while the width and flow path have remained essentially unchanged. Due to this change, HRI contracted WWC Engineering to conduct a HEC-RAS flood inundation analysis using the updated arroyo profile and cross sections and the 100-year peak flow estimate from the CUP FEIS (78 m^3/sec [2,767 cfs]). The updated analysis used cross sections developed from HRI's 2011 aerial topography.

The results from the WWC Engineering HEC-RAS analysis were mapped and compared to the previous HRI study. Figure 3.4-3 shows that the estimated 100-year flood inundation area will be contained within the existing arroyo limits except for the southwestern portion of the Section 17 project area, where the arroyo becomes less defined as it enters the Puerco River floodplain. Therefore, the projected 100-year floodplain in this area was interpolated from existing topography and aerial photographs along with the HEC-RAS analysis. The calculated discharge velocity from the analysis ranged from 1 to 6 m/sec [4 to 19 ft/sec], which indicates potential for additional erosion. These results are comparable to those identified in the previous study.

3.4.1.3.2 Surface Water Quality

Surface water quality has been measured at one site (USGS 09395350) near the Church Rock Sections 8 and 17 project areas (see Figure 3.4-1 for gaging station location). This site is located on the ephemeral Puerco River and was monitored for water quality between 1979 and 1983 and between 1989 and 1991. USGS water quality data indicated that surface runoff is fresh to moderately saline, with TDS concentrations ranging from 431 to 3,350 mg/L. TDS concentrations are classified according to the USGS salinity classification (Heath 1983) as follows: fresh, 0-1,000 mg/L; slightly saline, 1,000-3,000 mg/L; moderately saline, 3,000-10,000 mg/L; very saline, 10,000-35,000 mg/L; and briny, more than 35,000 mg/L. Table 3.4-1 presents selected water quality data for the site.

3.4.1.3.3 Surface Water Use

As indicated in Section 3.3.2.4 of the CUP FEIS, downstream use of surface water is limited to occasional livestock watering. This water is derived from storm flows that are captured in the arroyos and pumped for use.

3.4.2 Wetlands and Waters of the United States

Wetlands and waters of the United States (WoUS) discussions were not included in the CUP FEIS. Section 3.5.4.2 of the ISR GEIS includes general information regarding wetlands and WoUS in northwestern New Mexico. New regional and site-specific discussions of wetlands and WoUS are presented below.

The regulatory program of the plays a critical role in the protection of the aquatic ecosystem and navigation. Under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, the ACOE performs the following services:

- Conducts jurisdictional determinations for wetlands and other Waters of the United States (OWoUS) and navigable waters of the United States
- Authorizes activities in these jurisdictional areas through individual and general permits
- Ensures compliance of issued permits
- Enforces requirements of the law for unpermitted activities

Under Section 404 of the Clean Water Act, the Secretary of the Army is responsible for administering a regulatory program that requires permits to discharge dredged or fill material into WoUS, including wetlands.

Isolated waters such as playa lakes, prairie potholes, old river scars, cutoff sloughs, and abandoned construction and milling pits may also be WoUS if they meet certain criteria. Wetlands are found in many different forms including bottomland hardwood forests, wooded swamps, marshes, wet meadows, bogs, and playa lakes. Wetlands are of particular value because they assist in restoring and maintaining the quality of WoUS. Their functions include sediment trapping, nutrient removal, chemical detoxification, shoreline stabilization, aquatic food chain support, fish and wildlife habitat, floodwater storage, and groundwater recharge.

According to ACOE (1987), wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." A minimum of one positive indicator from each parameter (vegetation, hydrology, and soils) must be found to make a positive wetland determination.

- Vegetation—Under normal circumstances, an area is considered to have hydrophytic vegetation when more than 50% of dominant species, from all plant strata, are classified as Obligate (OBL), Facultative Wet (FACW), or Facultative (FAC).
- Hydrology— ACOE (1987) requires that wetland soils must be continually saturated for a prolonged period (at least 5% of the time) during the growing season.
- Soils—Hydric soils are those that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in their upper parts.

Man-made ponds and other surface features not immediately adjacent to traditional navigable waters do not fall under the jurisdiction of ACOE. The landward regulatory limit for waters (in the absence of adjacent wetlands) is the ordinary high-water mark. The ordinary high-water mark is the line on the shores established by the fluctuations of water and indicated by physical characteristics such as:

- a clear natural line impressed on the bank;
- shelving;
- changes in the character of the soil;
- destruction of terrestrial vegetation;
- the presence of litter and debris; and
- other appropriate means that consider the characteristics of the surrounding areas.

WoUS and special aquatic sites that include wetlands need to be identified and the impact determined for a potential ISR facility. Based on impacts and jurisdictional determination for each affected wetland or WoUS, an appropriate permit will need to be obtained from the local

ACOE district. Within the project region, the State does not regulate wetlands; however, Section 401 state water quality certification is required for work in OWoUS.

Currently, no digital data identifying wetlands or WoUS are available within the project region. However, hardcopy National Wetland Inventory maps are available from the USFWS. In general, WoUS in this region consist of ephemeral arroyos with few perennial rivers. Bands of wetlands are typically concentrated along rivers and streams while seasonally emergent wetland areas may be found within woody habitat at high elevations. Within the project region, springs and seeps often support small marshes (cienegas), oases, and other wetland types (ACOE 2006). Desert playas are intermittent, shallow basins that develop every year in areas with no outlet that periodically fill with water.

According to Section 3.5.4.2 of the ISR GEIS, wetlands and other shallow aquatic habitats occupy only about 1–5% of the land surface in northwestern New Mexico.

3.4.2.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

Surface water features associated with the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas are typical of a semiarid climate, with low precipitation and high surface evaporation. Significant, long-term runoff and surface water are rarely observed. WoUS in this region consist of ephemeral arroyos, which flow only in response to major runoff events. Site-specific wetland delineation surveys have not been conducted in any of the project areas. Although it is unlikely that wetlands occur within these areas due to the lack of surface water, a formal wetland delineation/verification may be required prior to site development. Any work in OWoUS, including ephemeral arroyos, will require conditional certification from the NMED-SWQB.

3.4.3 Groundwater

Section 3.3.1 of the CUP FEIS provides a detailed discussion of regional groundwater resources as well as groundwater within and surrounding each of the project areas. The CUP FEIS includes the results of the baseline monitoring conducted by HRI and includes a discussion of the water quality and characteristics of the aquifers. The following presents a general discussion of the regional groundwater resources and summarizes site-specific groundwater quality and groundwater use. Since the publication of the CUP FEIS the EPA/NNEPA water quality standards have been revised. The groundwater quality tables presented in this section reflect these changes. In addition, a groundwater rights search is presented for the project areas and surrounding areas within 2 miles per NUREG-1569. Groundwater levels in the Church Rock Sections 8 and 17 areas have been monitored since the CUP FEIS was issued. The results are included in Section 3.4.3.3.3 of this ER.

3.4.3.1 Regional Groundwater Resources

A discussion of the regional groundwater resources is provided in Section 3.3.1.1 of the CUP FEIS. In addition, Section 3.5.4.3 of the ISR GEIS provides a description of the regional aquifers. The following summarizes the regional aquifer systems as they relate to the CUP.

Northwestern New Mexico is situated over a portion of the much larger Colorado Plateaus aquifers, which approximately coincide with the Colorado Plateaus Physiographic Province. In general, the aquifers in the Colorado Plateaus are composed of permeable, moderately to well-consolidated sedimentary rocks. For purposes of discussion, the many water-yielding units in the area have been grouped into four principal aquifers: the Uinta-Animas, Mesaverde, Dakota-Glen Canyon aquifer system, and the Coconino-De Chelly (Robson and Banta 1995).

Uinta-Animas Aquifer

The Uinta-Animas aquifer within the San Juan Structural Basin comprises the San Jose, Animas, and Nacimiento formations and the Ojo Alamo Sandstone. The combined aquifer thickness is approximately 1,070 m [3,500 ft]. The Uinta-Animas aquifer is recharged from higher altitude areas around the basin. Water quality is fresh to moderately saline with TDS values ranging from 1,000 to 4,000 mg/L. This aquifer is not present within the CUP.

Mesaverde Aquifer

In the San Juan Structural Basin, the Mesaverde aquifer is present in rocks of the Mesaverde Group, which consists of sandstone, coal, siltstone, and shale. In the southern portion of the San Juan Structural Basin the maximum thickness of the Mesaverde aquifer is 1,370 m [4,500 ft]. Recharge to this aquifer occurs from the area of the Zuni Uplift, Chuska Mountains, and in northern Sandoval County, New Mexico. The aquifer discharges to the San Juan and Chaco Rivers and their tributaries. The water quality of the aquifer within the San Juan Structural Basin is variable (fresh to moderately saline) with TDS values ranging from 1,000 to 4,000 mg/L. The aquifer is confined by the underlying Mancos Shale, which ranges in thickness from 300 to 1,800 m [1,000 to 6,000 ft]. This aquifer is present within the CUP, but is structurally above the target zone for uranium ISR.

Dakota-Glen Canyon Aquifer System

The Dakota-Glen Canyon aquifer system comprises four permeable zones including, in descending order, the Dakota Sandstone aquifer, the Morrison Formation aquifer, the Entrada Sandstone aquifer, and the Glen Canyon Sandstone aquifer. The lithology of the Dakota-Glen Canyon aquifer system varies and includes conglomerate, sandstone, siltstone, mudstone, carbonaceous shale, and coal. Underlying the Dakota aquifer is the Brushy Basin Member confining unit. The Brushy Basin Member is composed of impermeable siltstone, mudstone, and claystone providing confinement between the Dakota aquifer and the Morrison Formation. The Morrison Formation aquifer is located in the middle to lower portion of the Morrison Formation and consists of sandstone, siltstone, and mudstone. CUP uranium ISR will target uranium deposits in the Westwater Canyon sandstone aquifer in the Morrison Formation. Throughout the majority of the Colorado Plateaus the Curtis-Stump Member confines the Morrison Formation aquifers from the Entrada aquifer. In part of the Colorado Plateaus, the Carmel-Twin Creek Member is the underlying confining unit between the Entrada aquifer and the Glen Canyon aquifer. The Glen Canyon aquifer is the thickest aquifer of the Dakota-Glen Canyon aquifer system, varying in thickness from 600 to 3,700 m [2,000 to 12,000 ft]. The lowest confining unit in the Dakota-Glen Canyon aquifer system is the Chinle-Moenkopi confining unit.

While water recharge data for the Dakota-Glen Canyon aquifer system are sparse, it appears that major recharge areas lie along the southeastern end of the Uncompahgre Uplift, the northern margins of the Uinta Basin, and the eastern side of the Piceance Basin. Water discharges along the White, Colorado, and Gunnison Rivers. The water quality of the aquifer within the San Juan Structural Basin is highly variable (fresh to briny). TDS concentrations range from 1,000 mg/L in the shallower portions to over 35,000 mg/L in the deeper portions of the aquifer system.

Coconino-De Chelly Aquifer

The Coconino-De Chelly aquifer is present in the southern part of the Colorado Plateaus. The aquifer comprises three formations: the Coconino, De Chelly, and Glorieta sandstones; the San Andres Limestone; and the Yeso and Cutler formations. Within the San Juan Structural Basin, the aquifer is recharged from the Zuni and Defiant uplifts and discharges from the aquifer are north to the Colorado River. The water quality of the aquifer within the San Juan Structural Basin is considered fresh (TDS concentrations typically less than 1,000 mg/L). This aquifer is present within the CUP but is structurally below the target zone for uranium recovery.

3.4.3.1.1 Navajo-Gallup Water Supply Project/Conjunctive Groundwater Development Plan

The Omnibus Public Land Management Act of 2009, Title X Part III (Public Law 111-11) authorizes construction of the Navajo-Gallup Water Supply Project. When completed in 2040, the project will transport water from the San Juan River to the eastern section of the Navajo Nation, the southwestern portion of the Jicarilla Apache Nation, and the city of Gallup. Construction will include 450 km [280 mi] of pipeline, pumping plants, and two water treatment plants and is estimated to provide approximately 4.7×10^{10} L [38,000 ac-ft] of water annually. The water will provide a long-term (40-year) water source to support current and future populations.

The water supply project includes a conjunctive groundwater component to supplement diversions from the San Juan River until the project is completed. The supplementation plan is described in the Conjunctive Groundwater Development Plan, prepared by the Navajo Nation Department of Water Resources, Water Management Branch (NNDWR 2010). The plan provides a preliminary analysis of existing wells within the Navajo-Gallup Water Supply Project area and provides a list of potential conjunctive groundwater projects.

In 2012 HRI recently collaborated with the Navajo Nation and the City of Gallup to evaluate the potential for the Church Rock Section 8 project area to impact the Navajo-Gallup Water Supply Project. The study results indicate that existing Gallup, Fort Wingate, Rehoboth, and Navajo Nation water wells will not be impacted by Church Rock Section 8 ISR activities. Moreover, the evaluation concluded that there is no discernible risk that ISR activities will adversely affect groundwater allocated for the Navajo-Gallup Water Supply Project. The report, “Section 8/Navajo-Gallup Groundwater Report and Conjunctive Use Evaluation,” was prepared by Daniel B. Stephens and Associates, Inc. in October 2012.

3.4.3.2 Crownpoint and Unit 1

Due to the proximity of the Crownpoint and Unit 1 project areas, the discussion is combined regarding groundwater resources for these areas. The site hydrogeology within the Crownpoint and Unit 1 project areas is described in Sections 3.3.1.2 and 3.3.1.3 of the CUP FEIS, respectively. In the Crownpoint and Unit 1 areas, in descending order, the Mesaverde Group (Gallup Sandstone), Dakota Sandstone, and Morrison Formation (Westwater Canyon) aquifers are of primary interest (Figure 3.3-7).

The thickness of the Gallup Sandstone varies regionally from 0 to more than 70 m [230 ft] and is about 25 m [80 ft] near the Crownpoint and Unit 1 project areas. The Upper Cretaceous age Mancos Shale is a confining unit that separates the Gallup Sandstone from the underlying Dakota Sandstone. This confining unit is approximately 183 to 213 m [600 to 700 ft] thick in the Crownpoint and Unit 1 project areas.

The Dakota Sandstone is the second major aquifer encountered in the Crownpoint and Unit 1 project areas. The Dakota Sandstone crops out around the margins of the San Juan Basin and thickens towards the center of the basin to about 60 m [200 ft]. This aquifer is structurally above the target zone for uranium ISR. The Dakota Sandstone at the town of Crownpoint is classified as an USDW. The Upper Jurassic age Brushy Basin Member is the confining unit separating the Dakota Sandstone from the underlying Westwater Canyon aquifer. This confining unit is approximately 47 m [153 ft] thick in the Crownpoint and Unit 1 project areas.

The Morrison Formation aquifer is located in the middle to lower portion of the Morrison Formation and consists of sandstone, siltstone, and mudstone. In the Crownpoint and Unit 1 project areas, the Morrison Formation aquifer is referred to as the Westwater Canyon aquifer. Uranium ISR will target uranium deposits in the Westwater Canyon Member aquifer in the Morrison Formation. In the Crownpoint and Unit 1 project areas, the top of the Westwater Canyon Member is found at an average depth of approximately 560 m [1,840 ft] and ranges in thickness from 72 to 107 m [236 to 350 ft]. The Westwater Canyon aquifer at the town of Crownpoint is classified as a USDW.

In 1992 HRI conducted pump tests in the Westwater Canyon aquifer to determine the hydraulic properties of the ore-bearing sandstone and to determine the degree of vertical hydraulic confinement between the Dakota Sandstone and the Westwater Canyon aquifer. The test was performed for 72 hours from April 17 through April 20 by pumping a Westwater Canyon well located near the Crownpoint project area facilities. During the pump test water levels were monitored in one monitor well completed in the Dakota Sandstone and five monitor wells completed in the Westwater Canyon. The results presented in Table 3.15 of the CUP FEIS indicated that transmissivities range from 237 to 251 m^2/day [2,556 to 2,698 gal/day/ft] in the Westwater Canyon aquifer in the Crownpoint project area. No aquifer interconnection was detected by the test (i.e., no drawdown was detected in the Dakota Sandstone monitor well).

The Recapture Member is the confining unit between the Westwater Canyon aquifer and the underlying Cow Springs aquifer. This confining unit is approximately 79 m [260 ft] thick in the Crownpoint and Unit 1 project areas.

3.4.3.2.1 Groundwater Quality

The wells within and surrounding the Crownpoint and Unit 1 project areas have not been monitored since water quality samples were collected as part of the baseline sampling completed for the NRC license application in the early 1990s. The results of the baseline water quality sampling were submitted with the license application and are included in the CUP FEIS. Due to changes in EPA/NNEPA drinking water standards since publication of the CUP FEIS, new tables are presented to include the revised water quality standards. The following discusses the groundwater quality in the Gallup Sandstone, Dakota Sandstone, and Westwater Canyon aquifers in the Crownpoint and Unit 1 project areas. The major ion chemistry and TDS concentrations provide a general indication of water quality within each aquifer.

Gallup Sandstone aquifer water quality was estimated using the results of three samples from two USGS wells (USGS 354332108165501 and 354342108184001) completed approximately 6 km [4 mi] west of the Crownpoint and Unit 1 project areas. Selected water quality data for the two wells are included in Table 3.4-2. The general water chemistry is summarized in Table 3.4-3 and compared to that in other aquifers in and around the project areas. The cation chemistry of the Gallup Sandstone aquifer is dominated by sodium and anions by bicarbonate and sulfate. TDS concentrations in three samples from the two wells ranged from 427 to 877 mg/L. Water quality within the Gallup Sandstone aquifer in the area meets EPA and NNEPA primary drinking water standards. Table 3.4-4 presents the EPA and NNEPA drinking water standards that were exceeded by at least one sample.

Dakota Sandstone aquifer water quality in the Crownpoint project area was estimated using four samples from one well within the project area (CP-10). The results are listed in Table 3.4-5. The water chemistry is characterized by sodium sulfate/bicarbonate ions, and the TDS concentration ranged from 671 to 693 mg/L. The water quality meets EPA and NNEPA primary drinking water standards. Water quality data for the Dakota Sandstone aquifer in the Unit 1 project area was determined using four samples from two wells (15L-101 and 16P-101). The results are listed in Table 3.4-6. The water quality is characterized by sodium bicarbonate/sulfate ions with TDS concentrations ranging from 536 to 590 mg/L. The water quality exceeds EPA and NNEPA primary drinking water standard for uranium. Crownpoint and Unit 1 monitoring wells are summarized in Table 3.4-10 and depicted on Figure 3.4-4.

Westwater Canyon water quality within the Crownpoint project area was estimated using samples from 6 wells (CP-2, CP-3, CP-5, CP-6, CP-7, and CP-8). The results are summarized in Table 3.4-7. The water quality is characterized by sodium and bicarbonate ions. The TDS concentrations ranged from 318 to 666 mg/L. The water quality exceeds the primary drinking water standards for radium-226. The water chemistry in CP-2 was significantly different than the other monitored wells. This well is within the uranium ore body, and the water quality of this well will likely be more representative of the water quality encountered during uranium recovery operations. Westwater Canyon water quality within the Unit 1 project area was estimated using samples collected by Mobil in 1982. The results are listed in Table 3.4-8. The water quality is characterized by sodium bicarbonate ions, with TDS concentrations ranging from 0 to 590 mg/L. The water quality exceeds primary drinking water standards for gross alpha, radium-226, and uranium.

The town of Crownpoint derives its water supply from six wells. The water supply network is owned and operated by the BIA and the NTUA. Five of the wells (BIA-3, BIA-5, BIA-6, NTUA-1, and NTUA-2) are found near the Crownpoint project area. The two wells owned by NTUA (NTUA-1 and NTUA-2) are completed in the Westwater Canyon Member, while wells owned by BIA (BIA-3, BIA-5, and BIA-6) are completed in the Dakota Sandstone as well as the Westwater Canyon Member. In addition, well BIA-5 is also completed into the Cow Springs Member. Since these wells were completed in more than one formation, they were not included in the water quality analyses of individual aquifers. Results of water quality analyses for the five town of Crownpoint water supply wells near the Crownpoint project area are presented in Table 3.4-9. Table 3.12 of the CUP FEIS shows results for combined wells BIA-5 and BIA-6; however, the results are actually for combined wells BIA-3 and BIA-5 (HRI 1996d). Even though the town's water supply wells are completed in sands that contain uranium deposits within the project areas, radionuclide concentrations are low; average uranium concentrations range from <0.001 to 0.007 mg/L and average radium-226 concentrations range from 0.3 to 0.6 pCi/L. The average water quality of the five wells generally meets EPA and NNEPA drinking water standards. The town of Crownpoint water supply wells are summarized in Table 3.4-9 and depicted on Figure 3.4-4.

3.4.3.2.2 Groundwater Use

Groundwater rights were evaluated within 3.2 km [2 mi] of the Crownpoint and Unit 1 project areas to assess historical and current groundwater use per Section 2.2.2 of NUREG-1569. A search of the water rights registered with the NMOSE and NNWCA revealed 195 groundwater rights. The wells are depicted on Figure 3.4-4 and summarized in Table 3.4-10. In addition, one unregistered well was identified southwest of the Crownpoint project area. The records indicate that 154 of the 195 registered groundwater rights have been plugged and abandoned. The remaining 41 wells are permitted for the following uses:

# of Wells	Use
11	Exploration
9	Other
5	Domestic
3	Unknown
3	Sanitary
3	Livestock
2	Mining
2	Municipal
2	Prospecting
1	Industrial

Of the registered, non-abandoned wells within 3.2 km [2 mi] of the Crownpoint and Unit 1 project areas, nine are permitted for domestic, livestock, or municipal use. Water for the town of Crownpoint is supplied by wells completed in the Westwater Canyon Member, Dakota Sandstone, and/or the Cow Springs Member. Table 3.4-11 summarizes general information regarding the municipal and domestic water supply wells within 3.2 km [2 mi] of the project areas. Records for the wells operated by NTUA indicate that the 2005 average production rates for NTUA-1 and NTUA-2 were 380 Lpm [100 gpm] and 870 Lpm [230 gpm], respectively (NNDWR 2010). One unregistered well, Arviso Well, near the Crownpoint project area, is currently used for livestock watering.

In addition to the two NTUA municipal wells and three domestic wells used by BIA, two private domestic wells and three wells permitted for livestock use were identified within 3.2 km [2 mi] of the Crownpoint and Unit 1 project areas. Since the publication of the CUP FEIS, NTUA has completed a water supply system to residents living outside of the town of Crownpoint. It is likely that the two wells permitted for private domestic use are now used for livestock watering only. The water rights search also found three wells for sanitary use permitted by Mobil and HRI. The HRI well is located at the pump house near the existing Crownpoint facility and is intended for fire control, although it is not currently functional.

Several exploration drilling programs and two pilot projects were completed near the Crownpoint and Unit 1 project areas in the late 1970s and early 1980s. These projects provide valuable hydrogeologic data and include:

- A pilot project conducted by Mobil in Section 28 (T17N, R12W). The project included 22 wells. One well (SJ-533-EXPLORE) was plugged and abandoned in 1979, while the remaining wells were plugged and abandoned in 1987.
- A pilot project conducted by Mobil in Section 9 (T17N, R13W). All of the wells associated with the pilot project were plugged and abandoned in 1988.
- Full-scale well field development in Sections 15 and 16 (T17N, R13W). The wells were pump tested and baseline water quality samples were collected, but operations never commenced. Records indicate that all of the wells were plugged and abandoned in 1988.

In addition, Conoco/Westinghouse completed 11 wells within and surrounding the Crownpoint project area that were transferred to HRI. The wells are not currently in use and are equipped with well caps.

Water for the Crownpoint project area will be obtained from wells permitted through the NMOSE. Permit SJ-125-T authorizes HRI temporary appropriation for consumptive use of a maximum of 8.0×10^8 L [650 ac-ft] of water per year from the Westwater Member of the Morrison Formation. The wells associated with the water right will be located in Section 24 of T17N, R13W. These wells are not included in Table 3.4-10 since the wells have not been completed. A senior application for a water right for the Unit 1 project area has been submitted to the NMOSE, but has not yet been approved. The water right application will be amended by HRI for an appropriation of 8.0×10^8 L [650 ac-ft] prior to construction in the Unit 1 project area.

3.4.3.3 Church Rock Sections 8 and 17

The site hydrogeology within the Church Rock Sections 8 and 17 project areas is described in Section 3.3.1.4 of the CUP FEIS. In the Church Rock area, the key aquifers include, in descending order, the Dakota Sandstone, the “B” sands of the Brushy Basin Member, the Morrison Formation aquifer, and the Recapture Member (Figure 3.3-2). The Dakota Sandstone contains the first major aquifer encountered in the Church Rock Sections 8 and 17 project areas. It is structurally above the Westwater Canyon Member, which is the target zone for uranium ISR. Vertical flow in the Dakota Sandstone is believed to be downward, because the Dakota Sandstone aquifer is over-pressured relative to the Westwater Canyon aquifer. HRI believes that the lateral direction of groundwater flow in the Dakota Sandstone in the Church Rock Sections 8 and 17 project areas is northerly (CUP FEIS). The Upper Jurassic age Brushy Basin Member is the confining unit that separates the Dakota Sandstone from the underlying Westwater Canyon aquifer.

The Brushy Basin Member contains a sandstone aquifer 4 to 9 m [13 to 28 ft] thick, referred to in the Church Rock Sections 8 and 17 project areas as the “B” sands. This aquifer is stratigraphically above the Westwater Canyon Member, which is the target zone for uranium ISR. Clay confining units separate the “B” sands aquifer from the Dakota Sandstone aquifer above and the Westwater Canyon aquifer below.

The Morrison Formation aquifer is referred to as the Westwater Canyon Member aquifer in the Church Rock Sections 8 and 17 project areas.

3.4.3.3.1 Groundwater Quality

In 1987, HRI constructed six monitor wells (CR-1 through CR-6) in the Church Rock Section 8 project area for the purpose of hydrologic testing. During the initial pump test in January 1988, it was determined that well CR-4 was partially open into the production zone. In August 1988, well CR-4 was plugged and well CR-7 was completed in the Westwater Canyon “AA” sand as a replacement well. In addition, well CR-8 was completed to provide an analysis point between wells CR-3 and CR-6. The pump test of the Church Rock Section 8 project area was completed in September and October 1988. The monitor wells constructed by HRI and shown on Figure 3.4-5 were completed in the following aquifers:

- Westwater Canyon “A” sand – wells CR-3, CR-5, CR-6, and CR-8
- Westwater Canyon “AA” sand – well CR-7
- Brushy Basin“B” sand – well CR-2
- Dakota sand – well CR-1

The pump test was completed to determine the hydraulic properties of the ore-bearing sandstone and to determine the degree of vertical hydraulic confinement between the Dakota Sandstone aquifer, the Brushy Basin “B” sand aquifer, and the Westwater Canyon aquifer. Additional data from monitor wells were used to determine the degree of hydraulic communication that exists between the mineralized zone and perimeter monitoring points. As part of the pump test HRI completed four wells in the Westwater Canyon “A” sands aquifer, one well in the Westwater Canyon “AA” sands aquifer, one well in the Brushy Basin “B” sand aquifer, and one well in the Dakota Sandstone aquifer. The results, presented in Table 3.22 of the CUP FEIS, indicated that transmissivities ranged from 86 to 123 m^2/day [926 to 1,326 gal/day/ft]. No aquifer interconnection was detected by the test (i.e., no drawdown was detected in the Dakota Sandstone or Brushy Basin “B” sand monitor wells). In addition, a core analysis was performed on cores retrieved from the “AA” clay separating the Westwater Canyon Member from the underlying sands. The data from the analysis indicated that the permeability of the confining “AA” clay below the Westwater Canyon “A” sands was sufficiently low (5.6×10^{-6} to 1.3×10^{-6} md) to verify the isolation of the Westwater Canyon “A” sands aquifer from underlying formations (HRI 2011). In addition to the pump tests, HRI also collected baseline groundwater quality samples from each of the wells. The following summarizes the water quality for the various aquifers.

Dakota Sandstone water quality within the Church Rock Section 8 project area was estimated using 12 samples collected from well CR-1 (Table 3.4-12). The water quality within the aquifer is characterized by sodium bicarbonate ions, and the TDS concentration ranged from 812 to 875 mg/L. The water quality exceeded primary drinking water standards for fluoride, lead, and uranium in one or more samples.

Brushy Basin "B" sands water quality within the Church Rock Section 8 project area was estimated using 12 water quality samples collected from one well (CR-2) (Table 3.4-13). The water quality is characterized by sodium carbonate/bicarbonate/sulfate ions, with TDS concentrations ranging from 415 to 658 mg/L. The water quality exceeds primary drinking water standards for lead and radium-226 in one or more samples.

Westwater Canyon aquifer water quality was estimated using 43 samples collected from 4 wells (CR-3, CR-5, CR-6, and CR-8) (Table 3.4-14). The water chemistry is characterized by sodium bicarbonate ions, with TDS concentrations ranging from 322 to 435 mg/L. The water quality exceeds primary drinking water standards for arsenic, fluoride, uranium, and radium-226 in one or more samples.

3.4.3.3.2 Groundwater Use

Groundwater rights were evaluated within 3.2 km [2 mi] of the Church Rock Sections 8 and 17 project areas to assess historical and current groundwater use per Section 2.2.2 of NUREG-1569. A search of the groundwater rights registered with the NMOSE and NNDWR revealed 10 permitted groundwater rights. In addition, 30 unregistered water wells were identified within 3.2 km [2 mi] of the project areas. The records indicate that three of the wells are permitted for livestock use and one well for domestic use (although this well is currently inactive and not required for domestic use since NTUA installed a water distribution system). The groundwater rights for the Church Rock Sections 8 and 17 project areas are depicted on Figure 3.4-5 and summarized in Table 3.4-15.

Water for the Church Rock Sections 8 and 17 project areas will be obtained from NMOSE permit G-11-A. This permit is a water right appropriation for 8.0×10^8 L [650 ac-ft]. The well associated with this water right is located in Section 35, T16N, R16W and is outside of the area that was evaluated for water rights. As a result, this well is not included in Table 3.4-15.

Since the CUP FEIS was published, BIA and NTUA completed a public water distribution system near the Church Rock Sections 8 and 17 project areas. Completed in 1996, the distribution system (PWSID NN3500211) supplies drinking and livestock water to residents to the communities of Smith Lake, Mariano Lake, Pinedale, Springstead, Hardgrounds, Whitecliffs, Church Rock, and Sundance, New Mexico (NTUA 2012).

3.4.3.3.3 Groundwater Levels

Additional water levels have been collected in HRI's Church Rock Section 8 monitor wells and four OCRM wells since publication of the CUP FEIS. Table 3.4-16 provides the most recent water levels in addition to the 1993 water levels that were used to develop the potentiometric map presented in Figure 3.11 of the CUP FEIS. The table shows that water levels in the Church Rock Section 8 monitor wells, with the exception of CR-1 (completed in the Dakota Sandstone), increased by 6 to 8 m [20 to 26 ft] between 1993 and 2000. The increase in water level in the OCRM wells (Section 17) ranged from 6 to 29 m [21 to 94 ft] between 1993 and 2000. From 2000 to 2006, the water level increases slowed down considerably, with the exception of well CR-1, which increased by nearly 10 m [32 ft]. Between 2006 and 2011 the water levels in all wells increased by an average of 1.5 m [5 ft]. While the water levels in the monitor wells has increased, the groundwater flow direction of the Westwater Canyon aquifer remains to the north as presented in the CUP FEIS.

Table 3.4-1. Puerco River Water Quality (USGS Gaging Station 09395350)

Constituent	Units	N	Mean	Minimum	Maximum
Ammonia	mg/L	4	27.0	27.0	27.0
Arsenic	mg/L	8	0.001	0.001	0.001
Barium	mg/L	6	0.069	0.058	0.092
Boron	mg/L	7	0.094	0.07	0.16
Cadmium	mg/L	6	0.003	0.001	0.005
Calcium	mg/L	6	188.0	98	560
Chloride	mg/L	8	9.1	3	38
Chromium	mg/L	6	<0.005	<0.005	<0.005
Conductivity	µmhos/cm	22	943	530	3,450
Copper	mg/L	5	<0.010	<0.010	<0.010
Dissolved oxygen	mg/L	1	7.6	7.6	7.6
Fluoride	mg/L	8	0.7	0.6	0.8
Hardness	mg/L	6	587.2	320	1,700
Iron	mg/L	6	8.5	0.009	51
Lead	mg/L	1	<0.010	<0.010	<0.010
Magnesium	mg/L	6	28.7	13	75
Manganese	mg/L	5	0.139	0.038	0.310
Mercury	mg/L	1	0.0003	0.0003	0.0003
Molybdenum	mg/L	6	<0.010	<0.010	<0.010
Nickel	mg/L	5	<0.010	<0.010	<0.010
Nitrate + nitrite	mg/L as N	2	2.0	0.6	3.5
pH	s.u.	22	7.2	3.6	8.6
Potassium	mg/L	8	8.6	5.7	13
Radium-226	pCi/L	2	0.7	0.5	1.0
SAR	ratio	6	6.9	0.3	2.7
Selenium	mg/L	1	0.05	0.05	0.05
Silica	mg/L	6	14.1	7.9	41
Silver	mg/L	5	<0.010	<0.010	<0.010
Sodium	mg/L	6	61.5	13	260
Sulfate	mg/L	8	541.3	180	2,300
TDS	mg/L	7	1,019	431	3,350
Uranium	mg/L	2	0.152	0.004	0.30
Zinc	mg/L	6	0.63	0.006	1.90

Source: USGS 2012f

Table 3.4-2. Gallup Sandstone Aquifer Water Quality near the Crownpoint and Unit 1 Project Areas

						EPA/NNEPA MCL	
Constituent	**Units**	**N**	**Mean**	**Minimum**	**Maximum**	**Primary**	**Secondary**
Arsenic	mg/L	1	<0.001	<0.001	<0.001	0.01	---
Barium	mg/L	1	< 0.1	<0.1	<0.1	2	---
Bicarbonate	mg/L	3	218	190	236	---	---
Boron	mg/L	3	0.11	0.04	0.16	---	---
Cadmium	mg/L	1	<0.02	<0.02	<0.02	0.005	---
Calcium	mg/L	3	16	12	19	---	---
Carbonate	mg/L	3	0	0	0	---	---
Chloride	mg/L	3	6.6	4.6	7.9	---	250
Cobalt	mg/L	1	<0.1	<0.1	<0.1	---	---
Conductivity	µmhos/cm	3	1,100	660	1,350	---	---
Copper	mg/L	1	<0.02	<0.02	<0.02	1.3	1
Fluoride	mg/L	3	0.7	0.6	0.8	4	2
Hardness	mg/L as $CaCO_3$	3	71	50	97	---	---
Iron	mg/L	3	0.17	0.03	0.39	---	0.3
Lead	mg/L	1	<0.2	<0.2	<0.2	0.015	---
Lithium	mg/L	1	0.06	0.06	0.06	---	---
Magnesium	mg/L	3	7.5	4.8	12	---	---
Manganese	mg/L	1	0.1	0.1	0.1	---	0.05
Mercury	mg/L	1	<0.005	<0.005	<0.005	0.002	---
Molybdenum	mg/L	1	<0.001	<0.001	<0.001	---	---
Nitrate + nitrite	mg/L as N	1	0.21	0.21	0.21	10	---
pH	s.u.	3	8.2	8.2	8.3	---	6.5 - 8.5
Potassium	mg/L	3	2.4	2	2.8	---	---
Radium-226	pCi/L	1	0.22	0.22	0.22	5	---
Selenium	mg/L	1	<0.001	<0.001	<0.001	0.05	---
Sodium	mg/L	3	207	120	270	---	---
Sulfate	mg/L	3	330	140	450	---	250
Uranium	mg/L	1	0.00007	0.00007	0.00007	---	---
TDS	mg/L	3	705	427	877	---	500
Uranium	mg/L	1	<0.0004	<0.0004	<0.0004	0.03	---

Source: USGS 2012g
(USGS Wells 354332108165501 and 354342108184001)

Table 3.4-3. Crownpoint, Unit 1, and Church Rock Sections 8 and 17 Baseline Monitoring Network General Water Quality

Aquifer	Major Ion Chemistry	TDS (mg/L)
Gallup Sandstone (Crownpoint/ Unit 1)	Sodium sulfate/bicarbonate	427 - 877
Dakota Sandstone (Crownpoint)	Sodium sulfate/bicarbonate	671 - 693
Dakota Sandstone (Unit 1)	Sodium bicarbonate	536 - 590
Westwater Canyon (Crownpoint)	Sodium/bicarbonate	318 - 666
Westwater Canyon (Unit 1)	Sodium bicarbonate	0 - 570
NTUA-1	Sodium bicarbonate	402
NTUA-2	Sodium bicarbonate	351
BIA-3&5	Sodium bicarbonate	406
BIA-6	Sodium bicarbonate	325
Dakota Sandstone (Church Rock Sections 8 and 17)	Sodium bicarbonate	812 - 875
Brushy Basin "B" Sands (Church Rock Sections 8 and 17)	Sodium carbonate/bicarbonate/sulfate	415 - 658
Westwater Canyon "A" Sands (Church Rock Sections 8 and 17)	Sodium bicarbonate	322 - 435

Table 3.4-4. Aquifer Water Quality Comparison with EPA/NNEPA Standards

Aquifer	Constituents Exceeding Primary MCLs[1]	Constituents Exceeding Secondary Standards[2]
Gallup Sandstone (Crownpoint/Unit 1)	---	Iron, Manganese, Sulfate, TDS
Dakota Sandstone (Crownpoint)	---	pH, Sulfate, TDS
Dakota Sandstone (Unit 1)	Uranium	TDS
Westwater Canyon (Crownpoint)	Radium-226	pH, TDS
Westwater Canyon (Unit 1)	Gross Alpha, Lead, Radium -226, Uranium	Iron, pH, TDS
NTUA-1	---	pH
NTUA-2	---	pH
BIA-3&5	---	---
BIA-6	---	pH
Dakota Sandstone (Church Rock Sections 8 and 17)	Arsenic, Fluoride, Lead, Uranium	Fluoride, pH, TDS
Brushy Basin "A" Sand (Church Rock Section 8 and 17)	Lead, Radium-226	pH, TDS
Westwater Canyon (Church Rock Sections 8 and 17)	Fluoride, Radium-226, Uranium	Fluoride, pH

[1] At least one sample from the aquifer exceeded the MCL for the listed constituent.
[2] EPA designates secondary standards as non-enforceable contaminants that may cause cosmetic or aesthetic effects in drinking water.

Table 3.4-5. Dakota Sandstone Aquifer Water Quality in the Crownpoint Project Area

					EPA/NNEPA MCL	
Constituent	**Units**	**Mean**	**Minimum**	**Maximum**	**Primary**	**Secondary**
Alkalinity	mg/L	233.0	225.0	251.0	---	---
Ammonia	mg/L	0.05	0.03	0.08	---	---
Arsenic	mg/L	0.0	0.0	0.0	0.01	---
Barium	mg/L	0.05	0.01	0.05	2	---
Bicarbonate	mg/L	207.0	161.0	243.0	---	---
Boron	mg/L	0.2	0.14	0.2	---	---
Cadmium	mg/L	0.0	0.0	0.0	0.005	---
Calcium	mg/L	2.0	1.9	2.2	---	---
Carbonate	mg/L	38.5	16.0	58.0	---	---
Chloride	mg/L	6.0	3.9	9.6	---	250
Chromium	mg/L	0.0	0.0	0.0	0.1	---
Conductivity	µmhos/cm	991.3	981.0	1,000.0	---	---
Copper	mg/L	0.0	0.0	0.0	1.3	1
Fluoride	mg/L	0.6	0.55	0.72	4	2
Iron	mg/L	0.1	0.0	0.13	---	0.3
Lead	mg/L	0.0	0.0	0.004	0.015	---
Magnesium	mg/L	0.1	0.11	0.17	---	---
Manganese	mg/L	0.01	0.01	0.01	---	0.05
Mercury	mg/L	0.0	0.0	0.0	0.002	---
Molybdenum	mg/L	0.0	0.0	0.01	---	---
Nickel	mg/L	0.0	0.0	0.0	---	---
Nitrate	mg/L	0.1	0.0	0.24	10	---
pH	s.u.	9.0	8.81	9.31	---	6.5-8.5
Potassium	mg/L	2.5	1.5	3.8	---	---
Radium-226	pCi/L	0.6	0.4	0.9	5	---
Selenium	mg/L	0.0	0.0	0.0	0.05	---
Silica	mg/L	13.0	3.0	18.0	---	---
Silver	mg/L	0.0	0.0	0.0	---	0.1
Sodium	mg/L	225.3	217.0	231.0	---	---
Sulfate	mg/L	244.8	227.0	251.0	---	250
TDS	mg/L	682.8	671.0	693.0	---	500
Uranium	mg/L	0.0	0.0	0.0	0.03	---
Vanadium	mg/L	0.0	0.0	0.0	---	---
Zinc	mg/L	0.0	0.0	0.0	---	5

Source: CUP FEIS
Well CP-10 (See Table 3.4-10 and Figure 3.4-4)

Table 3.4-6. Dakota Sandstone Aquifer Water Quality in the Unit 1 Project Area

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Arsenic	mg/L	<0.005	<0.005	<0.005	0.01	---
Barium	mg/L	0.1	<0.2	0.4	2	---
Bicarbonate	mg/L	263.0	250.0	270.0	---	---
Boron	mg/L	<0.1	<0.1	0.2	---	---
Cadmium	mg/L	<0.005	<0.005	<0.005	0.005	---
Calcium	mg/L	17.0	16.0	18.0	---	---
Carbonate	mg/L	0.0	0.0	0.0	---	---
Chloride	mg/L	4.0	<3.0	6.0	---	250
Chromium	mg/L	NM	NM	NM	0.1	---
Conductivity	mg/L	786.0	740.0	820.0	---	---
Copper	µmhos/cm	0.001	<0.005	0.005	1.3	1.0
Fluoride	mg/L	0.1	<0.2	0.5	4	2
Gross alpha	mg/L	2.0	0.0	5.0	15	---
Gross beta	pCi/L	6.0	3.0	10.0	---	---
Iron	pCi/L	0.01	<0.01	0.02	---	0.3
Lead	mg/L	<0.005	<0.005	<0.005	0.015	---
Magnesium	mg/L	8.53	7.5	9.2	---	---
Manganese	mg/L	0.032	0.030	0.034	---	0.05
Mercury	mg/L	<0.0001	<0.0001	<0.0001	0.002	---
Molybdenum	mg/L	0.002	<0.005	0.008	---	---
Nickel	mg/L	<0.02	<0.02	<0.02	---	---
Nitrate	mg/L	0.02	<0.05	0.07	10	---
pH	mg/L	7.6	7.5	7.7	---	6.5-8.5
Potassium	s.u.	3.3	2.9	3.6	---	---
Radium-226	mg/L	1.3	0.0	2.0	5	---
Radon	pCi/L	1,175.0	22.0	4,400.0	---	---
Selenium	pCi/L	<0.005	<0.005	<0.005	0.05	---
Silica	mg/L	18.0	15.0	21.0	---	---
Silver	mg/L	<0.005	<0.005	<0.005	---	0.01
Sodium	mg/L	163.0	150.0	170.0	---	---
Sulfate	mg/L	209.0	187.0	220.0	---	250
TDS	mg/L	554.0	536.0	590.0	---	500
Uranium	mg/L	0.68	0.68	2.0	0.03	---
Zinc	mg/L	0.004	<0.005	0.01	---	5

Source: CUP FEIS
Wells 15-L101 & 16P-101 (See Table 3.4-10 and Figure 3.4-4)
NM – not measured

Table 3.4-7. Westwater Canyon Aquifer Water Quality in the Crownpoint Project Area

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Alkalinity	mg/L	209.3	256.0	193.0	---	---
Ammonia	mg/L	0.03	0.31		---	---
Arsenic	mg/L	0.0	0.001	0.0	0.01	---
Barium	mg/L	0.05	1.0	0.0	2	---
Bicarbonate	mg/L	201.22	260.0	54.0	---	---
Boron	mg/L	0.06	0.11	0.0	---	---
Cadmium	mg/L	0.0	0.0008	0.0	0.005	---
Calcium	mg/L	2.68	7.8	0.07	---	---
Carbonate	mg/L	26.42	127.0	0.0	---	---
Chloride	mg/L	10.9	54.0	1.8	---	250
Chromium	mg/L	0.0	0.0	0.0	0.1	---
Conductivity	mg/L	700.5	1,040.0	463.0	---	---
Copper	mg/L	0.0	0.92	0.0	1.3	1.0
Fluoride	mg/L	0.35	0.5	0.23	4	2
Iron	mg/L	0.03	0.1	0.0	---	0.3
Lead	mg/L	0.0	0.013	0.0	0.015	---
Magnesium	mg/L	0.44	2.5	0.0	---	---
Manganese	mg/L	0.0	0.029	0.0	---	0.05
Mercury	mg/L	0.0	0.0	0.0	0.002	---
Molybdenum	mg/L	0.0	0.02	0.0	---	---
Nickel	mg/L	0.0	0.0	0.0	---	---
Nitrate	mg/L	0.05	0.26	0.0	10	---
pH	mg/L	9.0	10.4	8.26	---	6.5-8.5
Potassium	mg/L	10.58	56.0	1.5	---	---
Radium-266	mg/L	65.85	806.0	0.1	5	---
Selenium	mg/L	0.0	0.0	0.0	0.05	---
Silica	mg/L	16.2	20.0	1.0	---	---
Silver	mg/L	0.0	0.0	0.0	---	0.01
Sodium	mg/L	120.3	184.0	97.0	---	---
Sulfate	mg/L	54.9	177.0	19.0	---	250
TDS	mg/L	367.8	666.0	318.0	---	500
Uranium	mg/L	0.001	0.021	0.0	0.03	---
Vanadium	mg/L	0.0	0.0	0.0	---	---
Zinc	mg/L	0.0	0.03	0.0	---	5

Source: CUP FEIS

Wells CP-2, CP-3, CP-5, CP-6, CP-7, & CP-8 (water quality for Well CP-2 only includes metals and radionuclides) (See Table 3.4-10 and Figure 3.4-4)

Table 3.4-8. Westwater Canyon Aquifer Water Quality in the Unit 1 Project Area

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Arsenic	mg/L	<0.005	<0.005	<0.005	0.01	---
Barium	mg/L	<0.2	<0.2	0.4	2	---
Bicarbonate	mg/L	206.0	89.0	270.0	---	---
Boron	mg/L	0.01	<0.1	0.5	---	---
Cadmium	mg/L	<0.005	<0.005	<0.005	0.005	---
Calcium	mg/L	3.75	1.1	18.0	---	---
Carbonate	mg/L	12.0	0.0	120.0	---	---
Chloride	mg/L	5.5	<3.0	41.0	---	250
Chromium	mg/L	0.003	<0.005	0.008	0.1	---
Conductivity	µmhos/cm	402.5	0.0	820.0	---	---
Copper	mg/L	0.0405	<0.005	0.980	1.3	1
Fluoride	mg/L	0.1	<0.5	0.4	4	2
Gross alpha	pCi/L	42.0	0.0	610.0	15	---
Gross beta	pCi/L	43.0	0.0	510.0	---	---
Iron	mg/L	0.04	<0.01	1.0	---	0.3
Lead	mg/L	0.0095	<0.005	0.170	0.015	---
Magnesium	mg/L	0.145	0.0	9.2	---	---
Manganese	mg/L	0.0035	<0.005	0.034	---	0.05
Mercury	mg/L	<0.0001	<0.0001	<0.0001	0.002	---
Molybdenum	mg/L	0.0035	<0.005	0.016	---	---
Nickel	mg/L	<0.02	<0.02	0.02	---	---
Nitrate	mg/L	0.03	<0.05	1.8	10	---
pH	s.u.	8.75	7.5	9.1	---	6.5-8.5
Potassium	mg/L	1.95	0.7	12.0	---	---
Radium-226	pCi/L	10.3	0.0	200.0	5	---
Radon	pCi/L	81,699.0	22.0	1,100,000.0	---	---
Selenium	mg/L	<0.005	<0.005	<0.006	0.05	---
Silica	mg/L	18.5	11.0	23.0	---	---
Silver	mg/L	<0.005	<0.005	<0.005	---	0.01
Sodium	mg/L	113.0	82.0	1,100.0	---	---
Sulfate	mg/L	35.5	20.0	220.0	---	250
TDS	mg/L	285.0	0.0	590.0	---	500
Uranium	mg/L	2.0	0.68	2.7	0.03	---
Zinc	mg/L	0.023	<0.005	0.800	---	5

Source: CUP FEIS
Wells 15L-37, 15L-50, 15L-51, 15L-64, 15L-65, 15L-78, 15L-79, 15M-21, 15M-35, 15M-49, 15M-6, 15M-63, 15M-7, 16I-53, 16I-56, 16I-69, 16I-70, 16I-84, 16P-1, 16P-15, 15P-29, 16P-43, 16P-44, 16P-57, 16P-59, 15L-17, 15L-17A, 15L-45, 15L-5, 15L-7, 15L-73, 15M-12, 15M-39, 15M-67, 15M-92, 15M-94, 15I-11, 15I-23, 16I-51, 15I-81, 16P-102, 16P-11, 16P-37, 16P-65, 16P-94, 16P-96 (See Table 3.4-10 and Figure 3.4-4).

Table 3.4-9. Town of Crownpoint Supply Wells Water Quality Data

Constituent	Units	Well NTUA-1[1]	Well NTUA-2[1]	Wells BIA-3&5[1]	Wells BIA-6[1]	EPA/NNEPA MCL	
						Primary	Secondary
Alkalinity	mg/L	220.0	215.0	206.0	197.0	-	-
Ammonia	mg/L	<0.01	<0.01	<0.01	<0.01	-	-
Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	0.01	-
Barium	mg/L	0.02	0.05	0.05	0.06	2	-
Bicarbonate	mg/L	234.0	221.0	249.0	223.0	-	-
Boron	mg/L	0.05	0.06	0.07	0.05	-	-
Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.001	0.005	-
Calcium	mg/L	5.0	1.3	9.2	1.8	-	-
Carbonate	mg/L	17.0	20.0	1.0	8.0	-	-
Chloride	mg/L	7.7	3.2	3.2	2.0	-	250
Chromium	mg/L	<0.01	<0.01	<0.01	<0.01	0.1	-
Conductivity	µmhos/cm	625.0	529.0	603.0	484.0	-	-
Copper	mg/L	<0.01	<0.01	<0.01	<0.01	1.3	1.0
Fluoride	mg/L	1.1	0.32	0.34	0.27	4	2
Iron	mg/L	0.02	<0.01	0.01	<0.01	-	0.3
Lead	mg/L	<0.001	0.002	<0.001	<0.001	0.015	-
Magnesium	mg/L	2.0	0.08	4.5	0.14	-	-
Manganese	mg/L	0.01	0.01	<0.1	<0.01	-	0.05
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.002	-
Molybdenum	mg/L	<0.01	<0.01	<0.01	<0.01	-	-
Nickel	mg/L	<0.01	<0.01	<0.01	<0.01	-	-
Nitrate	mg/L	0.01	0.02	0.02	0.01	10	-
pH	s.u.	8.79	8.91	8.33	8.7	-	6.5-8.5
Potassium	mg/L	4.9	1.2	2.3	1.7	-	-
Radium-226	pCi/L	0.6	0.3	0.6	0.3	5	-
Selenium	mg/L	<0.001	<0.001	<0.001	<0.001	0.05	-
Silica	mg/L	10.0	18.0	20.0	18.0	-	-
Silver	mg/L	<0.01	<0.01	<0.01	<0.01	-	0.10
Sodium	mg/L	131.0	121.0	119.0	111.0	-	-
Sulfate	mg/L	82.0	52.0	98.0	49.0	-	250
TDS	mg/L	402.0	351.0	406.0	325.0	-	500
Uranium	mg/L	<0.001	<0.001	0.007	<0.001	0.03	-
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	-	-
Zinc	mg/L	0.01	0.01	<0.01	<0.01	-	5

[1] 1 sample collected September 1990
Source: CUP FEIS

Table 3.4-10. Groundwater Rights within 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
15-0580		NNDWR	SESE	17	17N	12W	Unknown	Other	Conoco	12/1/1975	2450	---
15-0581		NNDWR	SESE	17	17N	12W	Active	Municipal	NTUA	3/16/1974	2377	---
15-0579		NNDWR	NWSE	19	17N	12W	Active	Municipal	NTUA	8/28/1964	2345	---
CRWNPT PM6		NNDWR	SESE	19	17N	12W	Active	Domestic	BIA	8/24/1961	2500	---
CRWNPT PM7		NNDWR	NWNW	20	17N	12W	Unknown	Unknown	---	8/28/1964	2345	---
15-UNK-0009		NNDWR	SENW	28	17N	12W	Unknown	Other	Mobil Oil	5/22/1979	1750	---
15-UNK-0010		NNDWR	SENW	28	17N	12W	Unknown	Industrial	Mobil Oil	5/28/1979	2140	---
28U-321P		NNDWR	SENW	28	17N	12W	Inactive	Other	Mobil Oil	5/9/1979	2106	---
15B-19		NNDWR	NENE	28	17N	12W	Active	Livestock	Tribe O&M	---	500	---
SJ-533-EXPLORE	28U-132T	NMOSE	SWNW	28	17N	12W	---	Mining	Mobil Oil	6/10/1979	3100	7/31/79
SJ-533-I-10	28U-321P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/9/1979	2100	10/13/1987
SJ-533-I-12	28U-324P	NMOSE	SWNW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/28/1979	2140	10/15/1987
SJ-533-I-13	28U-325P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/9/1979	2120	10/5/1987
SJ-533-I-5	28U-314	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/22/1978	2050	10/26/1987
SJ-533-I-7	28U-318P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/13/1978	2060	10/23/1987
SJ-533-I-9	28U-320	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/6/1978	2050	10/19/1987
SJ-533-O-10	28U-89P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/22/1979	1750	10/5/1987
SJ-533-O-11	28U-105P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	4/30/1979	2175	10/5/1987
SJ-533-O-12	28U-116P	NMOSE	SWNW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/16/1979	2120	10/29/1987
SJ-533-O-13	28U-131P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/18/1979	2120	10/1/1987
SJ-533-O-14	28U-135P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/20/1979	2120	10/1/1987
SJ-533-O-2-EXPLOR	28U-302	NMOSE	SWNE	28	17N	12W	Abandoned	Mining	Mobil Oil	3/30/1978	2054	10/22/1987
SJ-533-O-4	28U-304	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/31/1978	2050	10/19/1987
SJ-533-O-6	28U-306	NMOSE	NENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/22/1978	2056	10/21/1987
SJ-533-O-7	28U-311	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	4/2/1978	1630	10/26/1987
SJ-533-O-8	28U-12P	NMOSE	SWNW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/19/1979	2140	9/29/1987
SJ-533-O-9	28U-29P	NMOSE	NENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/20/1979	2120	9/29/1987

Table 3.4-10. Groundwater Rights within 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-533-S-4	28U-323P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/28/1979	2149	10/15/1987
SJ-533-I	28U-307	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	3/9/1978	2050	10/23/1987
SJ-533-I-11	28U-322P	NMOSE	SENW	28	17N	12W	Abandoned	Mining	Mobil Oil	5/23/1979	2120	10/13/1987
SJ-533-I-3	28U-309	NMOSE	SWNE	28	17N	12W	Abandoned	Mining	Mobil Oil	3/17/1979	2050	10/28/1987
15K-303		NNDWR	SWNE	30	17N	12W	Active	Domestic	BIA	5/31/1932	2496	---
CRWNPT PM5		NNDWR	NESW	30	17N	12W	Active	Domestic	BIA	9/5/1958	2544	---
15T-518		NNDWR	NWSW	34	17N	12W	Abandoned	Municipal	NTUA	12/2/1966	761	---
SJ-1495		NMOSE	NENE	8	17N	13W	---	Mining	Mobil Oil	10/17/1973	2235	---
94-202		NNDWR	NESW	9	17N	13W	Unknown	Other	Mobil Oil	4/6/1978	2120	---
PU-279		NNDWR	NESW	9	17N	13W	Unknown	Other	Mobil Oil	9/28/1979	2060	---
SJ-471	9U-211	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/13/1978	2120	5/12/1988
SJ-471-I	9U-208	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/14/1977	2115	5/12/1988
SJ-471-I-10	9U-80	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	11/12/1980	2145	5/15/1988
SJ-471-I-2	9U-209	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/18/1978	2120	5/12/1988
SJ-471-I-3	9U-210	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/29/1977	2107	5/10/1988
SJ-471-I-4	9U-213	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	1/8/1978	2109	5/12/1988
SJ-471-I-5	9U-214	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/28/1977	2100	5/11/1988
SJ-471-I-6	9U-215	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	1/11/1978	2119	5/10/1988
SJ-471-I-7	9U-218	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/15/1977	2103	5/13/1988
SJ-471-I-8	9U-219	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/9/1978	2107	5/11/1988
SJ-471-I-9	9U-220	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	1/4/1978	2113	5/11/1988
SJ-471-O	9U-201	NMOSE	NWSW	9	17N	13W	Abandoned	Mining	Mobil Oil	11/23/1977	2065	5/9/1988
SJ-471-O-10	9U-278	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	10/8/1979	2060	5/13/1988
SJ-471-O-11	9U-279	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	9/28/1979	2060	5/13/1988
SJ-471-O-12	9U-280	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	10/5/1979	2060	5/9/1988
SJ-471-O-2	9U-202	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/6/1978	2120	5/9/1988
SJ-471-O-3	9U-023	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/6/1977	2149	5/14/1988

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-471-O-4	9U-204	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	2/27/1978	2100	5/14/1988
SJ-471-O-5	9U-205	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	12/6/1977	2096	5/14/1988
SJ-471-O-6	9U-206	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	3/3/1978	2077	5/14/1988
SJ-471-O-7	9U-207	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	1/6/1978	1788	5/10/1988
SJ-471-O-8	9U-276A&B	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	9/25/1979	2390	5/12/1988
SJ-471-O-9	9U-277	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	10/10/1979	2060	5/13/1988
SJ-471-S	9U-212	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/10/1978	2110	5/10/1988
SJ-471-S-2	9U-216	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/15/1978	2130	5/13/1988
SJ-471-S-3	9U-217	NMOSE	NESW	9	17N	13W	Abandoned	Mining	Mobil Oil	4/20/1978	2117	5/11/1988
SJ-845		NMOSE	NESW	9	17N	13W	---	Sanitary	Mobil Oil	---	965	---
SJ-823		NMOSE	SWSW	12	17N	13W	---	Sanitary	Mobil Oil	12/19/1978	1037	---
15L-73		NNDWR	NWSW	15	17N	13W	Inactive	Other	---	4/13/1982	2100	---
15T-554		NNDWR	NENW	15	17N	13W	Inactive	Livestock	Tribe O&M	4/7/1976	873	---
SJ-1361-EXPLOR-10	15M-9	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	11/20/1981	2100	2/29/1988
SJ-1361-EXPLOR-108	15L-33	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/30/1981	2130	2/27/1988
SJ-1361-EXPLOR-109	15L-34	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/22/1982	2130	2/27/1988
SJ-1361-EXPLOR-110	15L-37	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/19/1982	2130	3/1/1988
SJ-1361-EXPLOR-114	15L-47	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/24/1981	2150	2/27/1988
SJ-1361-EXPLOR-115	15L-48	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/4/1982	2100	2/27/1988
SJ-1361-EXPLOR-116	15L-49	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/7/1982	2130	3/4/1988
SJ-1361-EXPLOR-117	15L-50	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/15/1982	2130	3/4/1988
SJ-1361-EXPLOR-118	15L-51	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/20/1981	2130	3/1/1988
SJ-1361-EXPLOR-12	15L-21	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	11/28/1981	2100	3/3/1988
SJ-1361-EXPLOR-120	15L-61	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/5/1982	2150	2/28/1988
SJ-1361-EXPLOR-121	15L-65	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/15/1981	2100	2/29/1988
SJ-1361-EXPLOR-125	15L-75	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/7/1981	2100	2/28/1988
SJ-1361-EXPLOR-126	15L-79	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/18/1982	2100	3/1/1988

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-1361-EXPLOR-129	15L-89	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/11/1981	2100	2/28/1988
SJ-1361-EXPLOR-13	15M-23	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/28/1981	2100	2/29/1988
SJ-1361-EXPLOR-131	15M-6	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/2/1981	2130	2/29/1988
SJ-1361-EXPLOR-135	15M-94	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/2/1982	2070	3/1/1983
SJ-1361-EXPLOR-14	15M-35	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/20/1981	2075	3/2/1988
SJ-1361-EXPLOR-148	15L-101	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	11/11/1981	1830	3/1/1988
SJ-1361-EXPLOR-15	15M-36	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	11/22/1981	2100	3/3/1988
SJ-1361-EXPLOR-150	15L-35	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	5/14/1982	2100	3/4/1988
SJ-1361-EXPLOR-151	15L-36	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	5/10/1982	2150	3/4/1988
SJ-1361-EXPLOR-152	15L-73	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/13/1982	2100	3/14/1988
SJ-1361-EXPLOR-16	15M-37	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/18/1981	2050	3/1/1988
SJ-1361-EXPLOR-162	15M-39	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/29/1982	2050	3/14/1988
SJ-1361-EXPLOR-163	15M-12	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/10/1982	2100	3/14/1988
SJ-1361-EXPLOR-164	15L-45	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/16/1982	2100	3/14/1988
SJ-1361-EXPLOR-165	15L-17	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/19/1982	2100	3/14/1988
SJ-1361-EXPLOR-166	15L-17A	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	5/5/1982	2100	3/14/1988
SJ-1361-EXPLOR-167	15L-5	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/22/1982	2090	3/11/1988
SJ-1361-EXPLOR-168	15L-7	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/25/1982	2130	3/11/1988
SJ-1361-EXPLOR-17	15M-49	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/11/1981	2075	3/2/1988
SJ-1361-EXPLOR-18	15M-51	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/6/1981	2075	3/1/1988
SJ-1361-EXPLOR-19	15M-63	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	9/22/1981	2050	3/2/1988
SJ-1361-EXPLOR-2	15L-62	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	12/19/1951	2130	2/28/1988
SJ-1361-EXPLOR-20	15M-64	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	9/17/1981	2050	3/2/1988
SJ-1361-EXPLOR-21	15M-65	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	9/19/1981	2075	3/1/1988
SJ-1361-EXPLOR-22	15M-67	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	4/5/1982	2075	3/15/1988
SJ-1361-EXPLOR-23	15M-92	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	3/29/1982	2075	3/15/1988
SJ-1361-EXPLOR-3	15L-64	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	2/10/1972	2130	3/3/1988

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-1361-EXPLOR-4	15L-76	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	2/6/1982	2120	2/28/1988
SJ-1361-EXPLOR-5	15L-77	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/31/1982	2130	3/4/1988
SJ-1361-EXPLOR-6	15L-78	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/23/1982	2130	3/3/1988
SJ-1361-EXPLOR-7	15L-90	NMOSE	NWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/10/1982	2130	2/29/1988
SJ-1361-EXPLOR-8	15M-7	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	1/3/1982	2150	3/30/1988
SJ-1361-EXPLOR-9	15M-8	NMOSE	SWSW	15	17N	13W	Abandoned	Exploration	Mobil Oil	10/31/1981	2100	3/3/1988
SJ-110-0		NMOSE	SESW	15	17N	13W	Abandoned	Prospecting	Mobil Oil	5/18/1976	2050	3/18/1988
SJ-110-0-2		NMOSE	NWSW	15	17N	13W	Abandoned	Prospecting	Mobil Oil	3/24/1977	2121	3/22/1988
SJ-110-X-1		NMOSE	NWSW	15	17N	13W	Abandoned	Prospecting	Mobil Oil	5/25/1976	2083	3/17/1988
SJ-1023		NMOSE	NESW	15	17N	13W	---	Domestic	Mary Largo	8/8/1979	840	---
SJ-1361		NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/28/1982	2100	3/9/1988
SJ-1361-EXPLOR-137	16I-44	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	3/11/1982	2150	3/7/1988
SJ-1361-EXPLOR-139	16I-56	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/24/1982	2100	3/7/1988
SJ-1361-EXPLOR-141	16P-52	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/20/1981	2060	3/15/1988
SJ-1361-EXPLOR-142	16P-54	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	9/29/1981	2050	3/10/1988
SJ-1361-EXPLOR-143	16P-58	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	9/26/1981	2070	3/17/1988
SJ-1361-EXPLOR-144	16P-68	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/11/1981	2075	3/10/1988
SJ-1361-EXPLOR-145	16P-80	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/20/1981	2060	3/16/1988
SJ-1361-EXPLOR-146	16P-96	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	3/26/1982	2100	3/15/1988
SJ-1361-EXPLOR-147	16P-102	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/24/1981	2060	3/16/1988
SJ-1361-EXPLOR-149	16P-101	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/13/1982	1800	3/8/1988
SJ-1361-EXPLOR-153	16I-45	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/17/1982	2135	3/11/1988
SJ-1361-EXPLOR-154	16I-53	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/19/1982	2150	3/11/1988
SJ-1361-EXPLOR-155	16I-59	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/23/1982	2135	3/11/1988
SJ-1361-EXPLOR-156	16I-69	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/26/1982	2150	3/11/1988
SJ-1361-EXPLOR-157	16I-23	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/3/1982		3/16/1988
SJ-1361-EXPLOR-158	16P-44	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/30/1982	2150	3/10/1988

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-1361-EXPLOR-159	16P-53	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	6/4/1982	2150	3/10/1988
SJ-1361-EXPLOR-160	16P-59	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	6/7/1982	2150	3/10/1988
SJ-1361-EXPLOR-161	16P-67	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	6/9/1982	2150	3/10/1988
SJ-1361-EXPLOR-169	16I-11	NMOSE	NWSE	16	17N	13W	Abandoned	Exploration	Mobil Oil	4/27/1982	2130	3/17/1988
SJ-1361-EXPLOR-170	16I-51	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/7/1982	2150	3/16/1988
SJ-1361-EXPLOR-171	16I-81	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/15/1982	2100	3/16/1988
SJ-1361-EXPLOR-172	16P-37	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/20/1982	2100	3/15/1988
SJ-1361-EXPLOR-173	16P-65	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/13/1982	2100	3/16/1988
SJ-1361-EXPLOR-174	16P-94	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	5/9/1982	2100	3/15/1988
SJ-1361-EXPLOR-63	16I-57	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/16/1982	2130	3/4/1988
SJ-1361-EXPLOR-64	16I-58	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/20/1982	2130	3/8/1988
SJ-1361-EXPLOR-66	16I-70	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/13/1982	2100	3/7/1988
SJ-1361-EXPLOR-67	16I-72	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	1/29/1982	2130	3/8/1988
SJ-1361-EXPLOR-68	16I-84	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	1/26/1982	2100	3/7/1988
SJ-1361-EXPLOR-69	16I-85	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	1/14/1982	2100	3/4/1988
SJ-1361-EXPLOR-70	16I-86	NMOSE	NESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	2/28/1982	2100	3/9/1988
SJ-1361-EXPLOR-86	16P-1	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/9/1981	2100	3/8/1988
SJ-1361-EXPLOR-87	16P-11	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/28/1981	2060	3/16/1988
SJ-1361-EXPLOR-88	16P-13	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/3/1981	2070	3/9/1988
SJ-1361-EXPLOR-89	16P-15	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/25/1981	2050	3/8/1988
SJ-1361-EXPLOR-90	16P-27	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/6/1981	2100	3/9/1988
SJ-1361-EXPLOR-91	16P-28	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/25/1981	2065	3/3/1988
SJ-1361-EXPLOR-92	16P-29	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/21/1981	2070	3/9/1988
SJ-1361-EXPLOR-93	16P-41	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/14/1981	2100	3/9/1988
SJ-1361-EXPLOR-94	16P-43	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/16/1981	2065	3/9/1988
SJ-1361-EXPLOR-95	16P-55	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/1/1981	2070	3/10/1988
SJ-1361-EXPLOR-96	16P-56	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	10/4/1981	2070	3/2/1988

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-1361-EXPLOR-97	16P-57	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	11/14/1981	2060	3/9/1988
SJ-1361-EXPLOR-99	16P-67	NMOSE	SESE	16	17N	13W	Abandoned	Exploration	Mobil Oil	9/13/1981	2020	3/9/1988
SJ-110	16U-224	NMOSE	NESE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	2/10/1977	2240	3/19/1988
SJ-110-0-3	16U-352	NMOSE	NENE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	2/10/1977	2190	10/7/1987
SJ-110-0-4	16U-218	NMOSE	NESE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	1/29/1977	2120	3/19/1988
SJ-110-0-5	16U-162	NMOSE	NWSE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	6/30/1976	2130	3/18/1988
SJ-110-0-6	16U-113	NMOSE	NWSW	16	17N	13W	Abandoned	Prospecting	Mobil Oil	7/13/1976	2120	10/7/1987
SJ-110-X-2	16U-203C	NMOSE	NESE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	6/14/1976	2120	3/18/1988
SJ-110-X-4	16U-256	NMOSE	SESE	16	17N	13W	Abandoned	Prospecting	Mobil Oil	1/26/1977	2080	3/21/1988
SJ-1230	16U-581P	NMOSE	NWSE	16	17N	13W	Abandoned	Exploration	Mobil Oil	---	---	3/29/1988
Begay Well		NNDWR	SESE	17	17N	13W	Unknown	Other	Unknown	1/1/1963	246	---
SJ-1197		NMOSE	SWNW	17	17N	13W	---	Domestic	Sarah McCray	7/8/1990	800	---
15R-318A		NNDWR	NWNW	21	17N	13W	Active	Livestock	Tribe O&M	12/14/1972	810	---
15T-534		NNDWR	SWSE	22	17N	13W	Active	Unknown	Tribe O&M	---	---	---
SJ-110-0-1	24U-36	NMOSE	NWSW	24	17N	13W	Abandoned	Prospecting	Mobil Oil	2/23/1977	2070	3/22/1988
SJ-1624		NMOSE	SESE	24	17N	13W	---	Sanitary	HRI	4/17/1980	2103	---
SJ-1071		NMOSE	SESE	24	17N	13W	---	Exploration	HRI	4/17/1980	2103	---
SJ-1071-EXPLOR-1	DWW#1	NMOSE	SESE	24	17N	13W	---	Exploration	HRI	4/4/1980	2193	---
SJ-1071-EXPLOR-10	CP-10	NMOSE	SESE	24	17N	13W	---	Exploration	HRI	12/9/1990	1685	---
SJ-1071-EXPLOR-3	DWW#3 (OP-5)	NMOSE	SESE	24	17N	13W	---	Exploration	HRI	10/15/1980	2136	---
SJ-1071-EXPLOR-4	DWW#4	NMOSE	SESE	24	17N	13W	---	Exploration	HRI	9/30/1980	2114	---
SJ-1071-EXPLOR-5	DWW#1	NMOSE	SESE	24	17N	13W	---	Exploration	HRI	9/16/1980	2139	---
SJ-1071-EXPLOR-6	5.85/0.05	NMOSE	NWSE	24	17N	13W	---	Exploration	HRI	7/30/1990	2090	---
SJ-1071-EXPLOR-7	5.5/11.94	NMOSE	NESE	24	17N	13W	---	Exploration	HRI	7/17/1990	2160	---
SJ-1071-EXPLOR-8	4.71/99.45	NMOSE	SWSW	24	17N	13W	---	Exploration	HRI	7/19/1990	2040	---

Table 3.4-10. Groundwater Rights within and 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
SJ-1071-EXPLOR-9	5.85/99.79	NMOSE	NWNE	24	17N	13W	---	Exploration	HRI	7/25/1990	2120	---
	Arviso Well	unpermitted	NWNW	25	17N	13W	Active	Livestock	Arviso	---	---	---
SJ-1071-T-S		NMOSE	SESE	24	17N	13W	---	Exploration	HRI	4/17/1980	2103	---
16P-101		NNDWR	SWSW	26	17N	13W	Unknown	Other	Mobil Oil	11/13/1982	1800	---
15-0593		NNDWR	SENE	28	17N	13W	Unknown	Unknown	Maddox	9/2/1971	2023	---
SJ-936		NMOSE	NENW	32	17N	13W	---	Prospecting	Pathfinder	2/9/1980	690	---
SJ-936-O	32-0	NMOSE	SWNW	32	17N	13W	Abandoned	Prospecting	Pathfinder	6/25/1981	2000	6/25/1981
PATH 320	33/3.65	NNDWR	NWNW	33	17N	13W	Unknown	Other	Pathfinder	6/15/1981	2000	---
SJ-593		NMOSE	SWNE	34	17N	13W	---	Prospecting	Teton Exploration	3/17/1978	1440	---

Source: NMOSE 2012, NNWCA 2012

Table 3.4-11. Municipal/Domestic Water Supply Wells within 3.2 km [2 mi] of the Crownpoint and Unit 1 Project Areas

Water Right No.	Well Name	Well Depth (m)	Average Summer Flow Rate (Lpm)	Minimum Distance to Crownpoint Project Area (m)	Minimum Distance to Unit 1 Project Area (m)
15-0579	NTUA-1	715	105	491	3,332
15-0581	NTUA-2	725	222	1,409	4,213
15K-303	BIA-3	761	301	716	3,427
CRWNPT PM5	BIA-5	776	23	780	3,369
CRWNPT PM6	BIA-6	762	379	1,265	4,107
SJ-1023	Mary Largo	256	--	2,909	0
SJ-1197	Sarah McCray	244	--	6,439	2,290

Source: HRI 1996a

Table 3.4-12. Dakota Sandstone Aquifer Water Quality Church Rock Sections 8 and 17 Project Areas

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Alkalinity	mg/L	491.0	474.0	514.0	---	---
Ammonia	mg/L	0.14	0.05	0.25	---	---
Arsenic	mg/L	0.001	0.001	0.002	0.01	---
Barium	mg/L	0.04	0.01	0.11	2	---
Bicarbonate	mg/L	550.0	441.0	600.0	---	---
Boron	mg/L	0.87	0.76	1.2	---	---
Cadmium	mg/L	0.0003	0.0001	0.0015	0.005	---
Calcium	mg/L	3.0	2.5	3.7	---	---
Carbonate	mg/L	23.0	5.0	67.0	---	---
Chloride	mg/L	35.0	31.0	43.0	---	250
Chromium	mg/L	0.01	0.01	0.01	0.1	---
Conductivity	µmhos/cm	1,287.0	1,230.0	1,360.0	---	---
Copper	mg/L	0.01	0.01	0.01	1.3	1.0
Fluoride	mg/L	4.7	4.3	5.1	4	2
Iron	mg/L	0.06	0.01	0.18	---	0.3
Lead	mg/L	0.006	0.001	0.022	0.015	---
Magnesium	mg/L	0.43	0.29	0.66	---	---
Manganese	mg/L	0.01	0.01	0.02	---	0.05
Mercury	mg/L	0.0002	0.0001	0.001	0.002	---
Molybdenum	mg/L	0.01	0.01	0.03	---	---
Nickel	mg/L	0.01	0.01	0.01	---	---
Nitrate	mg/L	0.04	0.01	0.14	10	---
pH	s.u.	8.7	8.45	9.25	---	6.5-8.5
Potassium	mg/L	2.1	1.3	4.4	---	---
Radium-226	pCi/L	0.6	0.2	1.0	5	---
Selenium	mg/L	0.001	0.001	0.003	0.05	---
Silica	mg/L	14.0	11.0	19.0	---	---
Silver	mg/L	0.01	0.01	0.01	---	0.10
Sodium	mg/L	300.0	285.0	317.0	---	---
Sulfate	mg/L	126.0	120.0	130.0	---	250
TDS	mg/L	835.0	812.0	875.0	---	500
Uranium	mg/L	0.038	0.001	0.342	0.03	---
Vanadium	mg/L	0.01	0.01	0.01	---	---
Zinc	mg/L	0.02	0.01	0.04	---	5

Source: CUP FEIS
Well CR-1 (See Table 3.4-16 and Figure 3.4-5)

Table 3.4-13. Brushy Basin "B" Sand Aquifer Water Quality in the Church Rock Sections 8 and 17 Project Areas

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Alkalinity	mg/L	319.0	560.0	249.0	---	---
Ammonia	mg/L	0.59	2.8	0.04	---	---
Arsenic	mg/L	0.002	0.004	0.001	0.01	---
Barium	mg/L	0.03	0.16	0.01	2	---
Bicarbonate	mg/L	66.0	148.0	0.0	---	---
Boron	mg/L	0.21	0.72	0.1	---	---
Cadmium	mg/L	0.0002	0.001	0.0001	0.005	---
Calcium	mg/L	7.5	32.0	1.9	---	---
Carbonate	mg/L	92.0	146.0	27.0	---	---
Chloride	mg/L	3.8	6.1	1.6	---	250
Chromium	mg/L	0.01	0.01	0.01	0.1	---
Conductivity	µmhos/cm	1,073.0	2,520.0	391.0	---	---
Copper	mg/L	0.03	0.14	0.01	1.3	1.0
Fluoride	mg/L	0.66	0.79	0.57	4	2
Hydroxide	mg/L	36.0	160.0	0.0	---	---
Iron	mg/L	0.04	0.08	0.02	---	0.3
Lead	mg/L	0.019	0.121	0.001	0.015	---
Magnesium	mg/L	0.03	0.05	0.01	---	---
Manganese	mg/L	0.01	0.01	0.01	---	0.05
Mercury	mg/L	0.0001	0.0001	0.0001	0.002	---
Molybdenum	mg/L	0.01	0.03	0.01	---	---
Nickel	mg/L	0.01	0.02	0.01	---	---
Nitrate	mg/L	0.03	0.07	0.01	10	---
pH	s.u.	10.5	12.0	9.77	---	6.5-8.5
Potassium	mg/L	10.8	31.0	3.9	---	---
Radium-226	pCi/L	1.1	9.6	0.01	5	---
Selenium	mg/L	0.002	0.009	0.001	0.05	---
Silica	mg/L	23.0	37.0	15.0	---	---
Silver	mg/L	0.01	0.01	0.01	---	0.10
Sodium	mg/L	166.0	248.0	141.0	---	---
Sulfate	mg/L	77.0	96.0	71.0	---	250
TDS	mg/L	480.0	658.0	415.0	---	500
Uranium	mg/L	0.005	0.013	0.001	0.03	---
Vanadium	mg/L	0.01	0.02	0.01	---	---
Zinc	mg/L	0.01	0.03	0.01	---	5

Source: CUP FEIS
Well CR-2 (See Table 3.4-16 and Figure 3.4-5)

Table 3.4-14. Westwater Canyon Aquifer Water Quality in the Church Rock Sections 8 and 17 Project Areas

Constituent	Units	Mean	Minimum	Maximum	EPA/NNEPA MCL	
					Primary	Secondary
Alkalinity	mg/L	256.0	218.0	491.0	---	---
Ammonia	mg/L	0.0775	0.01	0.16	---	---
Arsenic	mg/L	0.0025	0.001	0.012	0.01	---
Barium	mg/L	0.0675	0.02	0.12	2	---
Bicarbonate	mg/L	246.25	185.0	331.0	---	---
Boron	mg/L	0.1	0.04	0.65	---	---
Cadmium	mg/L	0.00028	0.0001	0.005	0.005	---
Calcium	mg/L	2.775	1.5	5.8	---	---
Carbonate	mg/L	28.75	0.0	80.0	---	---
Chloride	mg/L	6.15	2.8	12.0	---	250
Chromium	mg/L	0.0125	0.01	0.07	0.1	---
Conductivity	µmhos/cm	556.25	485.0	651.0	---	---
Copper	mg/L	0.0125	0.01	0.08	1.3	1.0
Fluoride	mg/L	1.628	0.21	22.0	4	2
Iron	mg/L	0.0375	0.01	0.29	---	0.3
Lead	mg/L	0.001	0.001	0.003	0.015	---
Magnesium	mg/L	0.235	0.07	0.81	---	---
Manganese	mg/L	0.01	0.01	0.01	---	0.05
Mercury	mg/L	0.0001	0.0001	0.0001	0.002	---
Molybdenum	mg/L	0.01	0.01	0.04	---	---
Nickel	mg/L	0.01	0.01	0.01	---	---
Nitrate	mg/L	0.02	0.01	0.16	10	---
pH	s.u.	8.923	8.15	9.67	---	6.5-8.5
Potassium	mg/L	2.46	0.85	6.6	---	---
Radium-226	pCi/L	10.225	1.1	26.0	5	---
Selenium	mg/L	0.00125	0.001	0.01	0.05	---
Silica	mg/L	16.5	11.0	68.0	---	---
Silver	mg/L	0.01	0.01	0.01	---	0.10
Sodium	mg/L	129.75	114.0	148.0	---	---
Sulfate	mg/L	37.0	32.0	46.0	---	250
TDS	mg/L	369.75	322.0	435.0	---	500
Uranium	mg/L	1.8	0.002	10.9	0.03	---
Zinc	mg/L	0.01	0.01	0.03	---	5

Source: CUP FEIS
Wells CR-3, CR-5, CR-6, and CR-8 (See Table 3.4-16 and Figure 3.4-5)

Table 3.4-15. Groundwater Rights within 3.2 km [2 mi] of the Church Rock Sections 8 and 17 Project Areas

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
	NECR-VENT HOLE #9	Unpermitted	SWNE	3	16N	16W	---	---	UNC	---	---	---
	14N-70	Unpermitted	NENW	6	16N	16W	---	---	Navajo Tribe	---	---	---
	NR106.0445 X0665	Unpermitted	NENW	6	16N	16W	---	---	---	---	---	---
	CR-1	Unpermitted	NWSE	8	16N	16W	Active	Monitor	HRI	1987	650	---
	CR-2	Unpermitted	NWSE	8	16N	16W	Active	Monitor	HRI	1987	690	---
	CR-3	Unpermitted	NWSE	8	16N	16W	Active	Monitor	HRI	1987	914	---
	CR-4	Unpermitted	NWSE	8	16N	16W	Abandoned	Monitor	HRI	1987	---	Aug-1988
	CR-5	Unpermitted	NESE	8	16N	16W	Active	Monitor	HRI	1987	910	---
	CR-6	Unpermitted	SWSE	8	16N	16W	Active	Monitor	HRI	1987	797	---
	CR-7	Unpermitted	NESE	8	16N	16W	Active	Monitor	HRI	1988	960	---
	CR-8	Unpermitted	NESE	8	16N	16W	Active	Monitor	HRI	1988	900	---
	16N.16W.5.4322b	Unpermitted	NWSE	15	16N	16W	---	---	---	---	---	---
16T-513		NNDWR	NWSE	15	16N	16W	Inactive	Domestic	Navajo Tribe	7/27/1959	318	---
	CON-16	Unpermitted	SWNW	15	16N	16W	---	---	NMED	---	---	---
	CON -2	Unpermitted	SWNW	15	16N	16W	---	---	NMED	---	---	---
	CON -3	Unpermitted	SWNW	15	16N	16W	---	---	NMED	---	---	---
	CON-1L	Unpermitted	SWNW	15	16N	16W	---	---	NMED	---	---	---
	WHITE WELL	Unpermitted	NESE	16	16N	16W	---	---		---	---	---
16T-532		NNDWR	NWNE	17	16N	16W	Inactive	Livestock	HRI	---	450	---
16T-606		NNDWR	NWSE	17	16N	16W	Abandoned	Livestock	Navajo Tribe	7/3/1980	417	1990
	OCR-ESCAPE SHAFT	Unpermitted	NWNE	17	16N	16W	Active	Monitor	HRI	---	---	---
	OCR-GRAVEL HOLE	Unpermitted	NENE	17	16N	16W	Active	Monitor	HRI	---	---	---
	OCR-MAIN SHAFT	Unpermitted	NWNE	17	16N	16W	Active	Monitor	HRI	---	---	---

Table 3.4-15. Groundwater Rights within 3.2 km [2 mi] of the Church Rock Sections 8 and 17 Project Areas (Continued)

Water Right No.	Well Name	Agency	Qtr-Qtr	SEC	TWN	RNG	Well Status	Well Use	Operator	Completion Date	Depth (ft)	Abandon Date
	OCR-VENT HOLE	Unpermitted	NWNE	17	16N	16W	Active	Monitor	HRI	---	---	---
16T-354	SFRR-138	NNDWR	SENW	19	16N	16W	Active	Livestock	Navajo Tribe	---	138	---
	SPRING - 1	Unpermitted	NWNW	19	16N	16W	Active	---	NMED	---	38	---
	SPRING - 2	Unpermitted	NWNW	19	16N	16W	---	---	NMED	---	37	---
	SPRING 3-L	Unpermitted	NWNW	19	16N	16W	---	---	NMED	---	52	---
	SPRING 3-U	Unpermitted	NWNW	19	16N	16W	---	---	NMED	---	31	---
	UNC	Unpermitted	SWSW	19	16N	16W	---	---	---	---	---	---
	TETON 4433	Unpermitted	NWNE	13	16N	17W	Inactive	Test Well	Teton	3/8/78	980	---
	TETON 4435	Unpermitted	NWNE	13	16N	17W	Inactive	Observation	Teton	3/19/78	1,000	---
	TETON 4437	Unpermitted	NWNE	13	16N	17W	Inactive	Test Well	Teton	3/20/78	700	---
G-15		NMOSE	NESW	13	16N	17W	Abandoned	Exploration	UNC/Teton	1/27/80	900	6/12/80
G-16		NMOSE	NESW	13	16N	17W	---	Exploration	UNC/Teton	12/7/79	819	---
G-17		NMOSE	NESW	13	16N	17W	Abandoned	Exploration	UNC/Teton	1/31/80	750	6/12/80
G-18		NMOSE	SESW	13	16N	17W	---	Exploration	UNC/Teton	12/8/79	750	---
G-20		NMOSE	NESW	13	16N	17W	---	Exploration	UNC/Teton	2/1/80	560	---
	ARVISO WELL	Unpermitted	NESE	13	16N	17W	Inactive	---	---	---	---	---

Sources: NMOSE 2012, NNWCA 2012

Table 3.4-16. Church Rock Project Sections 8 and 17 Areas Water Levels

Well Name	**11/29/93**	**4/24/2000**	**11/27/2006**	**9/2/2010**	**3/16/2011**
Section 8					
CR-1	2,018.5*	2,018.6	2,028.3	2,029.3	2,029.6
CR-2	2,010.2	2,016.5	---	---	---
CR-3	2,000.9	2,008.2	---	2,014.0	2,014.3
CR-5	1,999.8	2,007.7	2,012.0	2,013.6	2,013.9
CR-6	2,003.2	2,010.3	2,014.4	2,016.0	2,016.2
CR-7	---	2,008.6	2,012.7	2,014.3	2,014.6
CR-8	2,002.3	2,009.4	2,013.4	2,015.0	2,015.2
Section 17					
OCR-MAIN SHAFT	2,006.3	2,012.8	2,016.6	---	2,018.4
OCR-VENT HOLE	1,984.1	2,012.8	2,016.6	---	2,018.4
OCR-ESCAPE SHAFT	---	2,012.9	2,016.6	---	---
OCR-GRAVEL HOLE	1,988.8	2,012.9	2,016.6	---	2,018.4

*Water level taken on 1/6/1994
All water levels in m ANSL.

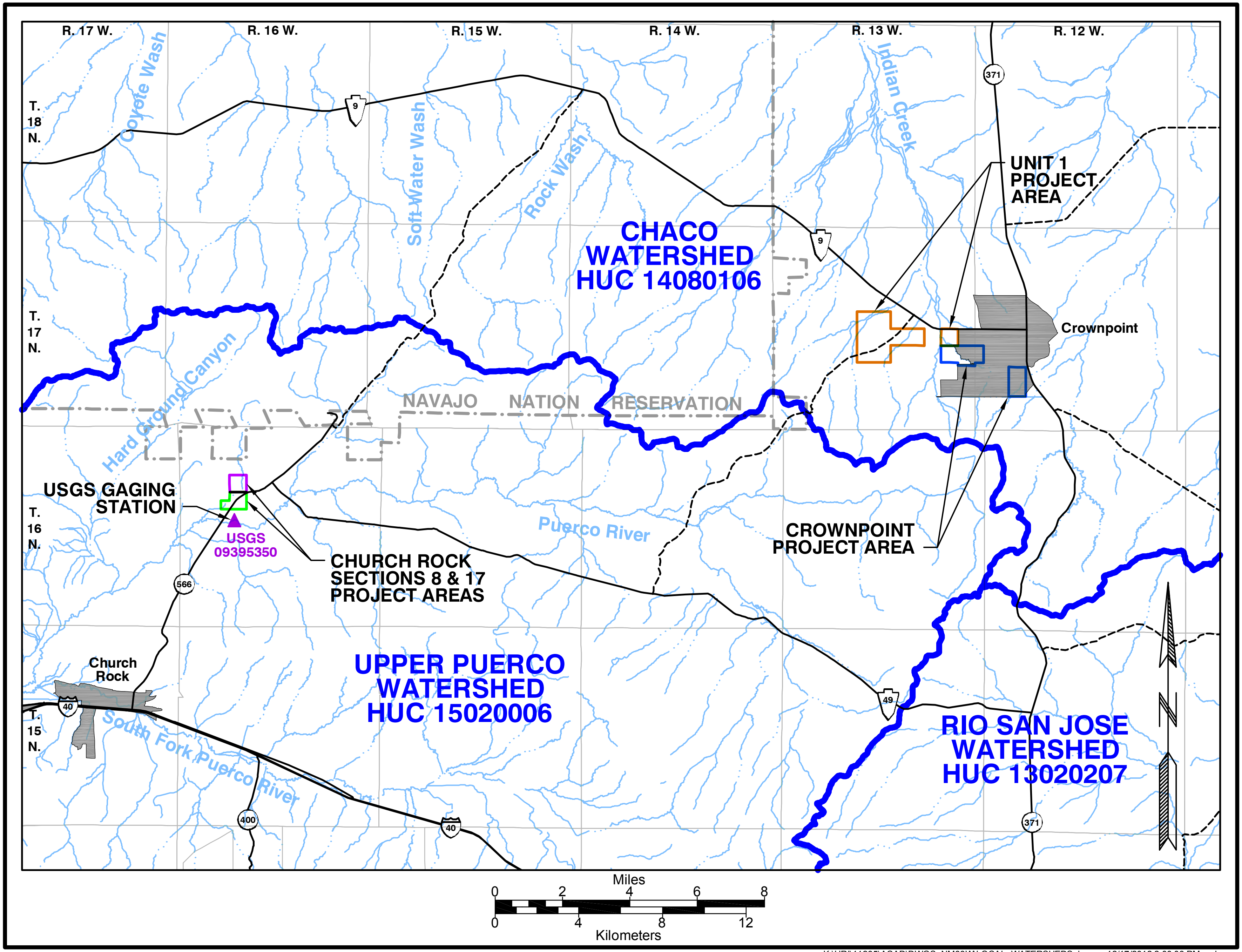


Figure 3.4-1. Regional Streams and Watersheds.

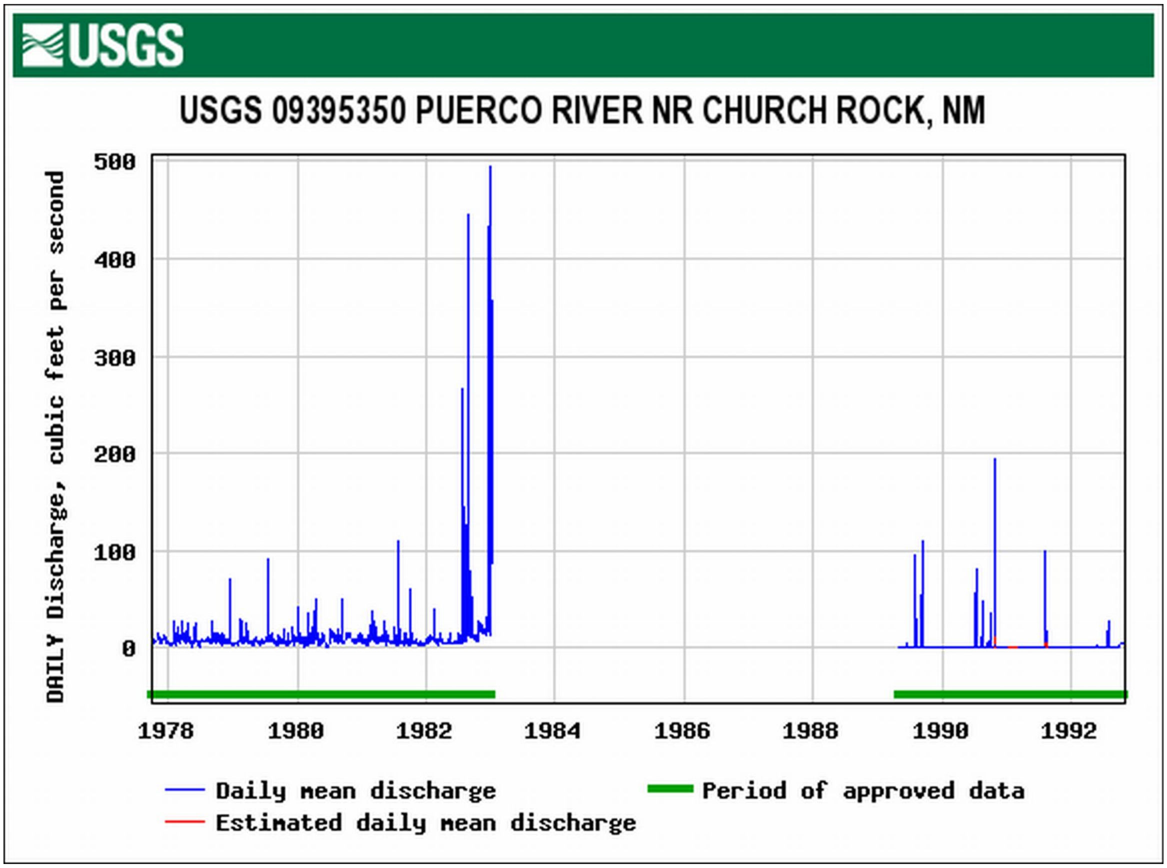


Figure 3.4-2. Daily Average Discharge, Puerco River near Church Rock

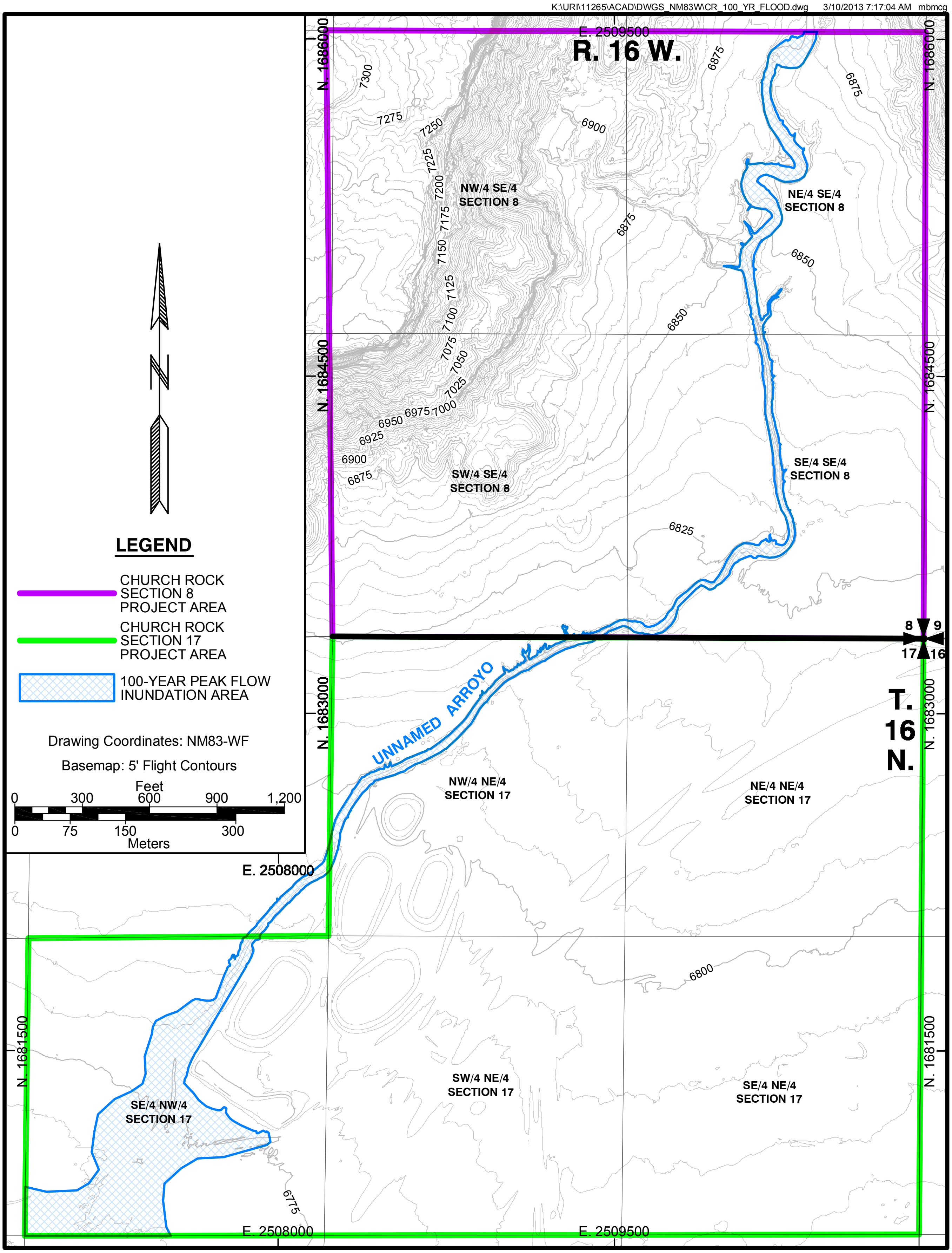


Figure 3.4-3. 100-year Peak Flow Inundation Area for the Church Rock Sections 8 and 17 Project Areas.

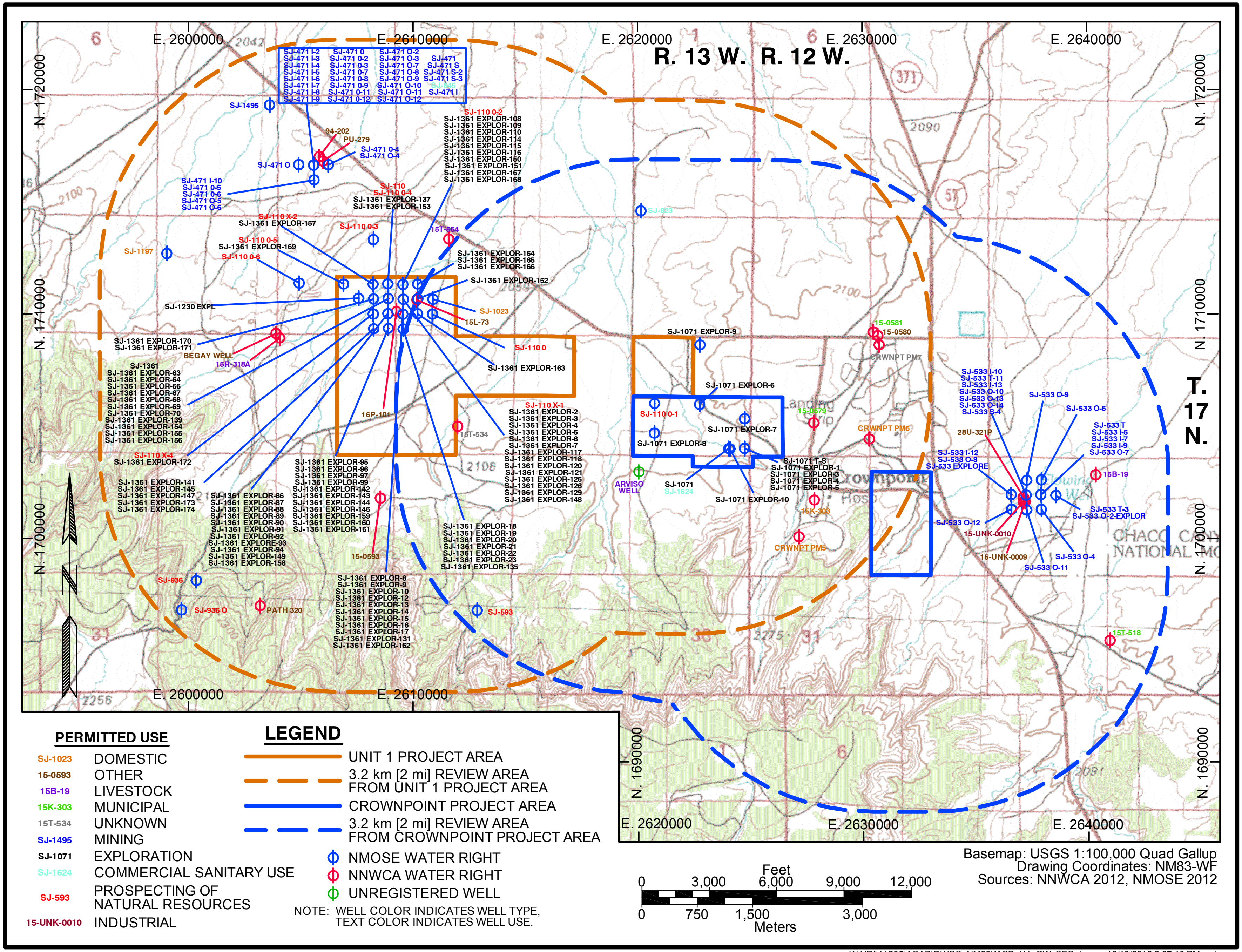


Figure 3.4-4. Groundwater Rights and Unregistered Wells within 3.2 km [2mi] of the Crownpoint and Unit 1 Project Areas.

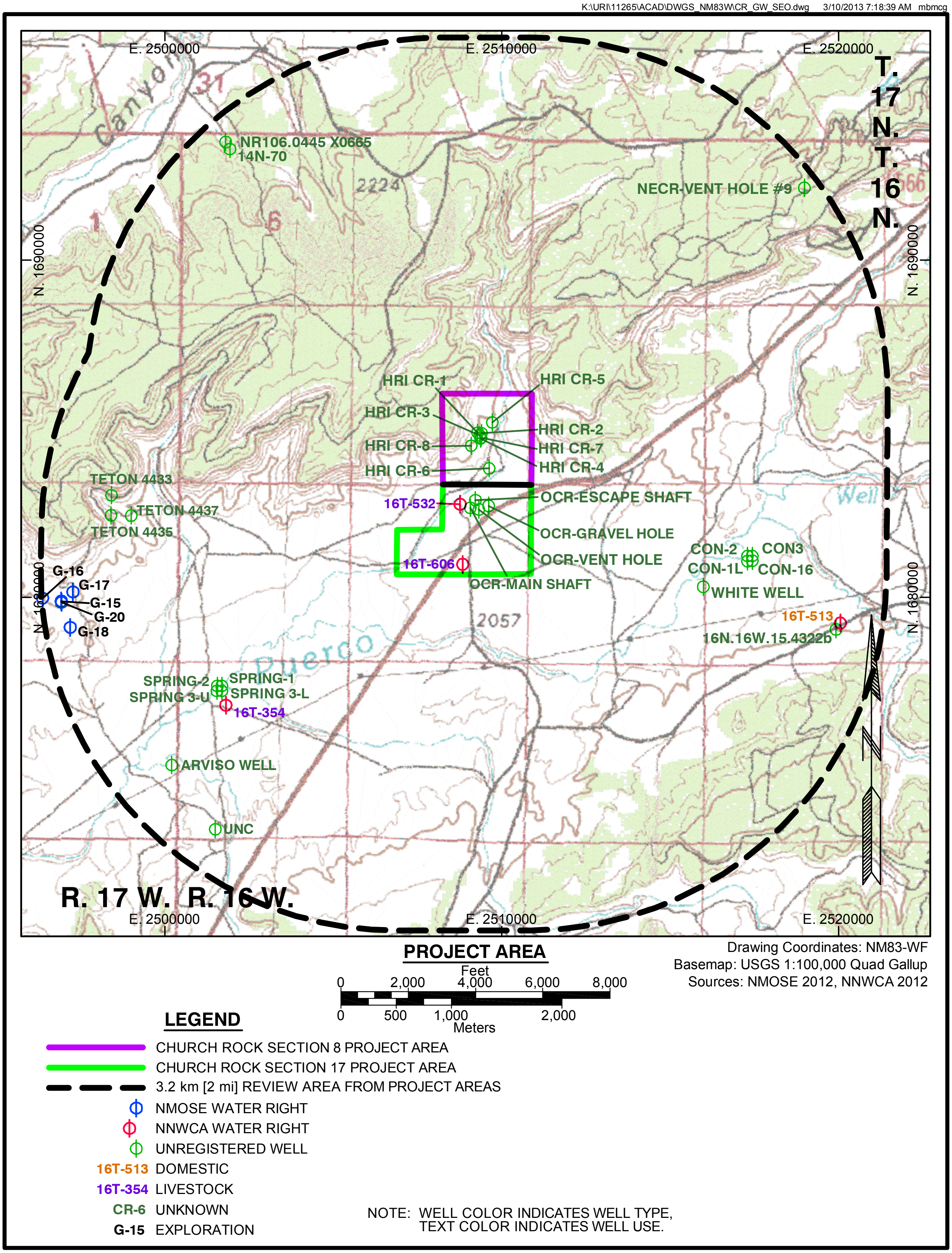


Figure 3.4-5. Groundwater Rights and Unregistered Wells within 3.2 km [2 mi] of the Church Rock Sections 8 and 17 Project Areas.

3.5 Ecological Resources

No new regional or project specific ecological resources surveys have been conducted by HRI since the publication of the CUP FEIS. Section 3.5 of the CUP FEIS describes the regional and project ecology. In addition, Section 3.5.5 of the ISR GEIS includes regional information regarding ecological resources in northwestern New Mexico. This section provides a discussion of regional and CUP ecological resources. In addition, updated tables are provided of USFWS and State listed and sensitive species. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to ecological resources.

3.5.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

3.5.1.1 Vegetation

Within the project region, vegetation patterns are generally related to topography as described in Section 3.5.1.1 of the CUP FEIS. Grassland vegetation of the central San Juan Basin northeast of the project areas grades into pygmy-conifer woodland along the southern edge of the basin. Grasslands predominate on gently or moderately sloping uplands, with mixed shrub-grass associations on the floodplains and widely scattered pinyon-juniper woodlands on the escarpments.

3.5.1.2 Wildlife

Regional wildlife species are discussed below by major faunal group. Unless noted, all discussions are taken from Section 3.5 of the CUP FEIS.

3.5.1.2.1 Big Game, Medium Mammals and Small Mammals

Big game animals are not common in the region. Mule deer (*Odcoileus hemionus*) and pronghorn (*Antilocapra americana*) occur in the area, but the preferred habitats of both of these species are lacking in the immediate vicinity of the project areas. There are no critical big game habitats associated with the Crownpoint and Unit 1 project areas (NMDGF 2007). The Church Rock Sections 8 and 17 project areas appear to be located along the northern border of a large area of critical elk winter range (NMDGF 2007). Elk were not observed during the wildlife surveys conducted in the project areas in 1978 to 1979 and 1987. Large mammalian predators (mountain lions [*Felis concolor*] and black bears [*Ursus americana*]) have been observed in the vicinity of the project areas but have not been observed in the immediate area. Coyotes (*Canis latrans*), kit foxes (*Vuples macrotis*), red foxes (*V. vulpes*), and badgers (*Taxidea taxus*) may occur on or near the project areas. Desert cottontails (*Sylvilagus auduboni*) and black-tailed jackrabbits (*Lepus californicus*) are present but not abundant. Abundant small mammal species documented during the 1978-79 live trapping near the Crownpoint project area included the silky pocket mouse (*Perognathus flavus*) and the deer mouse (*Peromyscus maniculatus*). All of McKinley County is within the range of the Gunnison's prairie dog (*Cynomys gunnisoni*). A prairie dog colony was documented near the Crownpoint project area, and prairie dogs may be present on or adjacent to the Church Rock Sections 8 and 17 project areas.

3.5.1.2.2 Avian Species (Passerine Birds, Waterfowl, Game Birds and Raptors)

The most abundant passerine bird species associated with the project areas is the horned lark (*Eremophila alpestris*). Other passerine birds occur in the vicinity of the project areas, but sparse nesting cover likely limits nesting. Waterfowl and shorebirds may pass through the region during migration and may use intermittent water features. Game birds (mourning doves [*Zenaidura macoura*] and scale quail [*Callipedepla squamata*]) have been observed in the region and likely occur in the project areas, but are not abundant. Specific surveys for raptors were not conducted as part of the license application, but western burrowing owls (*Speotyto canicularia hypugaea*) and American kestrels (*Falco sparverius*) have been observed in the area and likely occur in the project areas. Open grasslands throughout the region provide good hunting areas for raptors, and sandstone escarpments and the scattered pinyon pines and junipers within the project areas may provide nesting and roosting sites.

3.5.1.2.3 Reptiles

Five species of lizards and four snake species were observed on or near the project areas during the 1978 to 1979 and 1987 wildlife surveys. None of these species is listed as sensitive.

3.5.1.2.4 Aquatic Species

No aquatic habitats exist within the project areas that will provide stable conditions for aquatic life.

3.5.1.3 Threatened, Endangered, and Candidate Species

Discussions of threatened, endangered, and candidate (T&E) and other special status species are included in Section 3.5.1.4 of the CUP FEIS. The list of USFWS T&E species and species of concern has changed since the CUP FEIS was issued. The revised list is provided in Table 3.5-1.

Black-footed ferrets are the only T&E species that have the potential of occurring in the project areas. Ferrets are usually found in association with prairie dog colonies. The Gunnison's prairie dog is the only prairie dog species occurring in McKinley County (Natural Heritage New Mexico 2012). A survey for ferrets may be required if a Gunnison's prairie dog colony or complex of 200 acres or larger is present. Gunnison's prairie dogs may be present on or near the Unit 1 and Church Rock Sections 8 and 17 project areas, although it is unlikely that black-footed ferrets are present due to the small size of the previously documented colonies.

The Zuni fleabane is typically associated with Chinle and Baca Formation outcrops at elevations between 2,200 and 2,400 m [7,300 and 8,000 ft]. The preferred habitats are sandstone slopes and clay banks. This species was not documented in previous vegetation studies of the project areas, and there is a low likelihood of encountering the plant since the project areas are below 2,100 m [6,900 ft] in elevation and the Chinle and Baca formations do not crop out in the project areas.

Northern goshawks (a species of concern) could occur locally in mature, closed-canopied coniferous forests of mountains and high mesas. This species has not been recorded on or near the project areas.

Western burrowing owls (a species of concern) have been sighted approximately 2.4 km [1.5 mi] northeast of the Unit 1 project area and approximately 1.6 km [1 mi] north of the Crownpoint project area.

Acoma fleabane (a species of concern) grows in sandy soils at the base of sandstone cliffs. Although this habitat type could occur within the project areas, the nearest verified locations are in southern McKinley County.

New Mexico has separate provisions for endangered plants and animals. The state assists in the management of species of plants or wildlife that are deemed to be endangered elsewhere by prohibiting the taking, possession, transportation, exportation, processing, sale or offering for sale or shipment within the state. The New Mexico Department of Game and Fish (NMDGF), through its Conservation Services Division, oversees the endangered wildlife portion, and the Natural Resources Department oversees the endangered plant species. The list of New Mexico threatened, endangered, and candidate species and species of concern has changed since the CUP FEIS was issued. The revised list is provided in Table 3.5-2.

Only those species listed that have the potential of occurring in the project areas (based on the presence of suitable habitat) are included in this evaluation. The gray vireo (a State threatened species) is associated with arid juniper woodlands on foothills and mesas, most often with oaks and usually in habitat with a well-developed grass component. This species was observed on the Unit 1 project area in 1980. The Zuni fleabane is discussed above and is not likely to be present in the project areas since it is typically observed at higher elevations.

Table 3.5-1. USFWS Listed and Sensitive Species in McKinley County

Threatened and Endangered Species		
Common Name	**Scientific Name**	**Group**
ENDANGERED		
Southwestern willow flycatcher	*Empidonax traillii extimus*	Bird
Black-footed ferret *	*Mustela nigripes*	Mammal
THREATENED		
Mexican spotted owl (Designated Critical Habitat)	*Strix occidentalis lucida*	Bird
Zuni fleabane *	*Erigeron rhizomatus*	Plant
CANDIDATE		
Yellow-billed cuckoo	*Coccyzus americanus*	Bird
Zuni bluehead sucker	*Catostomus discobolus yarrowi*	Fish
EXPERIMENTAL, NON-ESSENTIAL POPULATION		
Whooping Crane	*Grus americana*	Bird
SPECIES OF CONCERN		
New Mexico silverspot butterfly	*Speyeria nokomis nitocris*	Arthropod - Invertebrate
San Juan checkerspot butterfly	*Euphydryas anicia chuskae*	Arthropod - Invertebrate
American peregrine falcon	*Falco peregrinus anatum*	Bird
Arctic peregrine falcon	*Falco peregrinus tundrius*	Bird
Black tern	*Chlidonias niger*	Bird
Northern goshawk *	*Accipiter gentilis*	Bird
Western burrowing owl *	*Athene cunicularia hypugaea*	Bird
Acoma fleabane *	*Erigeron acomanus*	Plant
Parish's alkali grass	*Puccinellia parishii*	Plant
Sivinski's fleabane	*Erigeron sivinskii*	Plant

* Could potentially occur within one of the project areas based on the presence of suitable habitat.
Source: USFWS 2010

Table 3.5-2. State Listed and Sensitive Species in McKinley County

Common Name	**Scientific Name**	**Group**	**Federal Status**	**State Status**
Zuni bluehead sucker	*Catostomus discobolus jarrovii*	Fish	Candidate	Endangered
Roundtail chub	*Gila robusta*	Fish	Not listed	Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Bird	Endangered	Endangered
Gray vireo *	*Vireo vicinior*	Bird	Not listed	Threatened
Rhizome (Zuni) fleabane *	*Erigeron rhizomatus*	Plant	Threatened	Endangered
Arizona montane vole	*Microtus montanus arizonensis*	Mammal	Not listed	Endangered
Parish's alkali grass	*Puccinellia parishii*	Plant	Not listed	Endangered

* Could potentially occur in within one of the project areas based on the presence of suitable habitat.
Source: Natural Heritage New Mexico 2012

3.6 Meteorology, Climatology, and Air Quality

Regional meteorology and air quality is discussed in Section 3.1 of the CUP FEIS. Much of the information presented in the CUP FEIS is based on historical meteorological data. The following presents updated regional meteorology. In addition, the air quality discussion presented in the CUP FEIS has been revised to reflect the most current standards. The information presented in this Section compares current meteorology, climatology and air quality to those described in the CUP FEIS. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to meteorology, climatology and air quality.

3.6.1 Meteorology and Climatology

The meteorology and climatology in the region of the CUP have not changed since the publication of the CUP FEIS in 1997. Section 3.1.1 of the CUP FEIS utilized temperature and precipitation data collected at the Crownpoint meteorological station from 1931 to 1960 to characterize the area. Since the Crownpoint station is no longer in service the following presents the regional meteorological data from three stations located in the vicinity of the project areas.

- Gallup is located approximately 18 km [11 mi] southwest of the Church Rock Sections 8 and 17 project areas and 92 km [57 mi] southwest of the Unit 1 and Crownpoint project areas. The elevation of Gallup is 1,970 m [6,468 ft].
- Grants is approximately 100 km [62 mi] southeast of the Church Rock Sections 8 and 17 project areas and approximately 90 km [56 mi] southeast of the Unit 1 and Crownpoint project areas. The elevation of Grants is 1,970 m [6,460 ft].
- Farmington is approximately 130 km [80 mi] north-northeast of the Church Rock Sections 8 and 17 project areas and approximately 115 km [72 mi] north of the Unit 1 and Crownpoint project areas. The elevation of Farmington is 1,644 m [5,395 ft].

The nearest NWS meteorological station with wind data is at Gallup. Since the wind discussion in the CUP FEIS focused on Gallup, the following discussion only includes wind data from the Gallup station. A meteorological evaluation, completed as part of the license renewal and provided in Addendum A, demonstrates that wind data from Gallup is representative of the project areas.

3.6.1.1 Temperature

As described in Section 3.1.1 of the CUP FEIS, the project areas are located on the Northwestern Plateau climatological subdivision of New Mexico. The region has an arid to semi-arid continental climate and meteorology is influenced by local topography. The annual average temperature for the region is 9 to 12 °C [48 to 53 °F]. Table 3.6-1 provides the monthly and annual average, minimum, and maximum temperatures for the three meteorological stations.

Figure 3.6-1 presents a graph of the data in Table 3.6-1 and includes, for comparison, the Crownpoint mean temperature as reported in Section 3.1.1 of the CUP FEIS. The figure shows that the three regional sites are similar to Crownpoint. For all sites July is the warmest month with average temperatures between 21 and 24 °C [70 and 76 °F], while December and January are the coldest months, with average temperatures between -2 and 1 °C [29 and 33 °F].

3.6.1.2 Precipitation

Table 3.6-2 provides average precipitation and snowfall for the region. Regional average annual precipitation varies from 22 cm [8.6 in] in Farmington to 29 cm [11.4 in] in Gallup. Over half of the precipitation occurs during the months of July through October, which corresponds to the summer thunderstorm season. Snowfall in the region varies with topography and is caused by frontal activity associated with the general movement of storms across the country. Gallup has the highest annual snowfall in the region, with an average of 74 cm [29.3 in]. The regional precipitation and snowfall are similar to data from the decommissioned Crownpoint, New Mexico station reported in the CUP FEIS. Between 1931 and 1960 the average annual precipitation at the Crownpoint station was 26 cm [10.2 in], and the average annual snowfall was 66 cm [26 in]. These values are within the range of the three regional sites and most closely resemble those for Gallup.

Severe weather in the region occurs in the form of thunderstorms during the summer months. Thunderstorms are relatively frequent, with 40 to 50 storms occurring per year. Tornadoes in New Mexico are less frequent (about 10 per year), with the majority occurring in the eastern portion of the state between April and July. No tornadoes were recorded in McKinley County between 1950 and 2011 (NOAA 2012a).

3.6.1.3 Wind Patterns

Winds in the region typically are mild. Over the past 15 years (1996 to 2011) the average wind speed at the Gallup meteorological station was 3.0 m/s [6.7 mph], while nearly 25% of the time winds were calm (i.e., below anemometer threshold). Similar to the CUP FEIS the highest wind speeds were measured during the spring months (3.9 m/sec [8.7 mph]). Figures 3.6-2 through 3.6-6 present the annual and quarterly wind roses for Gallup. Figure 3.6-2 shows that the predominant wind direction is southwesterly with the wind blowing out of that direction roughly 30% of the time. The wind rose for the 3rd quarter (Figure 3.6-5) shows that wind direction during the summer months is atypical of the rest of the year, although the predominant wind direction is southwesterly the wind rose show a stronger east-northeast component compared to other quarters.

To verify that wind data in the CUP FEIS represent long-term wind characteristics, a meteorological evaluation was completed and is provided in Addendum A. The meteorological evaluation examined spatial comparisons as well as short- and long-term temporal comparisons. The following summarizes the results of the evaluation.

Spatial Correlation – Mobil's Crownpoint Section 9 Pilot Project meteorological data were compared to the Gallup meteorological station data collected during the same time period (1978-1979). Wind speed correlations resulted in a correlation coefficient, R^2, of 0.97 while wind direction had an R^2 of 0.57. The difference in wind direction between the two sites is attributed to differences in local topography.

Short-term Temporal Correlation – Gallup wind speed and direction data from 1978-1979 were compared to data collected from 1979-1980 at the same site. The evaluation demonstrates wind speed and wind direction correlations of $R^2 = 0.96$ and $R^2 = 0.88$, respectively. These results indicate that the one year of monitoring completed by Mobil was similar to the baseline period used in CUP license application.

Long-term Temporal Correlation – Gallup meteorological data used as baseline (1976-1980) are compared to the last 15 years of data (1996-2010). The results of the comparison show that baseline wind speed and wind direction are representative of long-term conditions.

3.6.1.4 Cooling, Heating and Growing Degree Days

Cooling, heating, and growing degree days for Gallup are presented in Figure 3.6-7. The heating and cooling degree days are included to show deviation of the average daily temperature from a predefined base temperature (18 °C [65 °F]). The growing degree days are included to relate plant growth to air temperature using a predefined base temperature (10 °C [50 °F]). The number of heating degree days is computed by taking the average of the daily high and low temperature and subtracting it from the base temperature. The calculation for the cooling and growing degree days is the same, except that the base temperature is subtracted from the average of the daily high and low temperatures. Negative values are disregarded for both calculations.

3.6.2 Air Quality

The following presents background information on air quality regulations and current regional air quality near the project areas. Much of the information presented updates information in Section 3.1.2 of the CUP FEIS, including revised NAAQS and PSD increments.

3.6.2.1 NAAQS

The Clean Air Act (CAA) requires EPA to set NAAQS for air pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six criteria pollutants including carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), sulfur dioxide (SO_2), and particulate matter (PM). Primary standards are established to protect public health, and secondary standards are established to protect public welfare. These standards define the maximum level of air pollution allowed in the ambient air. The CAA and CAA Amendments allow states to promulgate additional air quality standards that are the same or more stringent than the NAAQS. Table 3.6-3 provides the primary and secondary NAAQS as well as New Mexico Ambient Air Quality Standards (NMAAQS) set by NMED.

3.6.2.2 Attainment/Non-Attainment Area Designations

Pursuant to the CAA, EPA has developed a method for classifying existing air quality in distinct geographic regions know as air basins, or air quality control regions. For each federal criteria pollutant, each air basin is classified as in "attainment" if the area is in compliance with NAAQS or classified as "non-attainment" if one or more NAAQS is exceeded. McKinley County, where the project areas are located, is in attainment for NAAQS.

3.6.2.3 PSD

In addition to the NAAQS the EPA has established PSD rules to prevent deterioration of air quality in attainment areas. The PSD increments, included in Table 3.6-4, provide maximum allowable increases in concentrations of nitrogen dioxide, sulfur dioxide, and particulate matter (PM_{10}) that are allowed to occur above a baseline concentration. Areas designated as Class I include all international parks, national wilderness areas greater than 2,000 ha [5,000 ac], national memorial parks greater than 2,000 ha [5,000 ac], and national parks which exceed 2,400 ha [6,000 ac]. All remaining areas are designated as Class II.

The closest Class I areas to the project areas include San Pedro Parks Wilderness (approximately 130 km [80 mi] northeast) and Bandelier Wilderness (approximately 160 km [100 mi] east) in New Mexico. In Arizona the closest Class I area is Petrified Forest National Park (approximately 110 km [70 mi] southwest), while Mesa Verde National Park is the closest Class I area in Colorado (approximately 160 km [100 mi] north).

3.6.3 Existing Air Quality

The Air Quality Control Program of the NNEPA monitors ambient airborne particulate matter 10 microns or less (PM_{10}) throughout the Navajo Nation. In addition, the NMED-AQB operates an extensive gaseous and particulate ambient monitoring program throughout New Mexico. The regional air quality monitoring stations used to evaluate regional air quality are depicted on Figure 3.6-8. The Crownpoint particulate station is the closest monitoring station to the CUP.

Table 3.6-5 presents the annual particulate results for three of the particulate monitoring stations operated by the NNEPA. Particulates at each of the stations are monitored using a tapered element oscillating membrane (TEOM). The results show that concentrations of PM_{10} have remained below the NAAQS of 150 $\mu g/m^3$. The highest daily PM_{10} concentration (97 $\mu g/m^3$) was measured in 2007 at the Shiprock particulate station.

The NMED has operated a gaseous monitoring station since 1997 at the USBR Shiprock substation between Shiprock and Farmington, New Mexico. Constituents monitored at the station include NO_2, O_3, and SO_2. Tables 3.6-6 through 3.6-8 present the annual monitoring results since 2007. With the exception of SO_2 in 2007, all constituents have been in compliance with the NAAQS.

Table 3.6-1. Regional Annual and Monthly Temperature Statistics (1981-2010)

Month	Average Temperature (°C)			Average Minimum Temperature (°C)			Average Maximum Temperature (°C)		
	Grants	Gallup	Farmington	Grants	Gallup	Farmington	Grants	Gallup	Farmington
Jan	-0.1	-1.7	-0.8	-9.2	-10.4	-7.1	9.2	7.1	5.6
Feb	2.6	1.0	2.3	-6.8	-7.6	-4.3	11.9	9.6	9.0
Mar	6.1	4.1	6.6	-3.9	-5.4	-1.1	16.1	13.7	14.2
Apr	10.1	8.1	10.6	-0.3	-2.2	2.3	20.6	18.3	18.9
May	15.2	13.1	15.9	4.7	2.5	7.3	25.8	23.8	24.5
Jun	20.1	18.2	21.2	9.0	7.0	12.0	31.1	29.3	30.3
Jul	22.7	21.6	24.2	13.1	12.0	15.7	32.4	31.1	32.8
Aug	21.4	20.5	23.1	12.1	11.6	15.0	30.7	29.5	31.1
Sep	17.5	16.2	18.7	7.4	6.3	10.6	27.6	26.1	26.9
Oct	11.1	9.4	12.0	0.5	-0.8	4.1	21.8	19.6	19.9
Nov	4.8	2.9	4.9	-5.1	-6.8	-2.1	14.7	12.5	12.0
Dec	0.1	-1.7	-0.4	-9.2	-10.4	-6.6	9.4	7.1	5.9
Annual	**11.0**	**9.3**	**11.6**	**1.0**	**-0.3**	**3.8**	**20.9**	**19.0**	**19.3**

Source: NOAA 2012b

Table 3.6-2. Regional Annual and Monthly Average Precipitation

Month	Precipitation (cm)			Snowfall (cm)		
	Grants	Gallup	Farmington	Grants	Gallup	Farmington
Jan	0.15	0.21	0.13	0.59	1.46	0.77
Feb	0.12	0.17	0.15	0.46	1.31	1.03
Mar	0.17	0.20	0.19	0.21	1.03	0.28
Apr	0.14	0.13	0.17	0.05	0.67	0.03
May	0.15	0.14	0.14	0.00	0.13	0.00
Jun	0.14	0.12	0.06	0.00	0.00	0.00
Jul	0.42	0.45	0.23	0.00	0.00	0.00
Aug	0.49	0.54	0.32	0.00	0.00	0.00
Sep	0.32	0.31	0.27	0.00	0.00	0.00
Oct	0.26	0.25	0.23	0.05	0.13	0.08
Nov	0.17	0.21	0.18	0.15	0.92	0.13
Dec	0.19	0.21	0.13	0.82	1.85	0.77
Annual	**2.72**	**2.93**	**2.19**	**2.33**	**7.51**	**3.10**

Source: NOAA 2012b

Table 3.6-3. NAAQS Primary and Secondary Standards

Criteria Pollutant	Averaging Time[1]	Primary NAAQS	Secondary NAAQS	NMAAQS
CO	1-hour	40,070	---	15,000
	8-hour	10,300	---	9,960
NO_2	1-hour	188	---	---
	24-hour	---	---	188
	Annual	100	100	94
O_3	8-hour	147	147	---
Pb	Rolling 3-month avg.	0.15	0.15	---
SO_2	1-hour	196	---	---
	3-hour	---	1,300	---
	24-hour	---	---	261
	Annual	---	---	52
$PM_{2.5}$	24-hour	35	35	---
	Annual	15	15	---
PM_{10}	24-hour	150	150	---
Total Suspended Solids (TSS)	24-hour	---	---	150
	7-day	---	---	110
	30-day	---	---	90
	Annual	---	---	60

All standards expressed in $\mu g/m^3$.

[1] Annual standards are not be exceeded; short-term standards are not be exceeded more than once per year.

Source: EPA 2012b, NMED-AQB 2012

Table 3.6-4. Maximum Allowable PSD Increments

Criteria Pollutant	Averaging Time[1]	Maximum Allowable Increase (µg/m^3)	
		Class I Area	Class II Area
NO_2	Annual	2.5	25
SO_2	3-hour	25	512
	24-hour	5	91
	Annual	2	20
PM_{10}	24-hour	8	30
	Annual	4	17

Source: 40 CFR Part 50

Table 3.6-5. NNEPA Annual PM_{10} Monitoring Results

Year		Crownpoint	Shiprock	Fort Defiance	NAAQS
2007	Max. 24-hr	---	97	80	150
	2nd High 24-hr	---	83	72	150
2008	Max. 24-hr	76	87	94	150
	2nd High 24-hr	69	82	78	150
2009	Max. 24-hr	92	65	70	150
	2nd High 24-hr	75	63	69	150
2010	Max. 24-hr	31	51	---	150
	2nd High 24-hr	26	45	---	150
2011	Max. 24-hr	47	54	---	150
	2nd High 24-hr	44	54	---	150

Concentrations in $\mu g/m^3$
Source: EPA 2012c

Table 3.6-6. USBR Shiprock Substation Daily High 1-Hour NO_2 Monitoring Results

Year	Maximum Daily High	NAAQS[1]
2007	0.053	0.100
2008	0.043	0.100
2009	0.044	0.100
2010	0.050	0.100
2011	0.045	0.100

Concentrations in ppm
[1] NAAQS based on 98th percentile
Source: EPA 2012c

Table 3.6-7. USBR Shiprock Substation O_3 Monitoring Results

Year	Maximum Daily 8-hr	Mean Daily 8-hr	4th High Daily 8-hr	NAAQS[1]
2007	0.074	0.035	0.070	0.075
2008	0.071	0.035	0.067	0.075
2009	0.062	0.030	0.058	0.075
2010	0.069	0.033	0.064	0.075
2011	0.071	0.038	0.067	0.075

Concentrations in ppm
[1] NAAQS based on 8-hr rolling average
Source: EPA 2012d

Table 3.6-8. USBR Shiprock Substation Daily High 1-Hour SO_2 Monitoring Results

Year	Maximum Daily High	NAAQS[1]
2007	0.126	0.075
2008	0.028	0.100
2009	0.030	0.100
2010	0.016	0.100
2011	0.027	0.100

Concentrations in ppm
1 NAAQS based on 98th percentile
Source: EPA 2012c

Figure 3.6-1. Regional Average Monthly Temperature

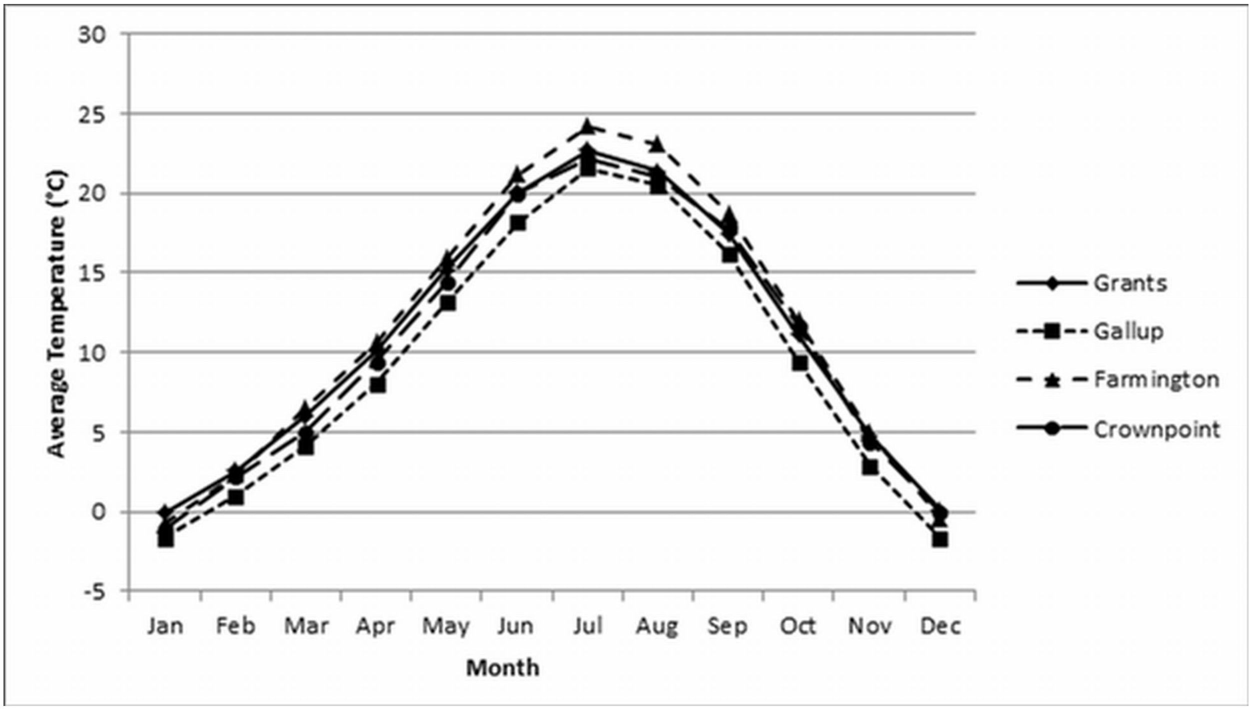


Figure 3.6-2. Annual Wind Rose, Gallup, New Mexico (1996 – 2011)

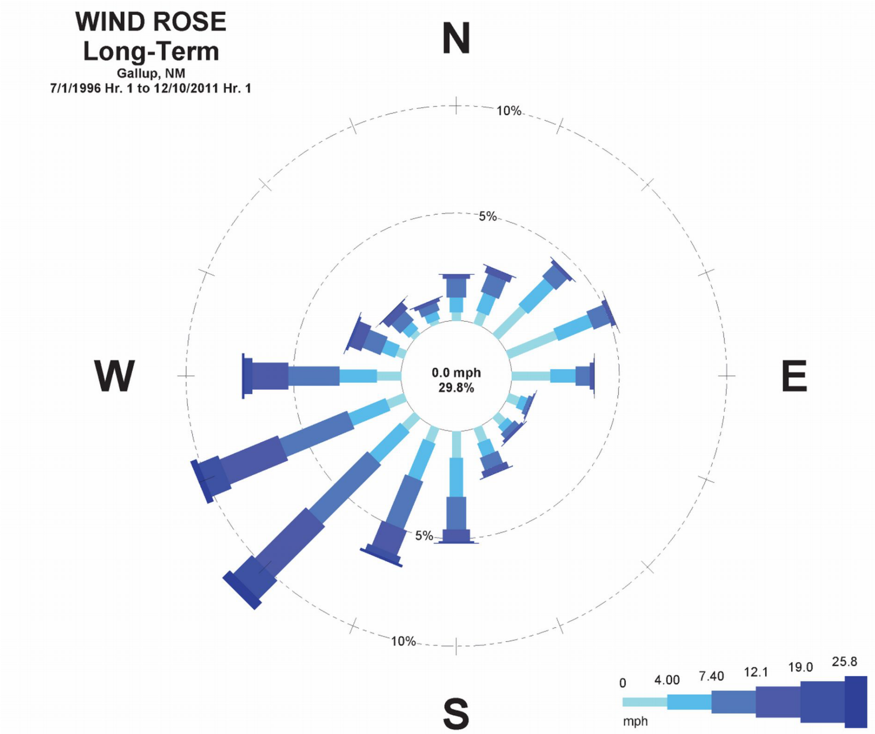


Figure 3.6-3. 1st Quarter Wind Rose, Gallup, New Mexico (1996 – 2011)

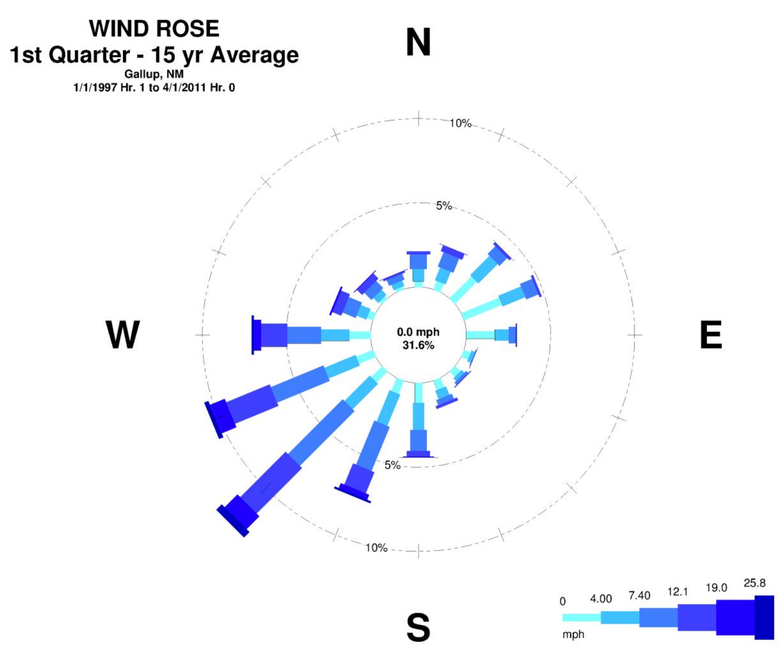


Figure 3.6-4. 2nd Quarter Wind Rose, Gallup, New Mexico (1996 – 2011)

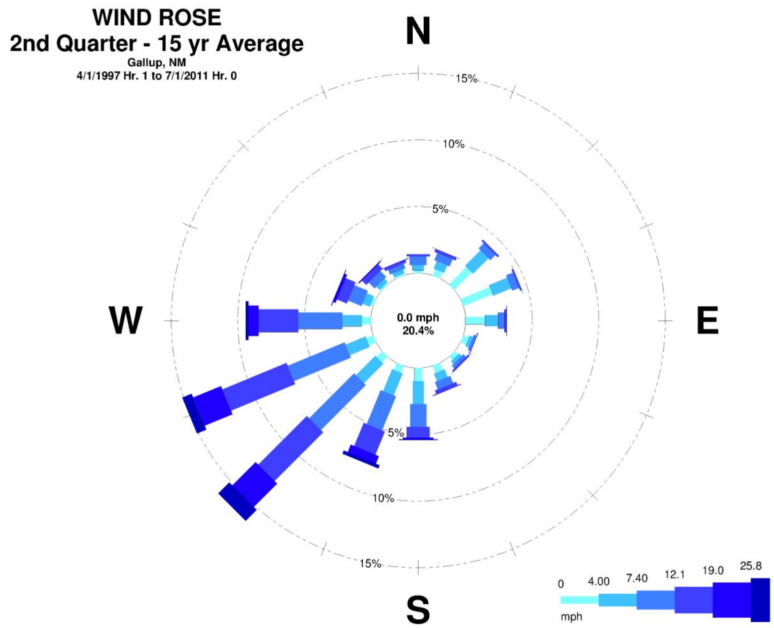


Figure 3.6-5. 3rd Quarter Wind Rose, Gallup, New Mexico (1996 – 2011)

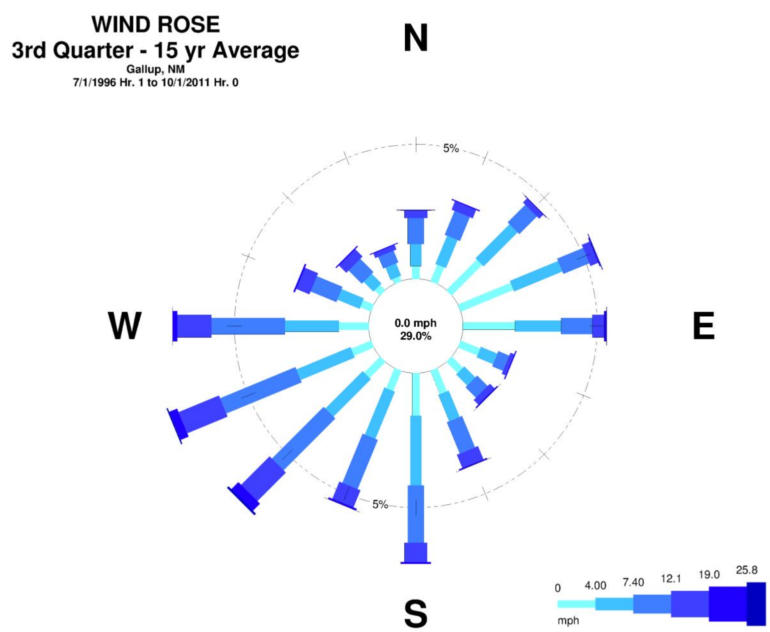


Figure 3.6-6. 4th Quarter Wind Rose, Gallup, New Mexico (1996 – 2011)

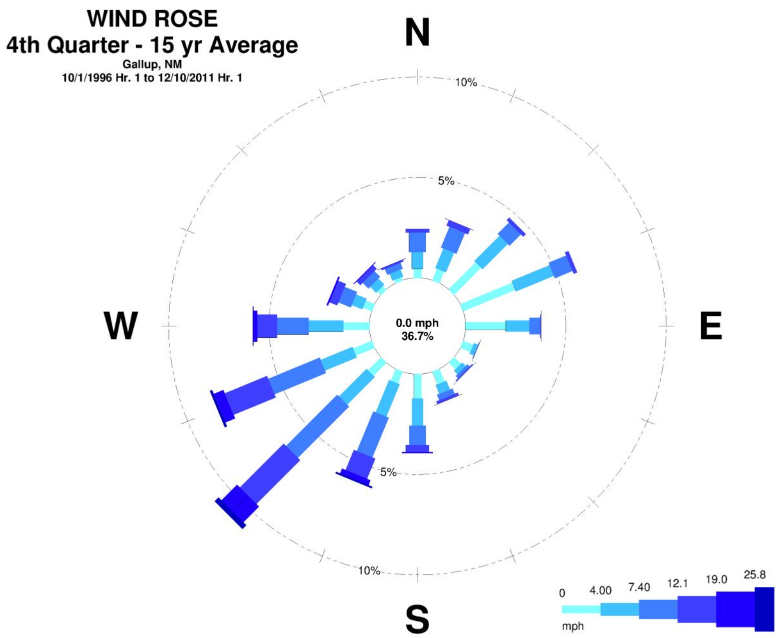
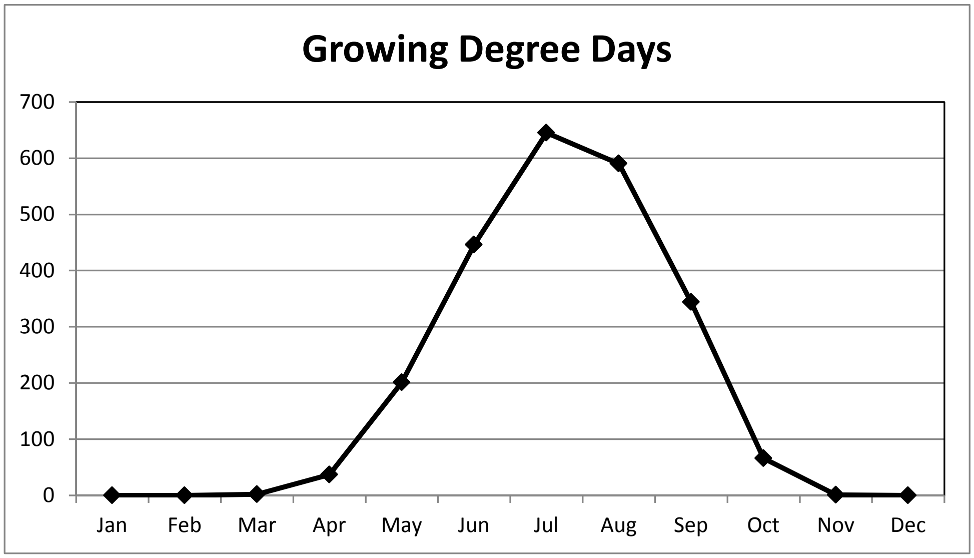
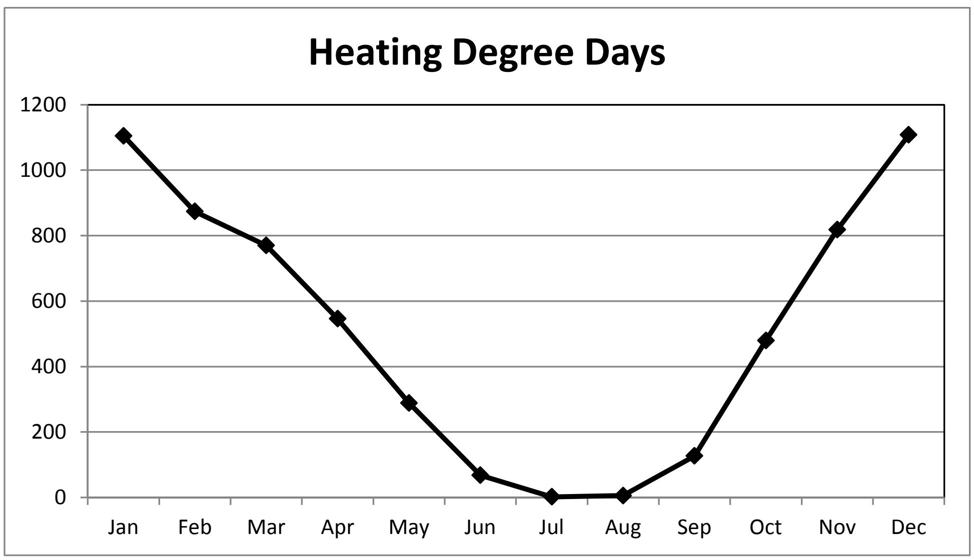
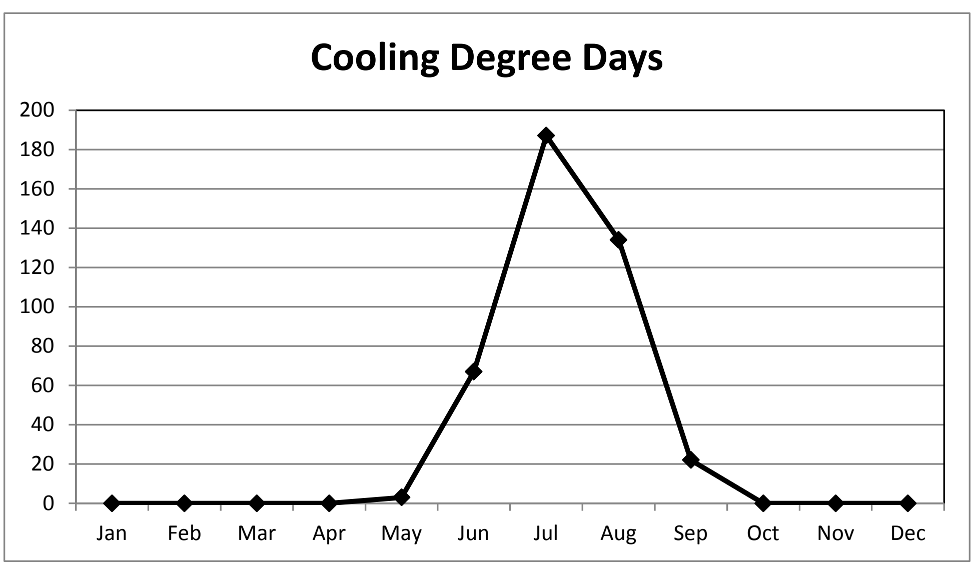


Figure 3.6-7. Cooling, Heating and Growing Degree Days







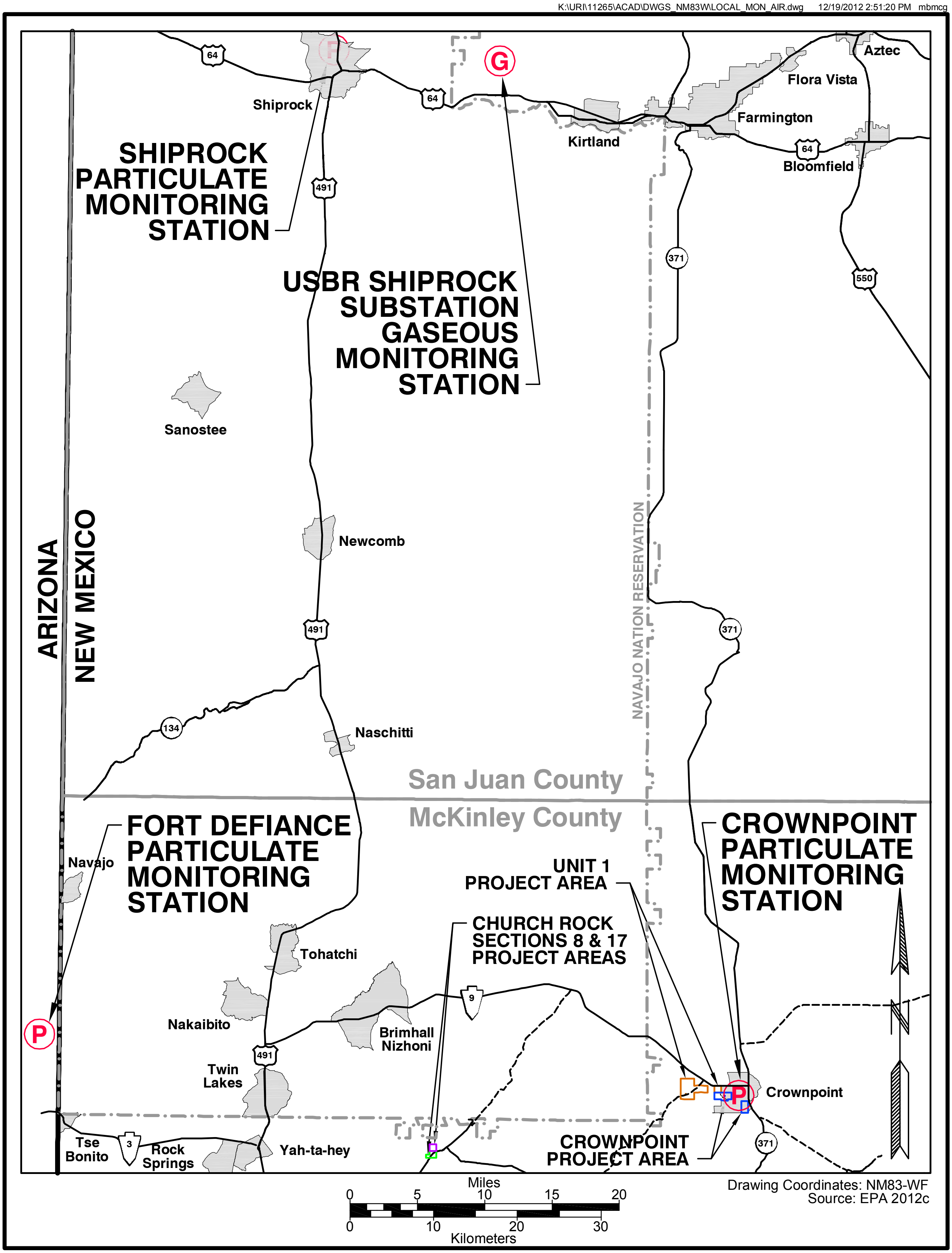


Figure 3.6-8. Regional Ambient Particulate and Gaseous Monitoring Stations.

3.7 Noise

No new regional noise-related data have been collected since the publication of the CUP FEIS. Section 3.5.7 of the ISR GEIS includes general information regarding noise levels in northwestern New Mexico. Updated general and project-specific discussions related to noise are included in this section. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to noise.

3.7.1 Noise Level Standards

Noise is technically defined as unwanted sound. Noise is a potential occupational hazard because prolonged exposure to noise may cause long-term hearing loss. The unit of measure used to represent sound pressure levels (decibels (dB)) using the A-weighted scale is a dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3.7-1 presents noise levels associated with some commonly heard sounds. Under the authority of the Noise Control Act of 1972, EPA identifies a 24-hour exposure level of 70 dBA as the level of environmental noise which will not cause any measureable hearing loss over a lifetime. A level of 55 dBA outdoors is identified as preventing activity interference and annoyance. The 24-hour equivalent level is the sound energy averaged over a 24-hour period and is represented by $L_{eq(24)}$. The day-night average sound level (L_{dn}) is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dBA imposed on the equivalent sound levels for nighttime hours of 10 p.m. to 7 a.m. (EPA 1974), since people generally have a lower tolerance to noise at night when they are trying to sleep. Outdoor day-night sound levels in rural wilderness areas range from 20 dBA to 30 dBA (EPA 1974).

Background noise around the project areas is mostly from automobile and light truck traffic. Existing ambient noise levels can be used to establish baseline conditions and determine potential site-specific disturbances associated with uranium ISR activities.

3.7.2 Regional

The region is predominantly rural and undeveloped. Rural areas tend to be quiet, open sagebrush-grass and forested areas where natural phenomena such as wind, rain, insects, birds, and other wildlife account for most natural background sounds. Baseline noise levels for typical undeveloped desert or arid environments range from day-night sound levels of 22 dB [28 dBA] on calm days to 38 dB [44 dBA] on windy days (Brattstrom and Bondello 1983, DOE 2007). The largest communities in the region include Gallup (2010 population 21,678) located approximately 18 km [11 mi] southwest of the Church Rock Sections 8 and 17 project areas; Crownpoint (2010 population 2,278) located adjacent to the Crownpoint project area; and Church Rock (2010 population 1,128) located approximately 10 km [6 mi] south of the Church Rock Sections 8 and 17 project areas. Urban noise levels in these communities and the smaller surrounding population centers will be similar (up to about 78 dB [84 dBA]) to those of other urban areas (WSDOT 2006). Areas with increased sensitivity to potential noise impacts will include areas of special significance to the Native American culture in the region (ISR GEIS).

3.7.3 Crownpoint

The project area is adjacent to the town of Crownpoint where the ambient noise levels will be expected to be similar to the regional, urban noise levels discussed above. Most of the existing ambient noise in the vicinity is generated from passenger vehicle and truck traffic along NM 371 and Navajo 9, as well as noise associated with urban activities. Based on the typical passenger vehicle noise levels presented in Figure 3.7-1, background noise levels are estimated to be generally less than 70 dB [76 dBA]. Potential noise receptors (occupied dwellings) within and 3.2 km [2 mi] surrounding the Crownpoint project area are depicted on Figure 3.1-4.

3.7.4 Unit 1

Due to the remoteness of the Unit 1 project area, low population density of the surrounding area, and lack of noise generated from the primary land use of rangeland (livestock grazing), existing noise levels generally are low. Most of the existing ambient noise in the vicinity is generated from passenger vehicle and truck traffic along Navajo 11, wind, and livestock-related activities. It is estimated that background noise levels generally are less than 50 dB [56 dBA]. The occupied dwellings within and 3.2 km [2 mi] surrounding the Unit 1 project area are depicted on Figure 3.1-4.

3.7.5 Church Rock Sections 8 and 17

Due to the remoteness of the Church Rock Sections 8 and 17 project areas, low population density of the surrounding area, and lack of noise generated from the primary land use of rangeland (livestock grazing), existing noise levels generally are low. Most of the existing ambient noise in the vicinity is generated from passenger vehicle and truck traffic along NM 556, wind, and livestock related activities. Based on the typical passenger vehicle noise levels presented in Figure 3.7-1, background noise levels are estimated to be generally less than 50 dB [56 dBA]. Occupied dwellings within and 3.2 km [2 mi] surrounding the Church Rock Sections 8 and 17 project areas are depicted on Figure 3.1-9.

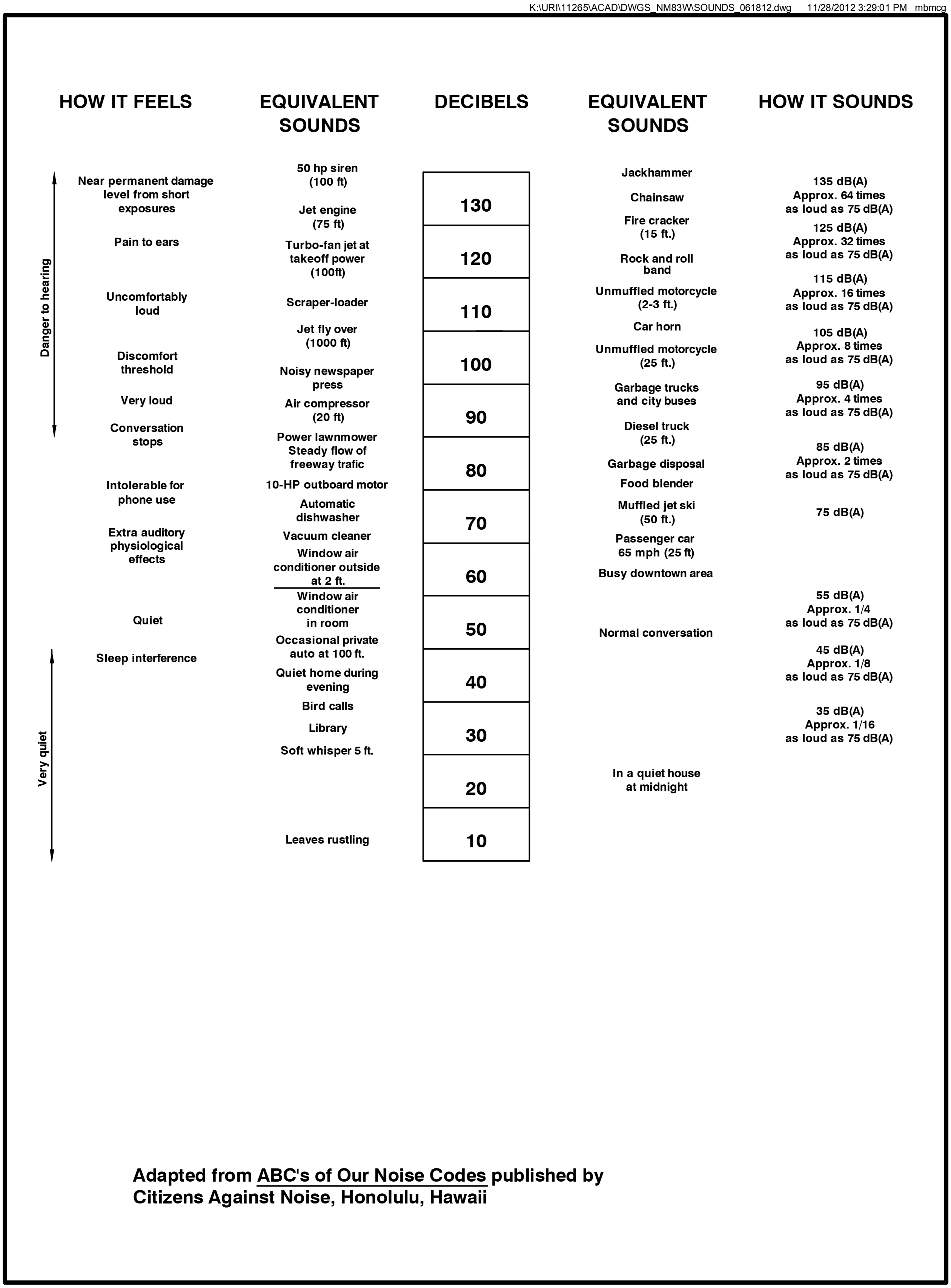


Figure 3.7-1. Relationship between A-Scale Decibel Readings and Sounds of Daily Life.

3.8 Historical and Cultural Resources

Section 3.9 of the CUP FEIS provides a detailed description of the regional historical and cultural resources, including human development. In 1997 when the CUP FEIS was published, the CUP Section 106 process was ongoing. Since that time, NRC completed the Section 106 process for project areas included in the first 5 years of development. Prior to engaging in an activity in areas not previously assessed, HRI will conduct a cultural resource inventory as indicated in LC 9.12 of SUA-1580. In addition, HRI will cease any activity that results in the discovery of previously unknown cultural artifacts. The following provides a detailed discussion of the Section 106 work completed for the CUP, including background, outreach and a summary of the litigation related to historical and cultural resources.

The initial phase discussed in this section addresses potential disturbance associated with HRI's initial 5-year plan including Church Rock Sections 8 and 17 and Crownpoint Section 24, where the CCP will be located. In a letter to the New Mexico Historical Preservation Division (NMHPD) dated October 2, 1996 and provided in Appendix C of the CUP FEIS, the NRC states that the New Mexico State Historic Preservation Office (NMSHPO) expressed a preference for evaluating the project incrementally since the project includes a large area of land with development occurring over a 20-year time period. The phased approach used by NRC for the Section 106 process also was litigated. The litigation related to historical and cultural resources is discussed in Section 3.8.4 of this ER. The litigation confirmed that the phased Section 106 approach is permissible under the National Historic Preservation Act (NHPA) and Advisory Council on Historic Preservation (ACHP) regulations for multi-year projects encompassing large areas. In addition, the phased Section 106 process fits with typical ISR facilities that are phased over the life of the project.

3.8.1 Background Historical and Cultural Resources Work

Section 3.9 of the FEIS describes the initial historical and cultural resources work completed prior to commencement of the Section 106 process. The following summarizes the reports and provides a discussion of the work completed in the project areas.

- In 1977 an archaeological survey of the SE¼ of Section 8, T16N, R16W (Church Rock Section 8 project area) was completed for UNC. During the survey four archaeological sites were located. (Ford and DeHoff 1977)
- In 1979 an archaeological survey of the SE¼ of Section 24, T17N, R13W (Crownpoint project area) was completed. During the survey eight archaeological sites were defined, including three within the boundary of the existing facilities in the Crownpoint project area. The three sites within the facility area were fenced by Conoco. In addition, two isolated locations or localities were identified in the northwest portion of the survey that had not been affected by construction. (Klager 1979)
- In 1988 an additional archaeological survey of the SE¼ of Section 8, T16N, R16W (Church Rock Section 8 project area) was completed for HRI. The survey included confirming the locations and documenting the archaeological sites identified by Ford and DeHoff. No additional cultural resources were identified during the survey. Following the

survey, boundaries for protective fencing around the archaeological sites were established to protect the identified cultural antiquities. (Hurley and Marshall 1988)

- In 1989 a Class III cultural resources inventory and management plan for the SW¼ of Section 24, T17N, R13W (Crownpoint project area) was completed. Prior to the survey an archaeological records search was completed; no records were found. Seven archaeological sites and two localities were identified during the survey. Recommendations for cultural resource management are included in the report. The recommendations include avoidance of cultural properties and fencing around identified cultural antiquities. (Marshall 1989)
- In 1991 a cultural resources environmental assessment and management plan for the Unit 1 project area was completed. The report includes the results of the cultural resource evaluation, which includes a search of archaeological records within the project area. The search identified 37 previously documented archaeological and historic sites. In addition, the report outlines a cultural resource management plan (CRMP) to preserve the cultural antiquities, historical properties, and traditional cultural properties within the Unit 1 project area. The principal objective of the CRMP is to avoid all cultural resources. (Marshall 1991)
- In 1992 a similar cultural resources environmental assessment and management plan for the Crownpoint project area was completed. The records search found 31 archaeological and historical sites documented within the project area. Similar to the Unit 1 project area report, the main objective of the CRMP for the Crownpoint project area is avoidance. (Marshall 1992)
- In 1995 HRI identified Ernest Becenti, Sr. as a Traditional Practitioner for both the Church Rock and Crownpoint Chapter areas. Mr. Becenti is well known as a Navajo Medicine Man with 30 years of experience. Mr. Becenti completed an inventory of potential sacred and TCPs within the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas. During the investigation Mr. Becenti walked each of the project areas looking for sacred plants and traditional places and interviewed nearby residents. Mr. Becenti reported that there were no significant sacred and traditional sites within the project areas. In addition, Mr. Becenti interviewed four individuals who all indicated that the majority of sacred sites and herb gathering places are in the mountains or along the mountain ridges. (Becenti 1996)

3.8.2 Preliminary HRI Tribal Outreach

Prior to the initiation of the Section 106 process, HRI solicited insight regarding historic preservation and mitigation from the tribal agencies (Navajo Natural Heritage Program and Navajo Nation Historic Preservation Department (NNHPD)) and tribes including the Acoma, Hopi, Laguna, Zuni, and All Indian Pueblo Council. The following summarizes the correspondence between HRI and each of the tribal agencies and tribes.

- In November 1991 two letters were submitted to the Navajo Natural Heritage Program and NNHPD soliciting information on cultural resources within the project areas. Each letter requested recommendations on identifying cultural resources within the Unit 1 project area and included the Unit 1 CRMP. The NNHPD responded in a letter dated

January 27, 1992, acknowledging the CRMP and stating that there was no objection to the execution of the lease agreement and that the plans and stipulations in the CRMP were adequate if HRI elected to proceed with uranium exploration.

- On February 9, 1996 HRI contacted Rolf Nabahe, an archaeologist for the NNHPD. Mr. Nabahe provided HRI with the Navajo Nation Policy to Protect Traditional Cultural Properties, which identified the steps required to record TCPs. The steps included contacting tribal officials to identify individuals familiar with TCPs. Mr. Nabahe stated that each individual is required to be interviewed by an ethnohistorian or qualified individual approved by the NNHPD. In addition a literature search for previously reported TCPs was required. The policy also required HRI to send letters to the governors of the Acoma, Hopi, Laguna, and Zuni tribes with a description of the project areas and inquiry of known TCPs with potential to be impacted.
- On February 22, 1996 HRI sent letters to the governors and/or chairpersons of the Acoma, Hopi, Laguna, Zuni and the All Indian Pueblo Council. The letters described the proposed CUP, including project area locations, and requested notification of TCPs located within or near the project areas. A correction to the letter was sent to the tribes on February 28 updating the project areas. HRI had not received any responses by March 26, 1996, so follow-up phone calls were made to each tribe. During the phone calls the Acoma stated that if human remains were found compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) should be followed. The Zuni Tribe indicated that there could be TCPs within the project areas and requested funding to perform the NHPA investigation. The Hopi Tribe indicated connections to the project areas and the possibility that ancestral cultural sites could be present. In addition, the Hopi Tribe requested a copy of the CRMP. The other tribes requested additional copies of the letter or had no comments.
- On February 22, 1996 additional letters were sent to the tribes informing them that Section 12, T17N, R13W had been added to the project. The letters also indicated that the Section 106 process would be commencing soon and requested information on TCPs within or near the project areas. Follow-up phone calls were made to the tribes between July 24 and 29, 1996. Mr. Petuuche of the Acoma Tribe indicated that there were no cultural properties in the project areas and approved HRI’s avoidance plan. All other tribes indicated that the letters were mailed to the correct contacts, but did not offer any guidance on TCPs within the project areas.
- In August 1996 HRI interviewed two knowledgeable individuals from the Crownpoint area, Mr. Tom Shorty and Mr. Lincoln Perry. Mr. Shorty grew up in the vicinity of Crownpoint and was known locally as a Medicine Man. Mr. Perry also grew up in the area of Crownpoint and resided near Unit 1. Both men were versed in identifying and using plants and herbs and noted that sacred localities are most commonly found in mountainous areas, canyons, and along cliffs. In addition, the individuals stated that plants grown for sacred purposes typically are located in clean areas and that the historical disturbances within the project areas made them unsuitable for plant growth. The individuals walked Section 12, T17N, R13W and identified several plant species and landscape changes. The plants identified by the individuals included yucca and orange mallow, which they stated held no sacred significance. In addition to the plants and herbs, Mr. Shorty and Mr. Perry identified where the Yahzi family lived. Mr. Perry believed that

Mr. Yahzi had passed away in 1930 and his body was buried in the floor of the house. He noted that although the human remains that may be present at the site are sacred, the land around the area does not hold sacred properties.

3.8.3 NHPA Section 106

The NHPA is the primary federal law governing the preservation of cultural and historic resources in the United States. In 1966 the NHPA established the ACHP to enforce Section 106. The regulations related to Section 106 are in 36 CFR Part 800 and include the following four main steps:

- Initiate Section 106 process (36 CFR § 800.3) – During this step the federal agency (NRC) determines whether the proposed action is an undertaking that has potential to affect historical properties. If the proposed action is determined to be such an undertaking, the federal agency is responsible for identifying the appropriate State Historic Preservation Office (SHPO) and/or Tribal Historic Preservation Office (THPO) for consultation. This phase also requires the federal agency to involve the public and consult with SHPO/THPO to identify additional consulting parties including organizations and individuals.
- Identify historic properties (36 CFR § 800.4) – The second step includes identification and evaluation of historical properties. Identification includes (1) determining and documenting the areas of potential effect, (2) reviewing existing information on historic properties within the areas, (3) seeking information from consulting parties with knowledge of the areas, and (4) gathering information from tribes to identify areas with religious and cultural significance that may be eligible for the National Register of Historic Places (NRHP). Following identification the federal agency is required to work with SHPO/THPO to determine if identified historical properties are eligible for inclusion in the NRHP.
- Assess adverse effects (36 CFR § 800.5) – As part of this step the federal agency is required to consult with SHPO/THPO to evaluate adverse effects that may result from the undertaking.
- Resolve adverse effects (36 CFR § 800.6) – In the last step the federal agency must consult with SHPO/THPO and consulting parties to resolve adverse effects. Typically resolution comes through the development of a memorandum of agreement (MOA) and/or programmatic agreement (PA) between the proponent, federal agency and consulting parties.

The following briefly describes the Section 106 process and details the steps taken by NRC to fulfill the Section 106 requirements for the CUP. A timeline of the CUP Section 106 process is provided in Figure 3.8-1.

3.8.3.1 Preliminary NRC Tribal Outreach

In addition to HRI's outreach NRC also made an effort to include tribal agencies and tribes in the development of the draft EIS. The following summarizes NRC's public outreach prior to commencement of the formal Section 106 process.

- In 1992 and 1993 NRC sent letters to individuals and agencies that had submitted comments regarding the CUP. The letters informed the individuals of the status of the HRI application and welcomed comments regarding the EIS.
- On September 24, 1992 HRI and NRC held scoping meetings at the Crownpoint facilities and Navajo Tribal headquarters in Window Rock, Arizona. The meetings were held to solicit concerns from local citizens, tribal officials, and others that could be addressed in the EIS.
- On December 18, 1992 NRC invited the Navajo Nation to become a cooperating agency in preparation of the EIS. The Navajo Nation replied to the NRC on February 20, 1993 stating that the Navajo Nation was opposed to the HRI project, but would like to be kept abreast of meetings and the progress of the EIS.

3.8.3.2 Initiate Section 106 Process

NRC formally initiated the Section 106 process for the CUP on October 2, 1996. As part of the initiation NRC mailed a letter to the NMSHPO providing the 5-year project areas and requesting assistance on the Section 106 process (Appendix C of the CUP FEIS). The letter described the work completed and proposed by HRI as well as a discussion of HRI's CRMP's for Crownpoint, Unit 1, and Church Rock Sections 8 and 17. In addition to the letter to the NMSHPO, NRC also distributed letters to other federal agencies and interested parties, including the BIA, BLM, NNHPD, and local tribes. The letter described the proposed action and informed the parties that they would be kept informed during the Section 106 process. On October 31, 1996 the NNHPD responded to the NRC's October 2, 1996 letter stating that NNHPD agreed with the incremental review of 5-year plans and providing Section 106 guidance as outlined in the Navajo Nation Policy to Protect Traditional Cultural Properties.

3.8.3.3 Identify Historic Properties

In 1996 HRI contracted the Office of Archaeological Studies, Museum of New Mexico (MNM) to conduct archaeological and TCP inventories of the project areas, including the Church Rock Sections 8 and 17 project areas and Section 12 north of the Unit 1 project area. The survey also included 136 ha [335 ac] of BLM-administered land in Section 8 not currently included in the project area (Blinman 1997). Research included Class III surveys and ethnohistoric research on TCPs. The results were compiled into a report, herein referred to as the MNM Report. During the survey 26 isolated occurrences (IOs) of artifacts were identified on the private land in Section 8 and 57 IOs on the BLM-administered land in Section 8. Within Section 17, five IOs were identified. Within Section 12, 73 IOs were identified. In addition, three modern burials on BLM-administered land in Section 8 and as many as two burials in Section 12 were identified.

In addition to the archaeological studies, ethnohistoric interviews were conducted with local Chapters to identify the presence of TCPs. Table 3.8-1 summarizes the interviews competed.

The report found that based on the proposed development, 12 archaeological sites in Section 8 will need to be avoided or mitigated. The report also found that no historical properties will be impacted by proposed development in the Church Rock Section 17 project area or Section 12 near the Unit 1 project area. The report noted that if construction activities changed, mitigation plans will be developed and implemented.

The MNM Report was mailed to the NNHPD, NMSHPO, and local tribes on June 18 and 19, 1997. The letter accompanying the report requested review and comments of the MNM Report. On November 20, 1997 the NMSHPO concurred with the sites that were eligible for inclusion in the NRHP. The eligible sites included 12 sites on private land in Section 8, 12 sites on BLM-administered land in Section 8, and 9 sites on private land in Section 12. The NMSHPO stated that three sites on BLM-administered land in Section 8 were not eligible for inclusion in the NRHP, while five additional sites on BLM-administered land in Section 8 and one site on private land in Section 12 required additional information to determine eligibility for the NRHP.

In 1998 HRI contracted the Office of Archaeological Studies, Museum of New Mexico to assess potential impacts to cultural resources due to facility modifications at the existing Crownpoint facility located in Section 24, T17N, R13W. Mr. Blinman conducted a survey of the existing facility and reviewed HRI's engineering plans for facility modifications. Mr. Blinman found that the existing facility was constructed between January 1980 and March 1981 by Conoco. Prior to construction by Conoco an archaeological inventory of the SE¼ of Section 24 was conducted by the staff of the University of New Mexico, Office of Contract Archaeology. Within the study area eight archaeological sites (three located within the boundary of the HRI facility) and two localities were defined. The three archaeological sites were fenced by Conoco and have not been disturbed, while the two localities were in an undisturbed area. Since the proposed facility modifications would be limited to the existing facilities area, Mr. Blinman concluded that there were no cultural resource issues associated with HRI's initial planned phase of development.

3.8.3.4 Assess Adverse Effects

NRC mailed the NMSHPO a letter on May 20, 1998 requesting consultation regarding the Section 106 process for Church Rock (Sections 8 and 17, T16N, R16W) and Section 12 (T17N, R13W). The letter requested concurrence on the no-effect findings described in the MNM Report. In addition, NRC also sent NNHPD a letter requesting consultation regarding the Section 106 process for the Church Rock Section 17 project area. The letter stated that the Navajo Nation and the National Park Service entered into an agreement in April 1997, making the Navajo Nation the historic preservation officer with respect to Navajo Tribal Lands. Since Section 17 is held in trust for the Navajo Nation, NRC requested concurrence with NNHPD that the Section 106 process on Section 17 was concluded based on the information presented in the MNM Report. Additional letters were mailed to the federal agencies, local chapters, and tribes requesting consultation on the MNM Report. In June the BLM, NNHPD, and NMSHPO concurred with NRC's "no-effect" findings. NMSHPO requested that the eligibility of the six sites (whose eligibility was undetermined without additional information) be determined prior to construction, mining or other ground-disturbing activities.

NRC informed HRI on July 10, 1998 that the NHPA Section 106 process with respect to Church Rock Sections 8 and 17 and Section 12 (T17N, R13W) was concluded. The letter (provided in Addendum B to this ER) includes three conditions:

1. Activities are restricted to Sections 8 and 17 (T16N, R16W) and Section 12 (T17N, R13W).
2. All eligible and potentially eligible properties in Sections 8 and 12 are required to be fenced. The fencing must remain in place until after site reclamation.

3. All ground-disturbing activities in the vicinity of the historic properties must be monitored by an archaeologist. If any undetected subsurface cultural resources are identified they must be reported to NRC, NNHPD, and NMSHPO within 24 hours.

In a letter dated May 13, 1999 NRC requested NMSHPO's concurrence on the "no-effect" finding at HRI's existing Crownpoint facility as reported by Mr. Blinman from the Museum of New Mexico, Office of Archaeological Studies. The research conducted by Mr. Blinman concluded that the identified archaeological sites and localities within the SE¼ of Section 24 (T17N, R13W) had been fenced or were in areas that had not been disturbed. Since future work at the facility would be confined to the existing pad, there would be no effects to cultural resources. On June 7, 1999 NNHPD objected to the conclusion on the basis that NNHPD had jurisdiction over the historic properties located on Section 24. NMSHPO concurred with NRC's "no-effect" findings for Section 24 in a letter dated June 17, 1999. NRC responded on June 25, 1999 stating that since HRI owned the land in Section 24 it was not considered a dependent Indian community, and therefore NMSHPO had NHPA jurisdiction.

In a letter to HRI dated July 8, 1999 NRC concluded the NHPA Section 106 process for Section 24. The letter (provided in Addendum B to this ER) includes three conditions as described below:

1. Activities are restricted to Section 24 (T17N, R13W).
2. All eligible and potentially eligible properties in Section 24 are required to be fenced. The fencing must remain in place until after site reclamation.
3. All ground-disturbing activities in the vicinity of the historic properties must be monitored by an archaeologist. If any undetected subsurface cultural resource are identified it must be reported to NRC, NNHPD, and NMSHPO within 24 hours.

3.8.3.5 Resolve Adverse Effects

The Section 106 process concluded with "no-effect" findings for the project areas included in HRI's 5-year disturbance plan.

3.8.4 Litigation Related to Historical and Cultural Resources

The Intervenors moved that the Presiding Officer stay the effectiveness of HRI's license on January 15, 1998. The Intervenors argued that NRC had violated Section 106 of the NHPA by issuing HRI's license prior to completion of the Section 106 process without consulting with appropriate tribes, interested parties and the NNHPD; by improperly excluding from review areas that will be disturbed by activities authorized by the license; and by relying on cultural resource reports that do not comply with Section 106. On January 23, 1998 the Presiding Officer temporarily stayed the license's effectiveness (LBP-98-3), but subsequently lifted the temporary stay and denied the Petitioners' motion for full stay on April 2, 1998 (LBP-98-5). On April 11, 1998 the Intervenors appealed the LBP-98-5 ruling to the Commission and requested a motion for both a full and temporary stay of the effectiveness of LBP-98-5. The Commission issued the temporary stay, pending consideration of the Intervenors' petition for review and motion for a full stay (CLI-98-4). On June 5, 1998 NRC denied the Intervenors a request for a full stay and lifted the temporary stay issued under CLI-98-4 (CLI-98-8).

The Presiding Officer issued a scheduling order that split the proceeding into phases on September 22, 1998. The first phase included the Church Rock Section 8 project area, while the second phase included the remaining three project areas (Church Rock Section 17, Crownpoint, and Unit 1). NRC upheld the bifurcation order on October 23, 1998 (CLI-98-22).

ENDAUM and SRIC submitted a "Brief in Opposition to Hydro Resources, Inc.'s Application for Materials License with Respect to Compliance with the National Historic Preservation Act, Native American Graves Protection and Repatriation Act and Related Cultural Resources Issues" on December 7, 1998. The brief raised concerns previously discussed in LBP-98-3. On February 19, 1999 the Presiding Officer stated that "the concurrence of the NMSHPO and NNHPD as to 'no effect' completes consultation on both archaeological and traditional cultural property resources and that HRI and the Staff have fulfilled their NHPA responsibilities [for the Church Rock Section 8 property]" (LBP-99-9). The Intervenors appealed the LBP-99-9 ruling to the Commission. The Commission affirmed the Presiding Officer's ruling on July 23, 1999. In February 2004 the Presiding Officer concluded the Phase I adjudication (LBP-04-03) and the Commission, on appeal, sustained the validity of HRI's license insofar as it relates to Church Rock Section 8.

Phase II challenges related to cultural resources were litigated in 2005 and 2006. Similar to Phase I, the Intervenors argued that HRI's license for Church Rock Section 17, Unit 1, and Crownpoint was invalid because it violated NHPA and NEPA. The Intervenors argued that the phased Section 106 approach was impermissible and that NRC had failed to adequately address cultural resources in the CUP FEIS. The Presiding Officer concluded that HRI demonstrated that the license complied with NHPA and NEPA requirements regarding cultural resources (LBP-05-26). In 2006 the Intervenors petitioned the Commission for review of LBP-05-26. The Commission agreed with the Presiding Officer's analysis of the adequacy of the NHPA and NEPA analysis and denied the Intervenors' petition for review (CLI-06-11).

3.8.5 Comparison to CUP FEIS

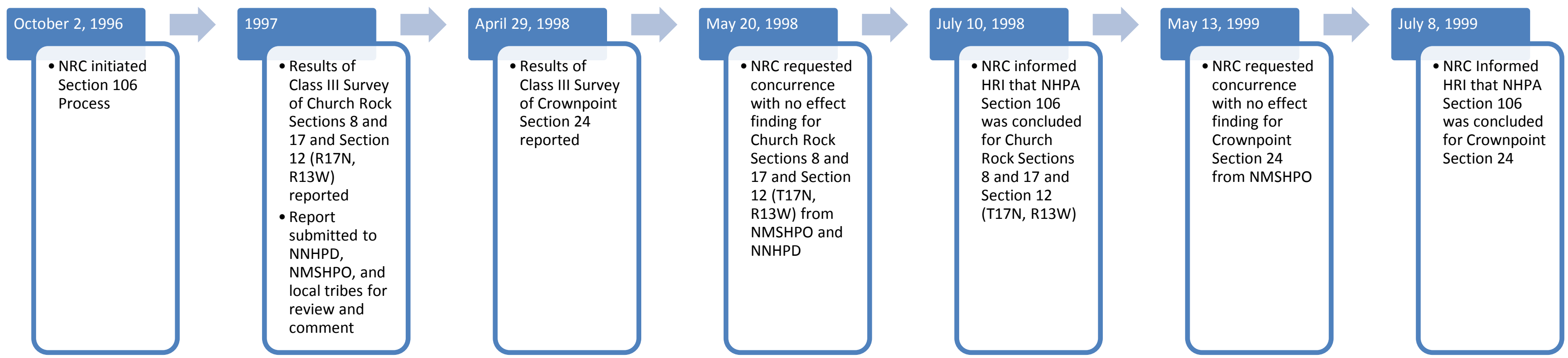
The information provided in this section demonstrates that NRC has completed the Section 106 process for the initial phase (5-year disturbance plan) of development in the CUP. Along with the information presented in Section 3.9 of the CUP FEIS, cultural resources have been addressed adequately. In addition, as stated in LC 9.12 of SUA-1580, HRI is required to conduct cultural resource inventory for "any construction activity not previously assessed by NRC."

Table 3.8-1. Summary of Ethnohistoric Interviews in Church Rock Sections 8 and 17

Consultant	Affiliation	Concerns
Ernest C. Becenti, Sr.	Church Rock Chapter; former chapter president; traditional practitioner	No known traditional uses
Ms. Jean Mariano	Mariano Lake Chapter; traditional practitioner	No known traditional uses
Nelson J. Largo, Sr.	Smith Lake Chapter president	No known traditional uses
Bennie Y. Begay	Pinedale Chapter; former chapter vice president; traditional practitioner	No known traditional uses
Jim Charley	Smith Lake Chapter; traditional practitioner	No known traditional uses
Tom Shorty[1]	Becenti Chapter; traditional practitioner	No known traditional uses
Lincoln Perry[1]	Crownpoint Chapter; traditional practitioner	No known traditional uses
William E. Raymond	Little Water Chapter; former chapter secretary; traditional practitioner	No known traditional uses
Charles Long	Crownpoint Chapter president	No known traditional uses
Confidential[1]	Dalton Pass Chapter; traditional practitioner	No known traditional uses
Herbert Benally	Church Rock Chapter president	No known traditional uses
Nelson Zuni	Pinedale Chapter vice president	No known traditional uses
George Toth	Little Water Chapter, council delegate	No known traditional uses
Bennie Enrico[2]	Little Water Chapter president	No known traditional uses
Thomas Barbone[2]	Little Water Chapter vice president	No known traditional uses
Ken Tapaha[2]	Little Water Chapter manager	No known traditional uses
Henry Tom[2]	Mariano Lake Chapter president	No known traditional uses

[1] Consultant less familiar with the Church Rock Sections 8 and 17 project areas.
[2] Deferred to the traditional practitioners who have been consulted.
Source: Blinman 1997

Figure 3.8-1. CUP Section 106 Process Chronology



3.9 Visual and Scenic Resources

Visual and scenic resources were discussed in the CUP FEIS under the heading of Aesthetics (Section 3.8). In addition, Section 3.5.9 of the ISR GEIS includes general information regarding visual and scenic resources in northwestern New Mexico. The following presents general and project-specific visual and scenic resources information including a discussion of the VRM system. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to visual and scenic resources.

Federal land management agencies such as the BLM and the USFWS have established guidelines to inventory and manage visual resources. Because there are a variety of visual values, different levels of management are necessary. These activities are typically part of a VRM system. The VRM system is the basic tool used by federal land management agencies to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for increasing levels of change within the characteristic landscape (BLM 2007).

The VRM classes are as follows (BLM 1987, 2007):

- Class I – Natural ecologic changes are provided for and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.
- Class II – Changes in any of the basic elements (form, line, color, texture) caused by an activity may be seen but should not attract the attention of a casual observer. Sculpted landscapes of mesas and canyons offer high scenic value to a large number of people. Within the predominantly open, arid landscape, numerous mesas and mountain ranges offer views that are typical in this region.
- Class III – Contrasts to the basic elements caused by an activity can be evident but should remain subordinate to the existing landscape.
- Class IV – Activity attracts attention and is a dominant feature of the landscape in terms of scale.
- Class V – This classification is applied to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

In general, visual and scenic resources are based on people's perception of certain characteristics. The primary viewers of the CUP will be the Native American residents living on or near the project areas. Both the CUP FEIS and ISR GEIS indicate that Native Americans place an emphasis on the visual aspect of specific objects rather than on landscapes. Native Americans may place more meaning on identifiable places rather than generalized landscapes.

The ISR GEIS indicates that there are no Class I VRM areas in northwestern New Mexico and most Class II VRM areas are located just north of I-40. The following discusses the visual and scenic resources for each project area. Visual resources for each of the project areas are evaluated based on landscape and on ISR GEIS Figure 3.5-20, which depicts BLM VRM classifications for northwestern New Mexico.

3.9.1 Crownpoint

The Crownpoint project area is located adjacent to the town of Crownpoint and demonstrates an urban character. The project area resembles a low-intensity industrial site and widespread overgrazing, bare soil and erosion are commonplace. Sandstone outcrops, rolling hills, and distant mountains provide a more natural-looking character. The Crownpoint project area is easily visible from the town of Crownpoint and from adjacent roads (NM 371 and Navajo 9). The site is approximately 10 km [6 mi] east of the border of the Navajo Nation. The Crownpoint project area is within a Class IV VRM area.

3.9.2 Unit 1

Unit 1 is the most natural appearing of the project areas. The project area is characterized by rolling, grass-covered hills used for livestock grazing, small arroyos, and scattered pinyon pines. The Unit 1 project area is visible from adjacent roads (Navajo 9 and Navajo 11). The site is approximately 5 km [3 mi] east of the border of the Navajo Nation. The Unit 1 project area is within a Class IV VRM area.

3.9.3 Church Rock Sections 8 and 17

The Church Rock Sections 8 and 17 project areas are characterized by a large, shallow, grassland valley between two large sandstone bluffs. Widespread overgrazing, bare soil and erosion within the project areas are commonplace and there is evidence of past uranium mining (a metal building, concrete pad, and ponds associated with the OCRM). The Church Rock Sections 8 and 17 project areas are visible from NM 556, which passes through the project areas. The Church Rock Sections 8 and 17 project area is within a Class IV VRM area.

3.10 Socioeconomics

There have been two decennial census periods since publication of the CUP FEIS (2000 and 2010). The following sections discuss changes in population, racial makeup, employment and income, and housing for the project since publication of the CUP FEIS. Although changes have occurred, the overall socioeconomic environment of the area has not changed appreciably and can be summarized as follows:

- *Population of the area has grown more slowly than projected in the CUP FEIS.*
- *The percentages of Native Americans in Crownpoint and McKinley County are higher than in the State of New Mexico, and those percentages have grown since the CUP FEIS.*
- *Unemployment continues to be higher in McKinley County than in the entire state.*
- *Government employment is still the single largest source of jobs and its lead over other sources of jobs has grown.*
- *The median value of housing in Crownpoint continues to be below values for McKinley County, the City of Gallup, and the State of New Mexico.*

This section provides additional details concerning the socioeconomic characteristics of the project region. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to socioeconomics.

3.10.1 Demographics

U.S. Census Bureau data show that the 2010 population of McKinley County was 71,492. This is less than the 77,823 that was projected in the CUP FEIS for 2010 and represents an annual growth rate of roughly half the 1.2% that was projected in 1995. The 2010 population of New Mexico was 2,059,175, which reflects close to the 1.3% annual growth rate that was projected in the CUP FEIS.

Table 3.10-1 reflects population and racial characteristics for the State of New Mexico, McKinley County, Crownpoint, and Gallup as of 2009 (not all data from the 2010 Census had been made available by the U.S. Census Bureau at the time of this writing). As of 2009 the Native American population of McKinley County had grown to 51,958 or 73.8% of the county population, compared to 1990 values of 43,570 and 71.8% (Table 3.26 in the CUP FEIS). By 2009 over 63% of the county's white population resided in Gallup and over 87% of the county population outside of Gallup was Native American, compared to values of 70% and 85% in 1990.

McKinley County's website states that the closing of the Pittsburg and Midway Mine (in 2009) dealt a major blow to the local economy, and that, "Reuse strategies and retraining programs are currently being explored to displace the lost tax base and reinsert employees into other jobs or other fields" (McKinley County 2012a). The Navajo Nation's Fire Rock Casino, which opened in Church Rock on November 19, 2008, may help to offset some of the employment and tax benefits lost by the closing of the coal mine.

3.10.2 Income

Table 3.10-2 presents income characteristics for the residents of McKinley County by race as of 1999, which represents the most recent data available from the U.S. Census Bureau at the time of this writing. Table 3.10-3 shows a comparison of income and poverty status in 1999 between McKinley County and the State of New Mexico. These tables show that McKinley County's Native American population continues to make up a disproportionate number of its poorest residents. However, some improvement has occurred since 1989 (the data used in the CUP FEIS). The 1999 Native American poverty rate in McKinley County was 42.6%, about 3.6 times that of whites but better than the 54% (about 5 times that of whites) in 1989 (Table 3.28 in the CUP FEIS). The percentage of people below the poverty level is about twice as high for McKinley County as for the entire state.

3.10.3 Earnings and Employment Structure

In November 2011 McKinley County's unemployment rate was 7.9%, compared to 6.5% for New Mexico and 8.6% for the United States. McKinley County's unemployment rate declined from 10.2% in January and February 2011 and reached a 2011 low of 7.5% in May (New Mexico Department of Workforce Solutions 2012). Though unemployment in the county is still higher than the statewide rate, the data seem to show that the county and state were less affected than the nation as a whole by the recession that began in 2007.

Government employment is the largest source of jobs in McKinley County. Government employment accounted for 37% of wage and salary employment and 52% of earnings in McKinley County in the second quarter of 2011 (New Mexico Department of Workforce Solutions 2011a). This is an increase from 19% of wage and salary employment in 1990 and 31% of total county earnings in 1994 (CUP FEIS). In the second quarter of 2011, the goods-related industry represented only 7% of total county earnings, compared to a State-wide value of 15.6%. Manufacturing wages in McKinley County ($47,632) still lagged behind the State ($52,843) but by a smaller percentage than in 1990 (New Mexico Department of Workforce Solutions 2011a).

According to the 2007 Census of Agriculture (the census is updated at 5-year intervals), McKinley County is 28th among the State's 33 counties in the total value of agricultural products sold. The number of farms in the county had increased from 150 in 2002 to 2,624 in 2007 and the average farm size had decreased from 8,555 ha [21,132 ac] to 489 ha [1,209 ac)]. It is believed that this results more from a revised definition of "farm" than from actual real estate transactions. The total market value of products sold increased from $6,401,000 in 2002 to $7,881,000 in 2007, while the average per farm dropped from $42,674 to $3,004. Government payments to farms declined from $265,000 to $71,000 during this 5-year period, from an average of $14,704 per farm to $518.

Tourism remains an important segment of McKinley County's economy, with its proximity to I-40, a major east-west traffic corridor and regional attractions including the Hubbell Trading

Post National Historic Site. Located in Arizona some 60 miles west of Gallup, annual visits to this site reached a peak of over 271,000 in 1998, declining to about 81,000 in 2010 (NPS 2012). Locally, the Chaco Culture National Historic Park, located about 48 km [30 mi] northeast of Crownpoint, is a major attraction, with park visitation of over 34,000 in 2010 after reaching a peak in 1997 of around 113,000 (NPS 2012).

3.10.4 Housing and Public Infrastructure

3.10.4.1 Housing

Table 3.10-4 presents a comparison of housing statistics for Crownpoint, Gallup, McKinley County, and the State of New Mexico. There continues to be a significant difference in the value of housing in Gallup compared to the rest of McKinley County, reflecting the higher incomes of residents in Gallup. Table 3.10-4 shows that the median value of housing in Crownpoint remains far below values for McKinley County, the City of Gallup and the State of New Mexico. The percentage of houses occupied by owners is lower for Crownpoint than for Gallup, the county and state as a whole, and the percent vacant is much higher for Crownpoint. The value of owner-occupied housing in Crownpoint is only about one-fifth that for the entire state.

3.10.4.2 Water and Wastewater Services

Water for residences, businesses, and public buildings within and surrounding the CUP project areas is provided by NTUA. Water for the Crownpoint community is supplied by the three NTUA wells described in Section 3.4.3.2.1 of this ER. BIA administered public buildings receive water from the two BIA wells located in Crownpoint. NTUA also operates a waste water treatment facility for the town of Crownpoint. The treatment facility consists of one lagoon and is operating at full capacity. Wastewater outside of the town of Crownpoint is treated using septic systems with leach fields.

3.10.4.3 Police, Fire, and Emergency Protection

Police protection around the CUP is provided by the Navajo Nation Police Department and the McKinley County sheriff department. Fire protection is provided by various volunteer fire departments. Currently there are 21 fire districts within McKinley County. The Crownpoint Volunteer Fire Department will provide fire protection for the all four of the project areas. The Crownpoint Volunteer Fire Department consists of 17 to 20 volunteers and is equipped with basic firefighting equipment (Crownpoint Volunteer Fire Department 2012). The Mariano Lake/Pinedale Volunteer Fire Department (2 to 3 volunteers) will provide additional fire protection at the Church Rock Sections 8 and 17 project areas (Mariano Lake/Pinedale Volunteer Fire Department 2012).

Emergency medical service (EMS) in the CUP is provided by the fire districts, McKinley County, and the Navajo Nation EMS. The fire districts are equipped with medical equipment and extraction capabilities, while ambulatory care is provided by McKinley County or the Navajo Nation EMS. Hospitals in the vicinity of the CUP include the Crownpoint Health Care Facility in Crownpoint, Cibola General Hospital in Grants, and Gallup Indian Medical Center and Rehoboth McKinley Christian Health Care Services in Gallup.

3.10.4.4 Education Resources

Education remains the primary economic activity in the town of Crownpoint. Total school enrollment in the eleven Crownpoint schools as of 2011 was about 2,160, an increase of over 50% from the 1992 total of 1,400 as stated in the CUP FEIS. Total school enrollment included the following: Crownpoint Elementary School (enrollment 251), Crownpoint High School (471), and Crownpoint Middle School (221), all operated by the Gallup McKinley County School District; Borrego Pass School (175), Crownpoint Community School (513), Lake Valley Navajo School (100), Mariano Lake BIA Community School (215), and Tse'ii'ahi' Community School (150), all operated by the Bureau of Native American Affairs; and three private schools: Bible Baptist Shepherd (6), Crownpoint Christian School (27), and La Vida Mission School (31) (Aol Real Estate 2012). Diné College, located in Tsaile, Arizona, serves the residents of the 26,000 sq-mi Navajo Nation, which is spread over Arizona, New Mexico and Utah. Founded in 1968, it is the first of 37 tribal colleges. Diné College has two main campuses and six community centers serving approximately 2,000 students. One of the community centers is located in Crownpoint. Diné College is a public institution of higher education chartered by the Navajo Nation (Diné College 2012).

3.10.5 Taxes and Local Finance

Sources of tax revenue for McKinley County include property and gross receipts taxes. The county tax rate on real and personal property is $31.567 per $1,000 of assessed value (McKinley County 2012b). This is a minor increase from the property tax rate of $30.823 per $1,000 of assessed valuation discussed in the CUP FEIS. Assessed value is set at one-third of fair market value for houses. Therefore, the annual property tax on a house on private property with a market value of $70,000 will be approximately $736. Business assets also are classified as personal property but for tax purposes can be depreciated at various schedules down to a floor of 12.5%. Therefore, a piece of equipment with a market value of $1 million when new will generate approximately $60,000 in personal property taxes for the county over a 10-year period assuming a Federal tax depreciation schedule of 10 years.

The assessed value of uranium production for tax purposes is 50% of the sales price. Therefore, at the current property tax rate, McKinley County will collect $15,783 ($1,000,000 x 0.5 x 0.031567) for each million dollars of yellowcake produced and sold.

McKinley County can collect property taxes on equipment and improvements for any non-Navajo operation outside the Navajo Reservation. The county also can tax any Navajo Reservation lands that have been acquired as private property.

McKinley County receives 0.25% gross receipts tax revenue as part of the gross receipts tax on goods and services collected by the State. Although this tax is applied to businesses, it is passed on to customers and resembles a sales tax. With the gross receipts tax, for every $10,000 of purchases made in McKinley County, the county receives $25 from the State.

The Navajo Nation can levy taxes in an area outside the Navajo Reservation if the area is classified as being in "Indian country," as defined in 18 U.S.C. Section 1151 (40 CFR § 144.3), which includes allotted land, trust land, and land within a dependent Indian community. Navajo taxes include a 5% business activities tax on business gross receipts. Gross receipts are reduced by a 10% standard deduction plus deductions for compensation paid to Navajo employees. This tax could be levied on uranium production off the Navajo Reservation if the production is determined to occur in “Indian country.” The Navajo business activities tax on construction is a 3% tax on payments to contractors and subcontractors without deductions for various construction activities including well drilling.

The State of New Mexico levies a 3.5% severance tax and a 0.75% natural resources tax on the sales price of uranium.

New Mexico corporate income tax is imposed on total net income (including New Mexico and non-New Mexico income). The percentage of New Mexico income is then applied to the gross tax. The tax rate is graduated as follows (New Mexico Taxation and Revenue Department 2010)

Net Income	Tax Rate
≤ $500,000	4.8% of net income
$500,000 to $1,000,000	$24,000 + 6.4% of net income over $500,000
≥ $1,000,000	$56,000 + 7.6% of net income over $1,000,000

The town of Crownpoint receives public funding from the Federal government, the Navajo Nation, the State of New Mexico, and McKinley County. For example, the Crownpoint Indian Health Care Facility is funded by the Federal government, water and waste water services and police protection are provided by the Navajo Nation, and public education is provided by the State of New Mexico, McKinley County, and BIA.

Table 3.10-1. 2009 Population and Racial Characteristics of the State of New Mexico, McKinley County, Crownpoint and Gallup

	Total	White	Black	Native American	Other[a]	Hispanic Origin[b]
New Mexico	1,964,860	1,436,818	55,451	209,499	329,317	879,480
(percent of total)[c]		73.1%	2.8%	10.7%	16.7%	38.2%
McKinley County	70,388	15,376	1,040	51,958	3,380	9,897
(percent of total)		21.8%	1.5%	73.8%	4.8%	14.1%
Crownpoint (Census designated place)	2,330	94	0	2,141	95	83
(percent of total)		4.0%	0.0%	91.9%	4.1%	1.3%
Gallup city	19,774	9,619	816	7,738	2,601	6,854
(percent of total)		48.6%	4.1%	39.1%	13.1%	21.8%
McKinley County not including Gallup	50,614	5,757	224	44,220	779	3,043
(percent of total)		11.1%	0.0%	85.7%	1.5%	6.0%

[a] Other includes Asians and Pacific Islanders.
[b] Hispanic origin can be any race and is calculated as a separate component of the total population (i.e., if added to the other 3 racial cohorts the total will be more than 100%).
[c] Percentages do not add to 100 because of rounding and because "Hispanic origin" is not a racial category.
Source: USCB 2012b

Table 3.10-2. McKinley County Household Income Distribution by Race, 1999

Income interval ($)	White (%)	Native American (%)	Other Race (%)
<10,000	2.1	18.6	1.3
10,000 to 14,999	2.3	8.4	1.1
15,000 to 24,999	3.6	11.3	1.3
25,000 to 34,999	3.8	8.6	1.2
35,000 to 49,999	4.4	9.1	1.4
50,000 to 74,999	4.6	6.5	1.7
75,000 to 99,999	1.8	2.5	0.7
Above 100,000	2.2	1.1	0.4
Percentage of all households	24.8	66.1	9.1

Source: USCB 2012c

Table 3.10-3. Comparison of Income and Poverty Status in 1999 between McKinley County and the State of New Mexico

	New Mexico	**McKinley County**
Per capita income	$17,261	$9,872
Median household income	$42,090	$29,369
Per capita income by race		
White	$20,307	$21,513
Black	$14,849	NA
American Indian, Eskimo, or Aleut	$8,679	$7,086
Asian or Pacific Islander	$21,435	NA
Other[a]	NA	NA
Percentage below poverty level-all persons	18.4	36.1
White	14.0	11.8
Black	23.0	NA
American Indian, Eskimo, or Aleut	36.2	42.6
Asian or Pacific Islander	NA	NA
Other[a]	23.8	26.4

NA – not available

[a] Other includes everyone except white and American Indian, Eskimo or Aleut groups when other data are not available. Some data not provided for confidentiality when sample groups are small.

Source*:* USCB 2012c

Table 3.10-4. Households, Housing and Rent in McKinley County, 2010

	Crownpoint	Gallup	McKinley County	New Mexico
Total housing units	837	8097	25,813	901,388
Median value owner-occupied housing	$33,800	$118,700	$60,300	$158,300
Median contract rent	$275	$375	$351	$406
Occupied housing units (households)	541	7,590	21,968	791,395
Vacant housing units	195	507	3,845	109,993
Percent vacant	23.3	6.3	14.9	12.2
For seasonal, recreational, or occasional use	60	47	1,252	36,612
Owner occupied	313	4,215	15,722	542,122
Percent owner occupied	48.8	55.5	71.6	68.5
Renter occupied	329	3,375	6,246	249,273
Percent renter occupied	51.2	44.5	28.4	31.5
Persons per occupied housing unit	3.29	2.79	3.22	2.55

Source: USCB 2012a, 2012b

3.11 Environmental Justice

There have been two decennial census periods since the publication of the CUP FEIS and one since publication of the ISR GEIS. Section 3.10 of this ER discusses changes in population, racial makeup, employment and income, and housing for the CUP since publication of these two documents. The overall socioeconomic environment of the area has not changed appreciably, and the factors that affect environmental justice in addition to those listed in Section 3.10 can be summarized as follows (IHS 2012).

- The American Indian people have long experienced lower health status when compared with other Americans. Lower life expectancy and the disproportionate disease burden exist perhaps because of inadequate education, disproportionate poverty, discrimination in the delivery of health services, and cultural differences. These are broad quality of life issues rooted in economic adversity and poor social conditions.
- Diseases of the heart, malignant neoplasm, unintentional injuries, diabetes mellitus, and cerebrovascular disease are the five leading causes of American Indian deaths (2004-2006).
- American Indians born today have a life expectancy that is 5.2 years less than the U.S. all races population (72.6 years to 77.8 years, respectively).
- American Indians die at higher rates than other Americans from tuberculosis (500% higher), alcoholism (514% higher), diabetes (177% higher), unintentional injuries (140% higher), homicide (92% higher) and suicide (82% higher).
- Subsistence (a regular pattern of eating wildlife hunted for one's self or family and/or eating vegetation or livestock raised by one's self or family) is a relatively common practice in the area. Subsistence activities are relevant in environmental justice analyses because the activities could introduce exposure pathways if contamination were to occur as a result of the project.

As stated in Section 3.10 of the CUP FEIS, because the population near the CUP is made up almost entirely of Navajo, many of them living in poverty, any significant adverse impact resulting from the project will be an environmental justice impact. In addition, the environmental justice of the CUP was litigated as part of Phase 1 in 1999. As part of the litigation, the Intervenors attempted to show that serious environmental costs would be imposed on the communities of Church Rock and Crownpoint from the CUP. The ASLB Presiding Officer concluded that based on the information presented in the CUP FEIS and a recent site visit to the Church Rock Section 8 project area, there will be no serious adverse impact on the environmental justice population (LBP-99-30).

3.12 Public and Occupational Health

This section describes existing public and occupational health conditions related to the proposed project areas. A discussion of potential exposures to populations and individuals is presented with a focus on topics related to the intended use of the project areas. This lays a foundation for later sections that describe potential impacts to the sites, especially Section 4.12, Potential Public and Occupational Health and Safety Impacts. Public Occupational Health and Safety discussions were not included in Chapter 3 of the CUP FEIS; however, health physics and potential radiological impacts discussions were included in Chapter 4 (Section 4.6, Health Physics and Radiological Impacts). Section 3.5.11 of the ISR GEIS includes general information regarding public and occupational health and safety in northwestern New Mexico. Since the publication of the CUP FEIS, two radiological characterization surveys were conducted in 2009 within and surrounding the Church Rock Section 17 project area. The results of these surveys as well as the background radiological conditions for the project areas are discussed in this section.

3.12.1 Background Radiological Conditions

Background radiation is defined in 10 CFR § 20.1003 as, "Radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents, such as Chernobyl, that contribute to background radiation and are not under the control of the licensee." Background dose varies by location primarily because of elevation changes and variations in the dose from radon. Radon and thoron are radioactive gases produced from the decay of uranium-238 and thorium-232, which were distributed during the Earth's formation 4.5 billion years ago. Background sources including cosmic radiation, terrestrial radiation, and internal radiation account for 50% of the average annual exposure to an individual in the U.S. Man-made sources account for the remaining 50%. Man-made radiation consists of contributions from medical procedures (including nuclear medicine), occupational exposure, consumer products and industrial activities.

For the average U.S. resident, the total effective dose from background radiation sources is approximately 3.1 mSv/yr [310 mrem/yr] but varies by location and elevation. In addition the average American receives approximately 3.1 mSv/yr [310 mrem/yr] from man-made sources including medical diagnostic tests and consumer products (NRC 2012d). Therefore, the total from natural background and man-made sources for the average U.S. resident is 6.2 mSv/yr [620 mrem/yr]. By comparison, the ISR GEIS states that the average U.S. citizen receives 3mSv/yr [300 mrem/yr] from background radiation sources but only 0.6 mSv/yr [60 mrem/yr] from man-made sources. The executive summary for the National Council on Radiation Protection and Measurements (NCRP) Report No. 160 (NCRP 2012) describes the increase in dose as follows:

> "Since [the early 1980s], the magnitude and distribution among the various sources of radiation exposure to the U.S. population have changed primarily due to increased utilization of ionizing radiation in diagnostic and interventional medical procedures."

The ISR GEIS states that the average background for northwestern New Mexico including natural and man-made sources is 3.15 mSv/yr [315 mrem/yr]. This is lower than the U.S. average rate of 3.6 mSv/yr [360 mrem/yr] indicated in the ISR GEIS primarily because average annual radon dose is less for New Mexico (1.32 mSv/yr [132 mrem/yr] versus the U.S. average of 2 mSv/yr [200 mrem/yr]).

The total effective dose equivalent (TEDE) is the total dose from external sources and internal material released from licensed operations. Doses from sources in the general environment (such as terrestrial radiation, cosmic radiation, and naturally occurring radon) are not included in the dose calculation for compliance with 10 CFR Part 20, even if these sources are from TENORM, such as preexisting radioactive residues from prior mining (ASLB 2006).

As part of developing an application for a radioactive material license for a uranium ISR facility, NRC requires an applicant to conduct a radiological assessment to determine the potential impact. A computer model known as MILDOS-AREA is typically used to generate estimates of dose to the public (Faillace 1997). The dose rates are then compared to the regulatory limits to demonstrate that no member of the public will be exposed to radiation levels in excess of regulatory limits set by the NRC (NRC 2002). HRI has completed two MILDOS-AREA analyses as part of the license applications for the Church Rock Sections 8 and 17 and Crownpoint project areas. Results of the MILDOS-AREA analyses are discussed in Section 4.6 of the CUP FEIS and in Section 4.12 of this ER.

3.12.2 Current and Historical Sources and Level of Exposure to Radioactive Materials

Other than background and the common sources of man-made exposure discussed in Section 3.12.1, there are no active nuclear facilities or active uranium recovery activities in the immediate area that could result in potential additional radiation exposure to the local population. There are, however, three inactive facilities either within or immediately adjacent to the Church Rock Sections 8 and 17 project areas. OCRM is an inactive uranium mining facility located in Section 17, T16N, R16W, within the Church Rock Section 17 project area. The mine was operated from 1960 to 1962 by Conoco and from 1976 to 1982 by UNC. All that remains of the inactive mine today are a sealed mine shaft, an empty ion-exchange building, five dry surface impoundments, former stockpile areas, and several concrete pads. The only remaining materials from the OCRM that could potentially constitute a source of mining-related environmental impacts are residual materials from waste rock and ore storage areas and debris from the demolition of site facilities.

NECR is a former uranium mine that was operated by UNC from 1967 to 1982. The site is located approximately 2.3 miles northeast of the Church Rock Sections 8 and 17 project areas. This site is an EPA Region 6 Superfund site, and EPA has detected radium contamination in 14 areas on and off-site (EPA 2012e). The sources of potential health risk are derived from two aspects of this mine: dewatering the mine shafts while the mine was in operation and creating mine waste piles while removing the ore. EPA recently announced a major cleanup effort at the site (EPA 2012f). The cleanup will include removal of approximately 1.4 million tons of radium- and uranium- contaminated soil and will employ the most stringent standards in the country. The multi-year phased cleanup will place the contaminated soil in a lined, capped facility.

The Quivira Mines (NE Church Rock #1 and #1 East) are two former uranium mines that were operated by Kerr McGee Corporation from 1974 to 1985. The former mine site is located directly north of the NECR site. The site is an EPA Region 9 Superfund site due to radium-226 contamination. EPA has completed efforts to identify and cleanup contamination from the mine. A draft report of the mitigative work performed and characterization data collected at or near the mine was published in September 2011. The site will continue to be monitored periodically for road sealing and related erosion work, erosion control measures, and fences and gates (RAML 2011).

There are two AEA-licensed, inactive uranium recovery facilities in the region that could be considered potential sources of radioactive material. The Rio Algom/Ambrosia Lake Uranium Recovery Facility (approximately 39 km [24 mi] southeast of the Crownpoint project area) and the Homestake/Grants Uranium Recovery Facility (approximately 53 km [33 mi] southeast of the Crownpoint project area) are both in the decommissioning/reclamation phase (NRC 2012b, 2012c). The remaining materials from the Rio Algom/Ambrosia Lake Uranium Recovery Facility that could potentially constitute a source of mining-related environmental impacts are remediated mill tailings piles. The remaining materials from the Homestake/Grants Uranium Recovery Facility that potentially could constitute a source of mining-related environmental impacts are two remediated tailings piles. The distances involved and the state of remediation of the mill tailings piles (which have met the EPA/NRC radon emanation limit of 20 $pCi/m^2/sec$) make it unlikely that these sources pose any significant potential threat to public health, safety, and the environment.

Comprehensive radiological baseline studies have been conducted at the project areas. They include determining the background dose from cosmic and terrestrial radiation via gamma scanning across each project area. These site-specific studies are discussed below.

3.12.2.1 Crownpoint and Unit 1

Comprehensive radiological baseline studies were conducted at the Crownpoint and Unit 1 project areas in 1978 and 1980. The studies included determining the background dose from cosmic and terrestrial radiation via gamma scanning across the project areas. Additionally, thermo luminescent dosimeters (TLDs), which continuously record the terrestrial plus cosmic background radiation, were placed at 10 strategic locations for 12 months. These studies indicated that the background dose rates from cosmic and terrestrial sources ranged from 1.25 to 1.53 mSv/yr [125 to 153 mrem/yr] (HRI 1992). An additional background radiological study of the Crownpoint project area was completed in 1989. The study measured background gamma radiation from 1.14 to 1.31 mSv/yr [114 to 131 mrem/yr], which were consistent with the previous radiological study (HRI 1989).

3.12.2.2 Church Rock Sections 8 and 17

A comprehensive radiological baseline study was conducted at the Church Rock Sections 8 and 17 project areas in 1987 and 1988. Gamma measurements ranged from 1.05 to 30.66 mSv/yr [105 to 3,066 mrem/yr], with the higher concentrations generally found in association with previous uranium mining activity. Since the publication of the CUP FEIS, two additional radiological surveys have been completed. The following summarizes the survey methods and results. Addendum C includes the reports for each survey.

A site characterization of HRI's Section 17 lease area was conducted in 2009 by INTERA, Incorporated. The characterization evaluated the potential for transport of constituents by a number of pathways including surface water, groundwater, and wind (URI 2009). Field activities associated with the site characterization included gamma scans, surface soil sampling, soil pit scans, and shallow alluvium evaluation. The main conclusions drawn from this characterization are:

- Off-site mine-related impacts are minor.
- There is evidence of historical surface water transport to the southeast.
- There is evidence of historical transport to the northeast during road construction.
- Historical wind transport cannot be ruled out with current data, but there is no evidence that it is occurring today.
- Gamma anomalies north and west of the site may be related to historical site activity.
- There is no evidence of groundwater transport.
- Additional residential surveys provide no evidence of impact.

Gamma scans were conducted by *iiná bá*, Inc. for the Navajo Nation in 2009 on sites adjacent to the Church Rock Sections 8 and 17 project areas to investigate the potential for contamination of dwelling units from naturally occurring radiation and radiation from nearby uranium mines. Based on radium-226 soil concentrations estimated from correlation with gamma scans, no sites had radium-226 soil concentrations in of excess safe levels of radiation and there were no dwellings with gamma contamination.

HRI has committed to the Navajo Nation to characterize the Church Rock Section 17 site and remove or remediate spoilage with elevated radium-226 to acceptable Navajo Nation Standards. The standards will be at levels that do not pose a public or occupational health risk.

3.12.3 Major Sources and Levels of Chemical Exposure

The remote Unit 1 and Church Rock Sections 8 and 17 project areas are characterized by sparse population settlements. The predominant land use for these areas is rangeland (livestock grazing). The Crownpoint project area is adjacent to the town of Crownpoint (2010 population of 2,278) and as such, the primary land use is urban/residential. Section 2.2.2 of this ER provides a discussion of projects within 80 km [50 mi] of the CUP. Active projects that have the potential to be existing sources of hazardous chemicals are presented in Table 3.12-1. There is also the potential that existing pole-mounted electrical transformers could contain polychlorinated biphenyls (PCBs), but the potential for chemical exposure is extremely low from intact and operational transformers. There are no recognized existing sources of any other hazardous chemicals at or near the proposed sites.

3.12.4 Occupational Health and Safety

Occupational health and safety hazards within the project areas are limited by existing land uses, which are primarily agriculture and urban/residential. Agricultural workers could be exposed to occupational health and safety hazards from tractor roll-overs, all-terrain vehicle (ATV) accidents, or horse-related injuries.

Occupational health and safety risks to uranium ISR workers from exposure to radiation are regulated by the NRC, mainly through the radiation protection standards contained in 10 CFR Part 20. In addition to annual radiation dose limits, these regulations incorporate the principal of maintaining doses ALARA such as through the use of proper worker safety training, using engineering and administrative controls and, where necessary, personal protective equipment (PPE) to prevent or minimize radiation exposures and effluents, and the measurement and monitoring of radiation doses and effluents.

The ALARA principle takes into consideration the purpose of the licensed activity and its benefits, weighs the associated costs and benefits to reduce radiation doses as appropriate (including selecting the most cost-effective and efficient technology for reducing doses), and quantifies the net benefits for each considered option to reduce radiation doses or exposures to other hazardous materials (e.g., chemicals) used at an ISR facility. Radiation safety measures are required for protecting workers and minimizing worker doses at uranium ISR facilities, ensuring that radiation doses are less than the occupational limits and are maintained ALARA.

Also of concern with respect to occupational health and safety are industrial hazards and exposure to non-radioactive chemicals and other industrial hazards, which for an ISR operation can include normal industrial airborne emissions associated with service equipment (e.g., vehicles), fugitive dust from access roads and well field activities, electricity and power tools, and slips, trips, and falls. The shipment of operational chemicals must follow U.S. Department of Transportation (DOT) hazardous materials shipping regulations and requirements. Spill responses would be similar to yellowcake, as discussed in Section 5.2 of this ER, although a spill of nonradiological materials is reportable to the appropriate state agency, the EPA, and DOT. The Occupational Safety and Health Administration (OSHA) sets worker exposure limits for these chemicals.

Table 3.12-1. Active Projects within 80 km [50 mi] of the CUP

Commodity	Owner	Facility Type	County	Distance from CUP[1] (Air km)	Status
Aggregate					
Hard Rock Pit (Scoria)	Bill's Enterprises	Surface Pit	McKinley	39	Active
Jim Stephens Pit (Scoria)	Jim Stephens, Inc.	Surface Pit	McKinley	42	Active
Prewitt-Elkins Material Source (Limestone)	FNF Construction	Surface Pit	McKinley	43	Active
San Antone Quarry (Limestone, Aggregate)	Gallup Sand and Gravel LLC	Surface Pit	McKinley	26	Active
Tinaja Pit (Limestone)	C & E Concrete, Inc.	Surface Pit	Cibola	70	Active
Coal					
El Segundo Mine	Peabody Natural Resources	Surface Strip Mine	McKinley	29	Active
Lee Ranch Mine	Peabody Natural Resources	Surface Strip Mine	McKinley	48	Active
Humate					
Black Springs (Jaramille)	Anasazi Stone, LLC	Surface Strip Mine	McKinley	72	Active
Pueblo Alto	Mesa Verde Resources	Surface Strip Mine	McKinley	60	Active
Star Lake Menefee	Menefee Mining Corporation	Surface Strip Mine	McKinley	69	Active
Star Lake Mesa Verde	Mesa Verde Resources	Surface Strip Mine	McKinley	62	Active
U-Mate	U-Mate International, Inc.	Surface Strip Mine	McKinley	28	Active
Power Plant					
Escalante	Tri-State Generation and Transmission	Coal Fired	McKinley	29	Active

1 Distance calculated from nearest project area boundary
2 Sources: NMENRD 2012a, NMENRD 2012b

3.13 Waste Management

Waste management was not discussed in the original environmental reports for Crownpoint, Unit 1, or Church Rock Sections 8 and 17 project areas submitted as part of the license application. Nor is waste management addressed for the affected environment in Chapter 3 of the CUP FEIS or ISR GEIS. The following includes a brief description of background waste management associated with the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas.

3.13.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

This section describes the existing sources of waste within the project areas and the current waste management practices. The following discussion describes the affected environment only. Proposed waste management practices and potential waste management impacts resulting from the CUP are provided in Section 4.13 of this ER. For consistency with other sections of this ER, including 4.13 and 5.13, wastes are separated into two general categories. The first category is AEA-regulated waste, which comprises 11e.(2) byproduct material. This is defined in the ISR GEIS as, "tailings or waste generated by extraction or concentration of uranium or thorium processed ores as defined under Section 11e.(2) of the Atomic Energy Act." The second category is non-AEA-regulated waste, which includes all non-11e.(2) byproduct material.

AEA-Regulated Waste

As discussed in Section 3.12, three previously operated conventional uranium mines were located on or near the Church Rock Sections 8 and 17 project areas. The OCRM operated within the proposed Church Rock Section 17 project area from 1960 to 1962 (by Phillips Petroleum) and from 1976 to 1982 (by UNC). The NECR mine is a former uranium mine that was operated by UNC from 1967 to 1982. This site is approximately 3.2 km [2 mi] northeast of the Church Rock Sections 8 and 17 project areas and is currently undergoing a major EPA/NRC sponsored cleanup. Directly north of NECR, Kerr-McGee Corporation operated the Quivira uranium mines from 1974 to 1985. The last phase of an EPA funded cleanup was recently completed and a draft report was issued by Rio Algom Mining, LLC (RAML) in 2011 summarizing the cleanup efforts and future monitoring. Although the NECR and Quivira Mine sites are near the Church Rock Sections 8 and 17 project areas, there are no AEA-regulated waste materials currently within the project areas.

A discussion of radiation surveys completed in 2009 in and around the Church Rock Sections 8 and 17 project areas is provided in Section 3.12 of this ER. These surveys indicated that off-site radium-226 soil concentrations are within safe levels of radiation and there is no evidence of radiation at nearby residences. The survey (URI 2009) found elevated gamma levels outside of the fenced OCRM site, but within HRI's lease area. Elevated gamma levels also were measured on both sides of NM 566, adjacent to the OCRM.

Non-AEA-Regulated Waste

The types of non-AEA-regulated waste primarily are determined by the types of land use within an area. As previously discussed, the primary land uses within the project areas are livestock grazing on rangeland and urban/residential. The activities associated with these land uses produce solid and liquid residential waste. Management of this waste is governed by New Mexico Environmental Department, Solid Waste Bureau (NMED-SWB), which maintains a list of recognized hazardous wastes (NMED-SWB 2007). The Navajo Nation also provides assistance for Navajo Nation communities to develop solid wastes systems through its solid waste management program.

Exploratory uranium drilling results in wastes, including drill cuttings and drilling wastes. Drilling wastes, as defined by EPA (2008) for ISR facilities, include drill muds, other drilling fluids, sludges, or evaporation products collected in excavated pits from waste water produced during drilling. These are classified as TENORM, the definition of which is provided by EPA (2008):

> "Naturally occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing."

Drill cuttings and drilling wastes typically are disposed on-site in mud pits pursuant to EPA TENORM regulations. Considerable mineral exploration has taken place within the boundaries of the Crownpoint and Unit 1 project areas. Exploratory drilling took place in the areas before 1980 and was conducted on a grid of approximately 60 m [200 ft]. Drilling related to the Mobil Oil Corporation Section 9 pilot mineral extraction project took place in the early 1980s, less than 1.6 km [1 mi] north of the Unit 1 project area. In addition, Conoco/Westinghouse drilled exploration holes within the Crownpoint project area in 1980. Exploration boreholes (with associated mud pits and cutting material) have been drilled in the Church Rock Sections 8 and 17 project areas. The early phase (1958-1962) of exploration was almost entirely unregulated and the degree of activities related to pit closure, plugging, and locations and abandonment practices of these early exploration holes are unknown. Since 1968 pit closures and plugging and abandonment methods have been regulated by the NMOSE.

Solid Wastes-Agricultural operations and residences/businesses within the project areas produce limited quantities of miscellaneous trash. There are no landfills within the project areas. Waste associated with agricultural operations or with residences/businesses is disposed in the nearest permitted solid waste disposal facility, which is the Red Rocks regional landfill approximately 10 km [6 mi] northeast of Thoreau. This facility is approximately 40 km [25 mi] south of the Crownpoint and Unit 1 project areas and approximately 52 km [32 mi] southeast of the Church Rock Sections 8 and 17 project areas.

Waste Water Treatment Facilities/NPDES Discharge-The NTUA operates a waste water treatment facility for the town of Crownpoint. This treatment facility can process waste water for approximately 2,000 residences. The discharge of treated water from this facility is authorized under EPA NPDES Permit NM0020630. The facility is located approximately 1.6 km [1 mi] north of the Crownpoint project area. There are no waste water treatment facilities or EPA-regulated NPDES discharge sites associated with the project areas.

4.0 POTENTIAL ENVIRONMENTAL IMPACTS

Chapter 4 of the CUP FEIS describes potential environmental consequences, monitoring, and mitigation for each resource. Following the requirements of NUREG-1748 this section describes the potential environmental impacts by resource for the Proposed Action and No Action Alternative. Following the structure of the ISR GEIS, the potential impacts for each resource are separated into the phase of development (construction, operation, aquifer restoration, and decommissioning) and categorized by significance level as follows:

SMALL: *The environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.*

MODERATE: *The environmental effects are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.*

LARGE: *The environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.*

The potential impacts described in this section are based on information presented in the CUP FEIS, COP, and ISR GEIS as well as any new information presented in Chapter 3 of this ER.

4.1 Potential Land Use Impacts

Potential impacts to land use are discussed in Section 4.8 of the CUP FEIS and include land disturbances, disruption of livestock grazing, and potential relocation of residents within the Unit 1 project area. In addition, Section 4.5.1 of the ISR GEIS provides a general discussion of potential land use impacts associated with ISR facilities in northwestern New Mexico. The following summarizes the potential land use impacts by project area. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential land use impacts.

4.1.1 Proposed Action

As described in Section 1.2 of this ER, the Proposed Action is to renew HRI's license that allows for construction and operation of ISR uranium recovery facilities at the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas. ISR facilities will include well fields, processing facilities, and associated infrastructure (access roads, pipelines, utilities, lined retention ponds, storage facilities, and other structures). Table 4.1-1 presents the total anticipated surface disturbance for each project area throughout the duration of the project. The overall anticipated disturbance is approximately 193.5 ha [478 ac] or 19% of the total CUP area. As HRI continues to delineate uranium ore within the project areas, the well field disturbance areas are likely to increase. Section 4.2.1 of the ISR GEIS states that the typical project areas associated with new ISR facilities range from 1,000 to 7,000 ha [2,471 to 17,297 ac], and total land disturbance typically ranges from 50 to 750 ha [120 to 1,860 ac].

Potential impacts during uranium recovery activities are discussed in Section 4.5.1.1 of the ISR GEIS and include (1) changes or disturbances to land uses, (2) restrictions to access and establishment of right-of-way for access, (3) affecting mineral rights or land use by allottees and others, (4) restrictions on livestock grazing areas, (5) restrictions on recreational activities, and (6) altering ecological, cultural, and historical resources. While some of the land within each project area will be temporarily changed, the land will be returned to its pre-construction use following decommissioning.

Within each project area access to well fields, processing facilities, and retention ponds will be controlled areas as defined in 10 CFR § 20.1003. The controlled areas will be fenced throughout the life of the project. Table 4.1-2 indicates the anticipated acres of controlled area for each project area. Public access to the controlled areas will be prohibited but no current public right-of-way will be impacted and no new public access will be established. All new project related roads will be private access and will be reclaimed following decommissioning unless transferred to lessees or allottees.

Affects to allottees and lessees as well as grazing restrictions are based on surface/mineral ownership and land use within each project area as described in Section 3.1 of this ER. The following summarizes the potential impacts to surface/mineral owners and grazing restrictions for each project area.

- Crownpoint: The Crownpoint project area is composed of land owned by HRI, BLM, and tribal trust land. Figure 4.1-1 shows that there are currently no residents, businesses, or other public buildings located within the controlled area. Within the project area potential grazing restrictions will be associated with the tribal trust land located in Sections 19 and 29 of T17N, R12W and the SW quarter of Section 24 of T17N, R13W which is owned by BLM but used as a community allotment for the Navajo. It is unlikely that there will be any grazing restrictions within the Crownpoint project area on the tribal trust land since there are currently no well fields proposed. HRI will work with the BLM to mitigate or relocate grazing on the SW quarter of Section 24. HRI anticipates that grazing within the controlled area of the Crownpoint project area (approximately 70.4 ha [174 ac]) will be in place for approximately 19 years.

- Unit 1: The Unit 1 project area comprises allotments held in trust for the use of individual Navajo. Effects on the allottees, including grazing restrictions, within the Unit 1 project area will be minimal since allottees will be required to sign lease agreements with provisions for surface use on a per acre basis. The lease agreements provide for compensation for lands no longer available to the allottees. Section 4.8.1 of the CUP FEIS stated that residents within the Unit 1 project area could potentially be relocated since occupied dwellings would be within controlled areas. Upon further evaluation it is determined that there are no occupied dwellings within the controlled area as depicted on Figure 4.1-2. Grazing restrictions within the Unit 1 project area (approximately 42.5 ha [105 ac]) will last approximately 10 years.

- Church Rock Sections 8 and 17: As described in Section 3.1 of this ER, the surface and mineral estate in the Church Rock Section 8 project area are owned by HRI. Throughout the duration of the project grazing will be prohibited from the controlled area depicted on Figure 4.1-3. Grazing restrictions within the Church Rock Section 8 project area (approximately 29.1 ha [72 ac]) will last approximately 8 years. Since the majority of the controlled area proposed for Church Rock Section 17 project area is previously disturbed from the OCRM, the potential impacts to surface/mineral owners and grazing will be minimal. Table 4.1-2 indicates that access to approximately 35.2 ha [87 ac] (of which approximately 22 ha [55 ac] were previously disturbed) will be included in the controlled area throughout the duration of the project. Grazing restrictions related to the Church Rock Section 17 project area are anticipated to last approximately 6 years.

Construction activities will not impact recreation activities since there are no such areas present within the project areas. Potential impacts to historic and cultural resources resulting from construction are discussed in Section 4.8 of this ER and include direct impacts to known and previously unidentified features.

4.1.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.1.1.1.1 Potential Construction Impacts

Potential changes in land use resulting from construction will be relatively minor and short-term because of the phased project development. In addition, much of the surface disturbance will be restored and reseeded directly following construction activities. Section 4.8.1 of the CUP FEIS states that during construction well fields will be restricted to 24 ha [60 ac], although experience indicates that well fields can be placed into production 2 ha [5 ac] at a time. While some of the land within each project area will be temporarily changed, the land will be released for unrestricted use following decommissioning. Overall, potential land use impacts due to construction will be SMALL to MODERATE. Mitigation measures to reduce potential impacts to land use during construction are described in Section 5.1 of this ER and include phasing well field development to minimize disturbance and restoring and reseeding disturbed areas promptly.

4.1.1.1.2 Potential Operation Impacts

Potential impacts to land use during operation will be less than during construction since much less surface disturbance will occur during operation. During operation, the primary change to land use will be the addition of well fields, which is considered with the potential construction impacts.

During operation land use will continue to be prohibited in the controlled areas. Operation in the Crownpoint project area is expected to last approximately 14 years. In the Unit 1 operations are expected to last approximately 6 years. Church Rock Sections 8 and 17 project areas operations are expected to last 6 and 4 years, respectively. Because the types of land use activities are similar to those evaluated in the ISR GEIS and the amount of land surface disturbance will be small, potential land use impacts during operation will be SMALL. Section 5.1 of this ER presents the mitigation measure HRI will use to reduce potential impacts to land use during operation.

4.1.1.1.3 Potential Aquifer Restoration Impacts

The types of potential impacts to land use during aquifer restoration will be similar to, or less than, those during operation. Similar to operation, portions of the project areas will be limited from land use including livestock grazing. The potential impacts to land use during aquifer restoration will be SMALL. Mitigation measures during aquifer restoration will be similar to operation and are discussed in Section 5.1 of this ER.

4.1.1.1.4 Potential Decommissioning Impacts

During decommissioning surface disturbance activities will increase and potential impacts will be similar to the construction phase. The areas primarily impacted during decommissioning will include the processing facilities, well fields, and associated infrastructure (i.e., pipelines, metering houses, and access roads). As decommissioning proceeds the area of disturbance and restriction will decrease.

During decommissioning, HRI will return the land to pre-construction use. Mitigation measures to reduce potential land use impacts during decommissioning are discussed in Section 5.1 of this ER. All contaminated equipment, materials, and structures will be decontaminated or removed from the site to a licensed facility for disposal or reuse. Equipment decontaminated to levels consistent with NRC requirements will be released for unrestricted use. All production, injection, and monitor wells will be plugged and abandoned, in accordance with applicable regulatory requirements. Well casing will be cut off below the ground surface. Final surface reclamation of each well field will be completed after NRC and NMED approval of aquifer restoration stability and the completion of well abandonment activities. All disturbed land will be recontoured to approximate preconstruction surface topography and reseeded as described in Section 5.5 of this

ER. Following decommissioning, all land will be released for unrestricted use. During decommissioning potential land use impacts will range from SMALL to MODERATE and will be SMALL when decommissioning and reclamation are completed.

4.1.2 No Action Alternative

Under the No Action Alternative, the CUP will not be constructed and land use within the project areas will not be affected.

Table 4.1-1. Anticipated Disturbance within the CUP

Facility	Areas of Anticipated Disturbance (ha)				
	Crownpoint	**Unit 1**	**Church Rock Section 8**	**Church Rock Section 17**	**CUP TOTAL**
Well Fields[1]	66.4	36.0	22.7	31.2	156.3
Processing Facilities	---	2.4	2.4	---	4.8
Associated Infrastructure	8.1	8.1	8.1	8.1	32.4
ANTICIPATED TOTAL DISTURBANCE	**74.5**	**46.5**	**33.2**	**39.3**	**193.5**
Total Project Area	**287.0**	**583.0**	**70.6**	**81.0**	**1,021.6**
% Disturbance	**26%**	**8%**	**47%**	**49%**	**19%**

[1] – includes previously disturbed areas

Table 4.1-2. Controlled Areas within the CUP

Facility	Anticipated Controlled Areas (ha)				
	Crownpoint	Unit 1	Church Rock Section 8	Church Rock Section 17	CUP TOTAL
Anticipated Controlled Area	70.4	42.5	29.1	35.2	177.2
Total Project Area	287.0	583.0	70.6	81.0	1,021.6
% Controlled Area	25%	7%	41%	43%	17%

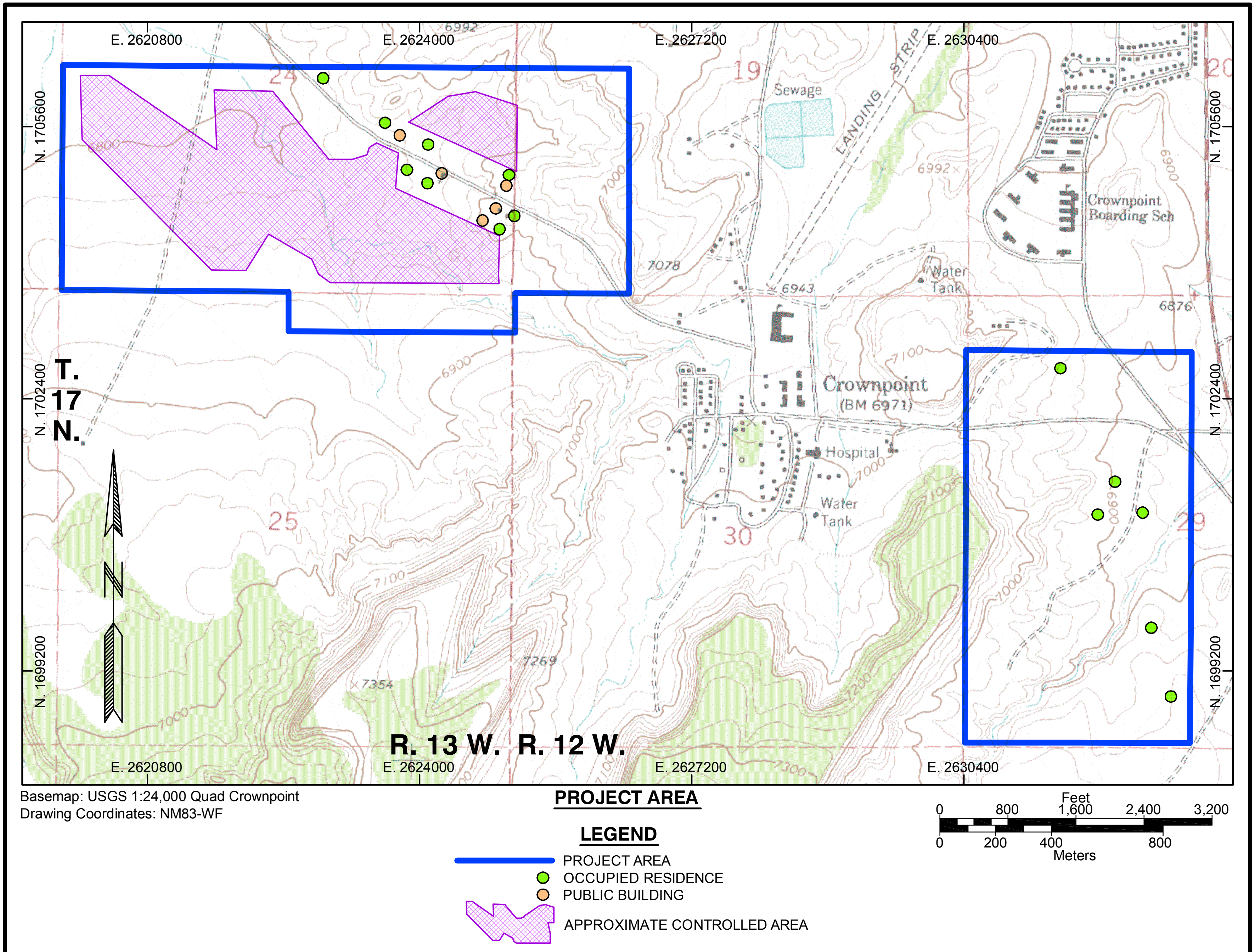
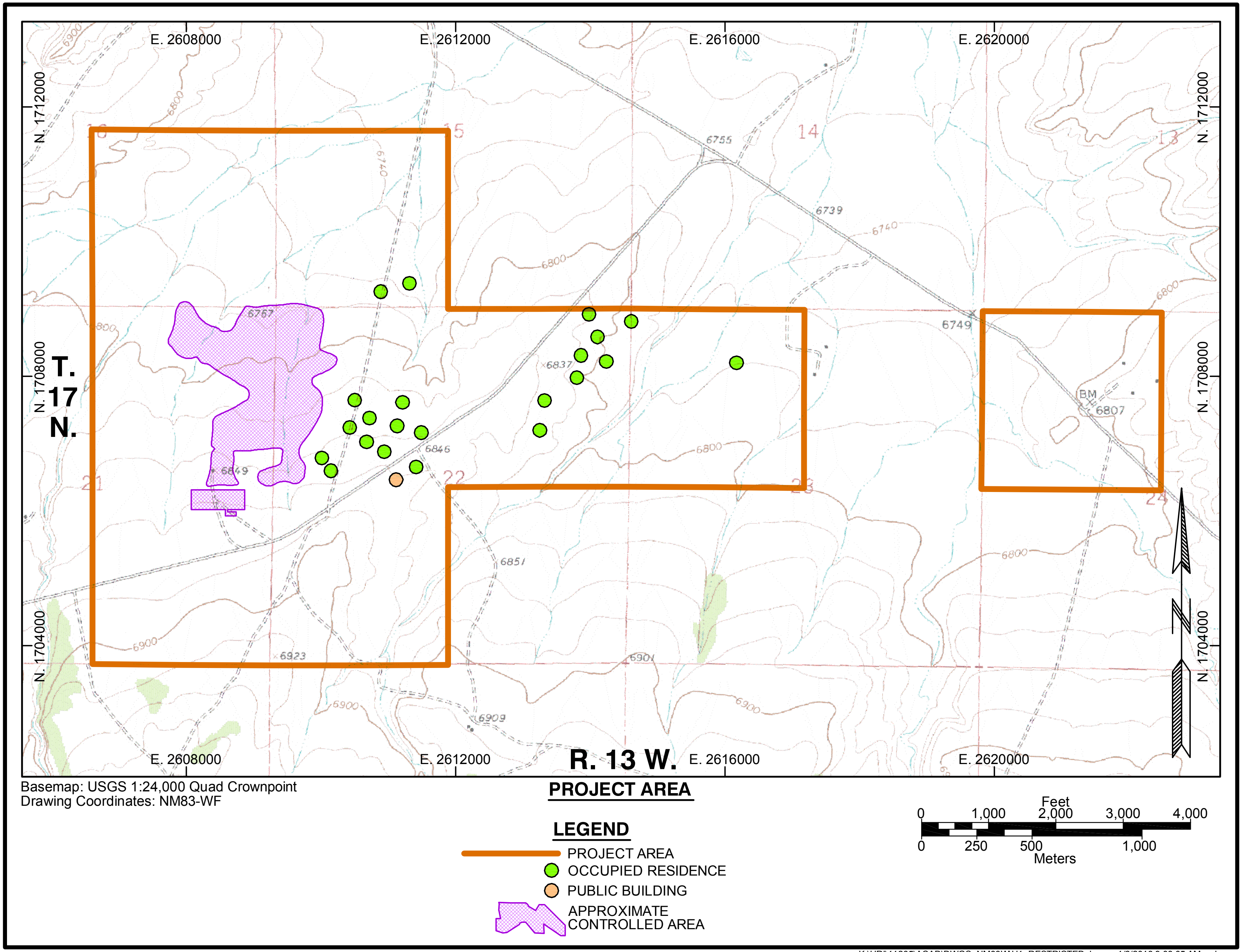


Figure 4.1-1. Controlled Areas within the Crownpoint Project Area.

Figure 4.1-2. Controlled Areas within the Unit 1 Project Area.



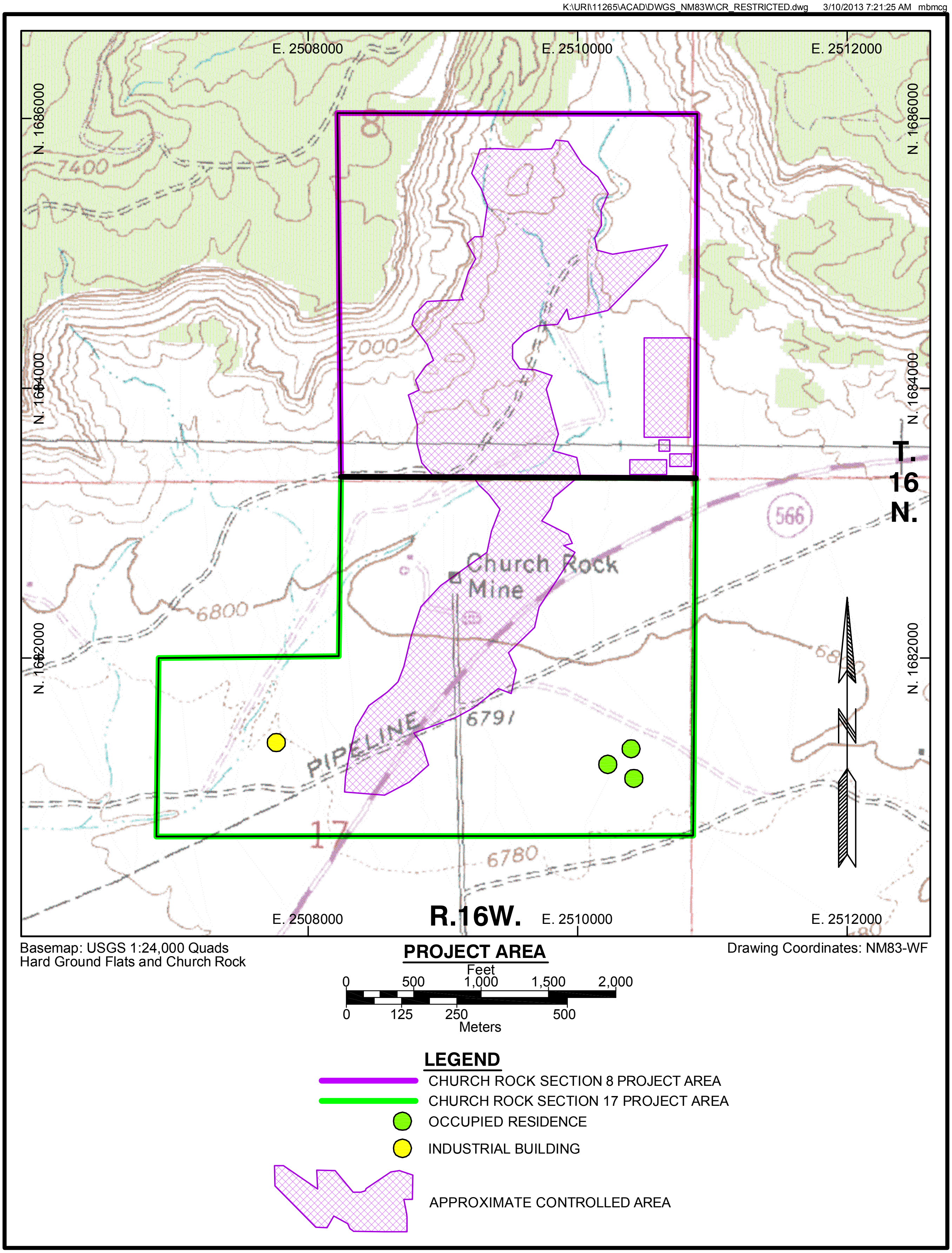


Figure 4.1-3. Controlled Areas within the Church Rock Sections 8 and 17 Project Areas.

4.2 Potential Transportation Impacts

Section 4.5 of the CUP FEIS discusses potential transportation impacts associated with transporting yellowcake from the CCP to a uranium conversion facility in Illinois, transporting loaded resin from the Unit 1 and Church Rock Section 8 satellite facilities to the CCP, transporting process chemicals to each project area, and transporting 11e.(2) byproduct material from the project areas to a licensed disposal facility in Utah. Potential transportation impacts also are discussed in Section 4.5.2 of the ISR GEIS. The following describes the potential transportation impacts for the CUP, including potential impacts associated with transporting loaded resin to licensed production facilities in Texas for processing into yellowcake. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential transportation impacts.

4.2.1 Proposed Action

Potential transportation impacts will occur during all phases of the Proposed Action, including construction, operation, aquifer restoration, and decommissioning. Table 4.2-1 provides estimated workers and traffic counts for each phase of the project. Section 3.2 of this ER describes the main routes for transporting all materials to and from the project areas. The following discusses the potential impacts for each project phase. Mitigation measures for potential transportation impacts are discussed in Section 5.2 of this ER.

4.2.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.2.1.1.1 Potential Construction Impacts

The potential transportation impacts associated with construction of the CUP include increased traffic and potential for accidents. During construction the anticipated workforce at each project area is expected to be 33 to 66 people, including contractors. Based on anticipated employment and construction activities, the traffic increase on affected roads is estimated to be up to 100 vehicles per day (50 round trips or 100 one-way trips). In addition, up to eight heavy truck shipments are anticipated each day (16 one-way trips). The truck shipments will include shipments of materials, equipment, and fuel.

Based on the 2010 AADT presented in Section 3.2 of this ER, the traffic volumes on the affected roads are estimated to increase by 1 to 58%. Navajo 11, which will provide access to the Unit 1 project area, will see the largest increase in traffic, while potential traffic impacts to I-40 will minimal. The potential traffic-related impacts during construction will range from SMALL to MODERATE and will be short in duration. In addition, potential impacts could result from livestock and wildlife vehicle collisions (Section 4.5 of this ER), fugitive dust (Section 4.6 of this ER), and noise (Section 4.7 of this ER). The potential impacts associated with these resources will range from SMALL to MODERATE.

4.2.1.1.2 Potential Operation Impacts

Anticipated passenger vehicle and truck traffic estimates during operation are provided in Table 4.2-1. For each project area, the passenger vehicle traffic is estimated to be 140 trips per day and truck traffic 4 shipments per day (8 trips). Potential traffic impacts during operation will be similar to construction and range from SMALL to MODERATE.

Materials transported to the project areas can be classified into the following categories:

- Shipment of yellowcake from the CCP to a uranium conversion facility in Metropolis, Illinois
- Shipment of process chemicals and fuel from suppliers to the project areas
- Shipment of loaded resin from the satellite facilities to the CCP or the licensed production facilities in Texas
- Shipment of 11e.(2) byproduct material from the project areas to a licensed disposal facility (White Mesa) in Blanding, Utah
- Shipment of solid waste from the project areas to a local municipal landfill
- Shipment of hazardous waste and used oil from the project areas to a NMED-HWB disposal facility

All shipments of materials and supplies to and from the project areas will be transported by appropriately licensed transporters and subject to both federal and state transportation regulations. The following discusses the potential impacts for each material that may be transported.

4.2.1.1.2.1 Yellowcake Shipment

The dried yellowcake produced at the CCP will be packaged in appropriately labeled, DOT-approved, 208 L [55 gal] drums. Each shipment will contain approximately 18,000 kg [40,000 lbs] of yellowcake, the weight limit for legal transport. Based on the maximum production rate of approximately 1.5 million kg/yr [3 million lbs/yr], up to 75 shipments could be required annually or an average of one shipment every 4.9 days. This is within the annual range of 21 to 145 yellowcake shipments for typical ISR facilities presented in Table 2.8-1 of the ISR GEIS.

All yellowcake shipments will be contracted to an appropriately licensed transport company that specializes in shipment of yellowcake. HRI's contingency plan for transportation accidents is described in Section 9.14 of the COP and includes procedures to be followed in the event of a highway transportation accident. The transport company will have extensive emergency response programs including spill response equipment on board. Drivers will be trained in emergency response procedures and there will be constant monitoring of truck location and operating parameters. The transport companies will also have standing contracts with environmental emergency response contractors for spill cleanup. Yellowcake shipments will be handled as low-specific-activity (LSA) material. In addition, HRI will develop an action plan as part of a SOP which will provide for equipping and training local emergency officials in the specific hazards and spill control procedures associated with yellowcake.

The potential transportation impacts associated with the shipments of yellowcake are discussed in Section 4.5.1.1 of the CUP FEIS and Section 4.5.2 of the ISR GEIS. Section 4.5.1.1 of the CUP FEIS determined the likelihood of an accident involving yellowcake shipments using probabilities obtained from Harwood and Russell (1990). Using 80 shipments of 40 drums per year the annual probability of an accident involving a yellowcake shipment was reported in the CUP FEIS as 10% on interstate highway and 0.5% on two-land roads (NM 371 and Navajo 9). NUREG-0706 states that the probability of a truck accident is in the range of 2.6 to 4.2 x 10^{-6}/km [1.6 to 2.6 x 10^{-6}/mi]. Based on the average of these two values, the likelihood of a truck shipping yellowcake being involved in an accident of any type during a one-year period is approximately 22%. This probability was obtained by multiplying the probability of an accident per vehicle-mile (3.4 x 10^{-6}/km [2.1 x 10^{-6}/mi]) by the maximum number of shipments per year (75) by the distance per shipment (2,250 km [1,400 mi]).

It is important to note that a minority of accidents will result in release of yellowcake. According to a report prepared for the Federal Motor Carrier Safety Administration (2001), the likelihood that an en route accident will result in a release, based on 12 categories of hazardous material transportation, is about 31%. Further, as described in Section 4.2.2.2 of the ISR GEIS, 30% or less of the shipment contents were released in previously reported accidents involving yellowcake release. Therefore, while there is an estimated 10 to 22% probability that an accident involving yellowcake shipment will occur in any one year, there is only about a 31% probability that the accident will result in a release of yellowcake, and then the volume of yellowcake released will likely be 30% or less of the quantity shipped. Based on a 18,000 kg [40,000 lb] typical load, this would result in a release of 5,500 kg [12,000 lb] or less of yellowcake.

Potential impacts resulting from the release of yellowcake include a very small risk of radiological impacts to people in the vicinity of a potential accident. As described in Section 4.2.2.2 of the ISR GEIS, an analysis of potential risk from an ISR facility generating 34 shipments of yellowcake per year yielded an estimate of 0.01 (complete loss of package contents) and 0.0008 (partial release) cancer deaths per year from yellowcake accidents. The ISR GEIS notes that, "These analyses are conservative and tend to overestimate impacts." Nevertheless, applying these conservative risk factors to the maximum of 75 shipments per year produced from the CUP yields estimates of 0.02 (complete loss of package contents) and 0.002 (partial release). Overall, the potential radiological impacts associated with yellowcake transportation will be SMALL.

The primary potential impact associated with an accident involving the spill of yellowcake will be potential impacts to soil in the immediate spill area. Potential impacts will be minimized by implementing an emergency response plan for yellowcake spill cleanup. Emergency response protocols will include communication and emergency spill kits on each vehicle and emergency response kits at shipping and receiving facilities. Yellowcake spills will be quickly cleaned up by the licensed yellowcake transporter, potentially with involvement from a local emergency response team and the HRI cleanup team.

4.2.1.1.2.2 Loaded Resin Shipment

Loaded resin from the satellite facilities will be transported to the CCP or licensed production facilities in Texas in DOT approved tanker trucks. At the maximum production rate of 0.5 million kg/yr [1 million lb/yr] for each satellite facility 350 shipments could be transported annually (one shipment per day) from each satellite facility.

Similar to yellowcake shipments, loaded resin will be transported by an appropriately licensed transport company that specializes in shipment of radioactive materials. The transport company will have extensive emergency response programs including spill response equipment on board. Drivers will be trained in emergency response procedures, and there will be constant monitoring of truck location and operating parameters. The transport companies will also have standing contracts with environmental emergency response contractors for spill cleanup.

The potential transportation impacts associated with the shipment of loaded resin from the satellite facilities to the CCP or licensed production facilities in Texas is the potential for an accident to occur and result in a release of material. Using the mean truck accident probability from NUREG-0706 (3.4×10^{-6}/km [2.1×10^{-6}/mi]), the annual probability of an accident involving a truck transporting loaded resin from the Church Rock Section 8 satellite facility to the CCP (66 km [41 mi]) is 0.9% and 3%, respectively. Similarly, the probability of an accident involving a truck transporting loaded resin from a satellite facility to a licensed production facility in Texas (1,770 km [1,100 mi]) is 81%.

In 2006, NRC issued an EA for R.M.D. Operations, LLC entitled “Performance-Based, Multisite License for a Uranium Water Treatment Program” (NRC 2006). The EA discusses transportation of uranium-loaded resin from water treatment facilities for disposal at appropriately authorized or licensed facilities. In the transportation impacts section of the EA, expected accidents, potential environmental impacts, and radiation doses to the members of the public from an accidental release are addressed. Based on 200 shipments of loaded resin per year, and 1,610 km [1,000 mi] average distance traveled the EA estimates that an accident involving a truck transporting loaded resin will occur once every 2.5 years. Based on these calculations, an accident involving a truck transporting loaded resin from the satellite facilities will occur once every 1.3 yrs (350 shipments/yr and 1,770 km [1,100 mi]). The EA also states that potential environmental impacts related to an accident involving the rupture of a tanker truck carrying loaded resin would be negligible, since the loaded resin would maintain the uranium, preventing contamination of the soils (NRC 2006). Radiation doses to the public from a transportation accident resulting in a spill were also evaluated and included in the EA. The EA indicates that radiation doses to the public will be negligible and in the range of background variability.

On April 16, 2012 the NRC issued Regulatory Issue Summary (RIS) 2012-06 regarding submittal of amendment applications for processing of equivalent feed at licensed uranium recovery facilities (NRC 2012e). The RIS provides procedures for licensed ISR, conventional mills, or heap leach facilities to receive and process equivalent feed without a license amendment. Enclosure 1 of the RIS discusses transportation impacts and indicates that there are no additional impacts associated with transporting loaded resin to licensed uranium recovery facilities.

Section 4.2.2.2 of the ISR GEIS states that the NRC regulations at 10 CFR Part 71 and the DOT regulations for shipping loaded resin provide confidence that the potential transportation impacts associated with shipping loaded resin will be SMALL.

4.2.1.1.2.3 Process Chemicals and Fuel Shipment

The potential transportation impacts associated with the shipments of process chemicals and fuel to the project areas during the operation phase are discussed in Section 4.5.1.3 of the CUP FEIS. Bulk chemicals required at the processing facilities are listed in Table 4.16 of the CUP FEIS and include, but are not limited to, salt, sodium bicarbonate, sodium carbonate, sodium hydroxide, hydrochloric acid, hydrogen peroxide, carbon dioxide, oxygen, diesel fuel, bottle gases, and liquefied petroleum gas. These chemicals likely will be shipped from local sources. The potential for environmental impacts if an accident were to occur would depend on the type of chemical, quantity released, and site-specific conditions such as proximity to surface water. It is estimated that up to 200 bulk chemical, fuel, and supply deliveries will be made per year to each processing facility throughout the operational life of the project. Since transportation of process chemicals and fuel will follow all applicable DOT hazardous material shipping regulations and requirements, potential impacts will be SMALL.

4.2.1.1.2.4 11e.(2) Byproduct Material Shipment

11e.(2) byproduct material will be transported to a licensed disposal facility (White Mesa) in Blanding, Utah. Currently, in Texas, HRI’s sister company maintains an 11.e.(2) byproduct material disposal contract with Denison’s White Mesa Mill and current assessments show that the amount of solid 11e.(2) byproduct material generated from the CUP will be within that facility’s annual disposal limits. In the event that additional disposal capacity is required, HRI will pursue a supplementary contract with another available disposal facility. Shipments will be handled as LSA material and will generally be made in sealed roll-off containers in accordance with the applicable DOT hazardous materials shipping provisions.

The potential transportation impacts associated with the shipments of 11e.(2) byproduct material are discussed in Section 4.5.1.4 of the CUP FEIS. Due to the low volume of 11e.(2) byproduct material generated, these shipments will be infrequent and average about 6 per year during operation at each processing facility. The risk of an accident involving the transporting of 11e.(2) byproduct material will be minimized through the use of proper packaging and exclusive use shipments. Shipments of 11e.(2) byproduct material will not significantly impact traffic compared to other operations at the project areas. Overall, potential impacts from transporting 11e.(2) byproduct material will be SMALL.

4.2.1.1.2.5 Solid Waste Shipment

The potential transportation impacts associated with shipments of solid waste were not discussed in the CUP FEIS. Solid waste will likely be transported to the Red Rocks regional landfill northeast of Thoreau as described in Section 3.2 of this ER. It is estimated that 63 trips per year will be required during operation from each processing facility, or a little more than one per week. Since the solid waste shipments will result in minimal traffic impacts, the potential transportation impacts will be SMALL.

4.2.1.1.2.6 Hazardous Waste and Used Oil Shipment

The transportation impacts associated with shipments of hazardous waste and used oil were not discussed in the CUP FEIS. Hazardous waste generated from the project may include small quantities of used batteries, expired laboratory reagents, fluorescent light bulbs, solvents, cleaners, and degreaser. In addition, small quantities of used oil from equipment and vehicles, oil-contaminated soil, and oily rags may be accumulated. Section 4.13 of this ER further discusses potential hazardous waste impacts. These items will be transported to a licensed off-site treatment, disposal or recycling facility. It is estimated that one trip per year from each processing facility will be required to ship hazardous waste and used oil to appropriate facilities during operation. Based on the low frequency of shipments, the potential transportation risks associated with hazardous waste will be SMALL.

4.2.1.1.3 Potential Aquifer Restoration Impacts

The potential transportation impacts during aquifer restoration are expected to be similar to or less than potential impacts during operation. During aquifer restoration the number of workers is expected to decrease. As shown in Table 4.2-1, traffic during aquifer restoration is expected to include 10 passenger vehicles per day (20 one-way trips) and 1 large truck per day (2 one-way trips) to each project area. Due to the small traffic volume the potential transportation impacts during aquifer restoration will be SMALL.

4.2.1.1.4 Potential Decommissioning Impacts

The potential transportation impacts during decommissioning are expected to be similar to the construction phase of the project. During decommissioning the workforce is estimated to include 12 HRI employees and 10 contractors at each project area. Due to activities at the project areas during decommissioning, fuel shipments, 11e.(2) byproduct material shipments, solid waste shipments, and hazardous waste and used oil shipment will increase. Overall, based on the transportation activities associated with decommissioning, potential impacts will be SMALL.

4.2.2 No Action Alternative

Under the No Action Alternative the CUP will not be developed and transportation in the project region will not be impacted.

Table 4.2-1. Estimated Workers and Traffic Counts

Project Area and Phase	Average Daily Workers	Passenger Vehicle Traffic[1]	Heavy Truck Traffic[1]	Total Traffic
Crownpoint				
Construction[2]	66	50	8	58
Operation	75	70	2	72
Aquifer Restoration	10	10	1	11
Decommissioning[2]	22	22	2	24
Unit 1				
Construction[2]	66	50	8	58
Operation	75	70	2	72
Aquifer Restoration	10	10	1	11
Decommissioning[2]	22	22	2	24
Church Rock Section 8				
Construction[2]	66	50	8	58
Operation	75	70	2	72
Aquifer Restoration	10	10	1	11
Decommissioning[2]	22	22	2	24
Church Rock Section 17				
Construction[2]	33	25	4	29
Operation	75	70	2	72
Aquifer Restoration	10	10	1	11
Decommissioning[2]	11	11	1	12

[1] Round trips per day
[2] Average daily work estimates include contractors

4.3 Potential Geology and Soils Impacts

Potential impacts to geology and soils are discussed in Section 4.2 of the CUP FEIS and include potential impacts to soils resulting from land disturbing activities associated with construction of waste water retention ponds and drill site clearing. During operation and aquifer restoration, potential impacts to soil will result from drilling and, potentially, land application of treated water. Section 4.5.3 of the ISR GEIS provides a general discussion of potential geology and soils impacts associated with ISR facilities in northwestern New Mexico. The following summarizes the potential geology and soils impacts described in the CUP FEIS and ISR GEIS that may result from the Proposed Action and the No Action Alternative. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential geology and soils impacts.

4.3.1 Proposed Action

As indicated in Section 4.5.3 of the ISR GEIS, potential impacts to soils during construction and decommissioning will primarily occur as a result of land disturbing activities, while potential impacts to soils during operation and aquifer restoration will primarily result from potential spills or leaks. There will be limited potential impact to geology due to the nature of uranium ISR. The following describes the potential soils and geology impacts associated with each project phase. Section 4.1 of this ER estimates that land disturbance within the project areas will be 193.5 ha [478 ac] or approximately 19% of the total CUP.

4.3.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.3.1.1.1 Potential Construction Impacts

According to Section 4.2 of the CUP FEIS and Section 4.5.3 of the ISR GEIS, potential impacts to soils during construction result from land disturbing activities, which will include topsoil removal, excavation, and soil compaction. These activities will occur during construction of the facilities, lined retention ponds, roads, and pipelines. Potential impacts associated with topsoil removal, excavation, and soil compaction will include increased potential for erosion and surface water runoff. Surface water runoff also contributes to increased sedimentation. Mitigation measures to reduce the potential impacts are discussed in Section 5.3. Potential construction impacts to geologic resources will occur only in the subsurface as a result of the installation of injection and production wells and deep disposal wells. Since construction activities will result in short-term disturbance of geology and soil, potential impacts will be SMALL.

4.3.1.1.2 Potential Operation Impacts

During operation there will be a low risk of hydraulic fracturing during operation of injection wells, including Class III injection wells in the production zone and Class I deep disposal wells. Potential impacts will be avoided by maintaining the injection pressure at a level that does not exceed the fracture gradient of the receiving formation. In addition, changes in the pressure of the producing aquifer may result in reactivation of faults or trigger or induce earthquakes, although historical uranium operations indicate that this is not anticipated (ISR GEIS). Similarly, NUREG-1748 notes that geological resources are more likely to exert an impact than be impacted by ISR construction and operation.

The only potential impact to the project area soils during operation will result from unintentional spills or leaks and possible soil contamination in the areas proposed for land application. The possible sources of soil contamination are from: (1) potential leaks or ruptures of pipelines, processing equipment and/or retention pond liners, and; (2) transportation accidents resulting in accidental spills of yellowcake or loaded resin. As discussed in Section 5.3 of this ER, specific procedures will minimize the potential for pipeline leaks and/or ruptures.

Overall, potential impacts to geology during operation will be SMALL. Potential impacts to soils will range from SMALL to MODERATE in the short-term depending on the extent of the spill or leak. Since all spills and leaks will be remediated, the long-term potential impacts to soil during operation will be SMALL.

4.3.1.1.3 Potential Aquifer Restoration Impacts

Potential impacts to the geology and soils during aquifer restoration will be similar to operation, with the exception that potential impacts associated with leakage or failure of pipelines and other facilities such as retention pond liners will be reduced, especially near the end of restoration activities. This is because the quality of the recovery solutions will progressively improve as restoration continues. As the water quality within the restored aquifer improves, the potential severity of contamination associated with a potential spill or pipe rupture is reduced. However, in the case of the waste stream brine, the potential will remain for water saturated with reject minerals and metals to contaminate soil while in transit to the deep disposal well or the lined retention ponds in the event of a spill or leak. During aquifer restoration potential impacts to soils and geology will be SMALL.

4.3.1.1.4 Potential Decommissioning Impacts

Potential impacts during decommissioning will be similar to those associated with construction. These will result from minor earth-moving associated with pipeline, well field and retention pond reclamation, and contaminated soil cleanup. Additional potential impacts will occur during well plugging and abandonment. These potential impacts will be SMALL, since the intent of decommissioning will be to reclaim the project areas back to pre-construction conditions.

4.3.2 No Action Alternative

Under the No Action Alternative, the geology and soils within the project areas will not be affected since the CUP will not be developed.

4.4 Potential Water Resources Impacts

4.4.1 Potential Surface Water Impacts

Potential surface water impacts are described in Section 4.4.1 of the CUP FEIS and Section 4.5.4.1 of the ISR GEIS. The following sections describe the potential impacts to surface water based on information presented in the CUP FEIS and ISR GEIS. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential water resources impacts.

4.4.1.1 Proposed Action

Potential impacts to surface waters are regulated by permits under Section 404 of the Clean Water Act (CWA). The use of these permits also requires that the actions satisfy the individual state Section 401 certification with regard to water quality. In New Mexico, the NMED-SWQB mandates the Section 401 certification for discharges into ephemeral streams. In addition, the NMED-SWQB requires that a project-specific Section 401 water quality certification be obtained for discharges to any intermittent, perennial, or wetland surface waters or to any OWoUS prior to construction. NMED-SWQB requires a complete application and ACOE permit verification prior to commencing the water quality certification review (NMED-SWQB 2007). If the project does not meet the requirements for a nationwide permit, then an individual Section 404 permit will be required.

4.4.1.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.4.1.1.1.1 Potential Construction Impacts

During construction, potential surface water impacts could occur primarily from disturbance activities such as well field, access road, pipeline, utility, and processing facility development. The disturbance activities at the project areas will include vegetation removal and topsoil stockpiling and limited periods of minor arroyo disturbance. These activities have the potential to result in minor spills, primarily related to fuel and lubricants from heavy equipment operation.

Vegetation removal and soil disturbance is described in Section 4.1. These activities will occur in all aspects of construction of the CUP. The primary potential surface water impact from the removal of vegetation and disturbance of soil is water quality degradation. Although unlikely due to the ephemeral nature of surface water within the project area, surface water quality has the potential to be adversely impacted by increasing suspended sediment concentrations due to vegetation removal and soil disturbance. A summary of the estimated disturbance by project area is presented in Table 4.1-1. This includes a total estimated disturbance of approximately 193.5 ha [478 ac], or about 19% of the combined project areas. Proposed facilities at the Crownpoint and Unit 1 project areas are depicted on Figure 4.4-1, and proposed facilities at the Church Rock Sections 8 and 17 project areas are depicted on Figure 4.4-2. During construction temporary sediment control features will be used until vegetation can be reestablished to minimize the potential impacts to surface water due to vegetation removal and soil disturbance. Temporary sediment control features described in Section 5.4 will include silt fence, sediment logs, straw bale check dams, or other best management practices (BMPs).

Arroyos within the project areas (described in Section 3.4 of this ER) will be minimally impacted from construction activities. Roads will be constructed away from drainages where possible. HRI estimates that one arroyo crossing will be constructed in the Church Rock Section 8 project area. The exact locations for roads needed for the Crownpoint and Unit 1 project areas have not been determined at this time. Storm water runoff during construction will be controlled through a stormwater pollution prevention plan (SWPPP) that is part of a NPDES permit issued by EPA.

Overall, the potential impacts to surface water within the project areas will be SMALL during the construction phase.

4.4.1.1.1.2 Potential Operation Impacts

Potential impacts to surface water during operation will not be significantly different than those described in Section 4.5.4.1 of the ISR GEIS. During operation, surface disturbing activities will be limited and vegetation will have been reestablished in previously disturbed construction areas. Therefore, the potential water quality impacts from sediment transport will be much lower during operation than during construction.

During operation, surface waters could be impacted by accidental spills/leaks from the processing facilities or by permitted discharges. Potential spills from the processing facilities, well fields, or transportation-related activities could impact surface waters by contaminating storm water runoff. A pipeline leak could potentially result in surface water quality degradation depending on the type of fluid, quantity of spilled fluid, and location of the leak. Surface water quality could be impacted if a leak inside a metering house reached an arroyo or reservoir. Within the processing facilities the potential impacts to surface water include leaking pipelines, leaking chemical storage tanks or process vessels, major damage of a process vessel, transportation accidents, or leaking ponds. Due to the ephemeral nature of the surface water within the project areas and engineering controls and spill response procedures described in Section 5.4 of this ER the potential impacts from spills will be SMALL.

Storm water runoff will be controlled by a SWPPP issued by EPA.

4.4.1.1.1.3 Potential Aquifer Restoration Impacts

Potential impacts to surface water during aquifer restoration will be the same or less than during operation. Potential impacts could result from sediment transport due to surface disturbing activities, management of produced water, storm water runoff, accidental spills, and management of brine reject from the RO system. The potential impacts are all expected to be similar or less than to those resulting from operation activities. Surface disturbing activities will be limited during aquifer restoration, reducing the potential for sediment transport from disturbed areas. During aquifer restoration the same levels of protection described previously will be provided to minimize potential surface water impacts from unintended release of process fluids or chemicals within the well field or processing facilities. Overall, the potential surface water impacts from aquifer restoration will be SMALL.

4.4.1.1.1.4 Potential Decommissioning Impacts

Potential impacts to surface water during decommissioning will not differ significantly from those described in Section 4.5.4.1 of the ISR GEIS. Sediment yield and storm water runoff have the potential to increase during decommissioning due to disturbances associated with equipment and structure removal and site reclamation activities. In general, potential impacts will be slightly less than those occurring during construction, since reclamation and decommissioning of well fields will be ongoing throughout the life of the projects, thereby reducing the area of disturbance during the final decommissioning activities. Potential surface water impacts during decommissioning will be minimized through implementation of sediment control and operational BMPs. The potential surface water impacts during decommissioning will be SMALL.

4.4.1.2 No Action Alternative

Under the No Action Alternative the project areas will not be developed and there will be no impacts to surface water quality or quantity.

4.4.2 Potential Groundwater Impacts

Detailed potential groundwater impact discussions were included in Section 4.3 of the CUP FEIS. Section 4.5.4.2 of the ISR GEIS presents a general discussion of potential groundwater impacts in northwestern New Mexico. The discussion below includes summaries of the potential impacts to groundwater described in the CUP FEIS and the ISR GEIS.

4.4.2.1 Proposed Action

There is potential for groundwater impacts to occur during all project phases. Detailed discussions of the potential impacts to groundwater resources from construction, operation, aquifer restoration, and decommissioning are provided in the following sections.

4.4.2.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.4.2.1.1.1 Potential Construction Impacts

During construction, potential groundwater impacts include consumptive use and potential impacts to groundwater quality during well construction. As is typical of ISR facilities and discussed in Section 2.11.3 of the ISR GEIS, groundwater use during construction will be limited to routine activities such as dust suppression, pump tests, delineation drilling and well drilling. The expected consumptive use of groundwater during construction for each project area will be approximately 6.2×10^7 L (50 ac-ft), which is well below the permitted water rights of 8×10^8 L (650 ac-ft).

Water for construction activities will be withdrawn from permitted water rights. As discussed in Section 3.4.3 of this ER, HRI currently holds two NMOSE water rights, SJ-125-T and G-11-A, for the Crownpoint and Church Rock Sections 8 and 17 project areas, respectively. In addition, a senior application for a water right for the Unit 1 project area has been submitted to the NMOSE, but has not yet been approved. Prior to construction, the water right application will be amended for an appropriation of 8.0×10^8 L [650 ac-ft]. The potential impacts to the consumptive use during construction will be SMALL, since water usage during construction will be relatively small and short-term.

Well installation programs have the potential to impact groundwater quality by mixing water between aquifers through over-penetration or lack of well integrity. The potential impacts to groundwater quality in the aquifers is expected to be SMALL, since exploration drilling and modeling allows HRI to accurately determine the well completion depths. In addition, HRI will employ a full-time engineer/geologist to oversee all well construction activities. Prior to operation, all wells also will undergo MIT as described in Section 2.1.3.3 of this ER.

4.4.2.1.1.2 Potential Operation Impacts

During operation, potential groundwater impacts could include consumptive water use and changes to water quality. Water quality changes will result from normal operations in the production aquifer. They have potential to result from a horizontal or vertical fortified groundwater excursion. Disposal of processing wastes using Class I deep disposal wells also can potentially impact groundwater quality in the receiving formation; however, the receiving aquifer will be exempted prior to deep disposal. The following describes the potential groundwater impacts to various aquifers.

4.4.2.1.1.2.1 Production and Surrounding Aquifers

Consumptive Water Use: Consumptive water use during operations will be primarily associated with process bleed and other small losses. As described in Section 2.1.3.3.3.1 of this ER process bleed is the net withdrawal maintained to ensure groundwater hydraulic gradients draw water in toward the production wells to minimize the potential for fortified groundwater to migrate away from the production zone causing an excursion and to minimize the level of contaminants in the production zone.

As part of the license application HRI modeled potential drawdown effects due to operation and aquifer restoration from the combined Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas. The model was developed to simulate the maximum amount of groundwater removed over a 21-year period. Model runs were long enough so that drawdown effects were changing very slowly with time.

The estimated cumulative drawdown at the end of 21 years of activity at the Crownpoint and Unit 1 project areas was 17 m [55 ft] at well NTUA-1, ranging from 15 to 17 m [49 to 55 ft] in the vicinity of the town of Crownpoint municipal wells. The maximum projected drawdown from the two project areas is anticipated to occur after 17 years, including an estimated 24 m [80 ft] of drawdown at well NTUA-1 or 21 to 24 m [70 to 80 ft] near the town of Crownpoint wells. The model for the Church Rock Sections 8 and 17 project areas predicted a decline in water levels at the most downgradient monitor well (MW-20) that ranged from approximately 4 to 10 m [12 to 34 ft] during the operation and aquifer restoration phases of the project (Reed 1993).

Baseline studies conducted by HRI (HRI 1996b) indicate that sufficient available drawdown exists in the Crownpoint area to ensure that the yields of the town of Crownpoint municipal wells will not be affected even in the worst-case drawdown scenario (i.e., if the currently available drawdown were 457 m [1,500 ft], then 433 m [1,420 ft] would still be available). HRI demonstrated that the submersible pumps in the town wells will not need to be lowered as a result of the projected decrease in water levels. However, an analysis by NRC staff concluded that there is a potential risk specific to uranium contamination of the water supply wells during restoration activities. For this reason, per LC 10.27 of SUA-1580, HRI is required to replace the water supply wells for the town of Crownpoint prior to commencing operations in the Crownpoint project area.

During operation, the maximum processing flow rate within each project area will be 15,140 Lpm (4,000 gpm) per LC 10.2 of SUA-1580. Assuming a 1 percent process bleed the consumptive use within each project area will be approximately 151 Lpm (40 gpm). Therefore the annual consumptive use within each project area will be approximately 8×10^7 L (65 ac-ft), which is well below the permitted water rights of 8×10^8 L (650 ac-ft).

Potential consumptive water use impacts to local water users from the production zone outside the exempted zone will be SMALL during operations. Groundwater rights and water use for the Crownpoint and Unit 1 project areas are discussed in Section 3.4.3.2.2 of this ER. Groundwater rights for the Church Rock Sections 8 and 17 project areas are discussed in Section 3.4.3.3.2 of this ER. The water rights registered with the NMOSE and NNWCA indicate that a majority of the valid, non-abandoned water rights near the project areas are permitted for industrial use. Five wells are permitted for municipal use (for the town of Crownpoint) and three are permitted for domestic use. The three domestic wells, which are currently used for livestock as described in Section 3.4.3 of this ER, are structurally above and isolated from the target zone for uranium ISR, and the long-term impacts to these wells are expected to be SMALL. As required by LC 10.27 of SUA-1580 and to avoid any potential for contaminating the Crownpoint municipal wells, HRI will replace the water supply wells for the town of Crownpoint prior to commencing operations in the Crownpoint project area. The wells, pumps, pipelines, and any other necessary changes to the existing water supply system will be made so the system can continue to provide the same quantity of water. The new wells will be located so that the water quality at each individual wellhead will not exceed EPA primary and secondary drinking water standards as a result of uranium recovery activities at the Crownpoint project area. HRI will coordinate with the appropriate agencies and regulatory authorities, including the BIA, NTUA, NNDWR, and NNEPA, to determine the appropriate placement of the new wells. The existing wells will be plugged and abandoned in accordance with applicable guidelines.

Excursions and Groundwater Quality: Groundwater quality in the production aquifer will be temporarily altered as part of uranium recovery operations. It will then, be returned to concentrations consistent with Criterion 5(B)(5) during aquifer restoration. The restoration of the production aquifer is discussed in Section 2.1.2 of this ER. In order for uranium recovery to occur, the production aquifer must be exempted as an underground source of drinking water through NMED or EPA. When economical uranium recovery is complete in a well field, HRI will be required to initiate aquifer restoration activities to restore the production aquifer consistent with the groundwater protection standards presented in Criterion 5(B)(5) on a COC basis using BPT. If the restoration activities are unable to achieve the background or maximum contaminant levels (whichever is greater) in Criterion 5(B)(5), HRI will return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR

§ 141.62 or 143.3. For these reasons, potential impacts to the water quality of the production zone aquifer as a result of ISR operations will be expected to be SMALL and temporary.

During operation, inward hydraulic gradients will be maintained by process bleed so that groundwater flow is toward the production zone from the edges of the well field. If this inward gradient were not maintained, horizontal excursions could lead to the spread of fortified groundwater outside of the aquifer exemption boundary. The rate and extent of spread will be driven largely by the collective effects of the aquifer transmissivity, groundwater flow direction, and aquifer heterogeneity. The potential impact of a horizontal excursion could be MODERATE to LARGE if a large volume of contaminated water were to leave the production zone. Section 5.4 of this ER includes mitigation measures that will be implemented to reduce potential impacts from horizontal excursions. This includes implementing a groundwater monitoring program and excursion control commitments in license SUA-1580. Section 6.2 of this ER describes HRI's groundwater monitoring plan and plans to identify and mitigate potential excursions.

Vertical hydraulic head gradients between the production aquifer and the underlying and overlying aquifers could be altered by potential increases in pumpage from these aquifers. Pumpage from water supply wells completed in the overlying Dakota Sandstone or the underlying Cow Springs Sandstone could enhance potential vertical excursions from the production aquifer because of potential discontinuities in the thickness and spatial heterogeneities in the vertical hydraulic conductivity of confining units. The potential impact from this type of vertical excursions could be MODERATE to LARGE if a large volume of contaminated water were to leave the production zone and moves into non-exempt underlying or overlying aquifers. Potential impacts related to vertical excursions will be reduced using mitigation measures discussed in Section 5.4 of this ER such as excursion monitoring and aquifer restoration. Section 6.2 of this ER describes excursion monitoring and recovery procedures that will be used to rapidly detect and correct a potential vertical excursion.

In addition, potential well integrity failures during operation could lead to vertical excursions. The failure of well casings above or below the production zone through inadequate construction, degradation, or accidental rupture could allow fortified groundwater to travel from the well bore into adjacent aquifers. Moreover, if underlying aquifer monitor wells, drilled through the production aquifer and confining units, are not completed properly there is the potential for vertical pathways for excursion of fortified groundwater from the production aquifer to the adjacent aquifers. The potential impact from well integrity failure could be MODERATE to LARGE if a large volume of contaminated water were to leave the production zone into underlying or overlying aquifers. Section 5.4 of this ER includes mitigation measures such as MIT and excursion monitoring that will be implemented to reduce potential impacts from well integrity failure.

In general, the potential environmental impacts of vertical excursions to groundwater quality in surrounding aquifers will be SMALL if the vertical hydraulic head gradients between the production aquifer and the adjacent aquifers are small, the vertical hydraulic conductivity of the confining units is low, and the confining layers are sufficiently thick. On the other hand, the environmental impacts could be MODERATE to LARGE if confinements are discontinuous, thin, or fractured (i.e., high vertical hydraulic conductivities), which could lead to the movement of large amounts of contaminated water. Potential operation impacts to surrounding aquifers related to production will be reduced due to the presence of adequate vertical confining layers overlying and underlying the production zone. Moreover, the potential operation impacts will be eliminated using mitigation measures discussed in Section 5.4 of this ER.

4.4.2.1.1.2.2 Deep Aquifers below the Production Zones

Potential environmental impacts to deep, confined aquifers below the production aquifers could occur as a result of disposal of waste water through Class I deep disposal wells. As discussed in Section 2.1.2 of this ER, deep well injection is a disposal method proposed by HRI. Deep disposal wells typically extend below any usable aquifers, since they must be completed in a horizon where groundwater is not suitable for drinking. An acceptable stratigraphic unit for deep well disposal will contain a deep, confined aquifer with water quality characterized by a TDS concentration higher than 10,000 mg/L. The Abo or Yeso formations, which underlie the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas at approximately 1,570 to 1,650 m [5,150 to 5,400 ft] deep, likely, would be the target formations for deep disposal. The potential environmental impacts of injecting waste water into deep formations below production aquifers will be expected to be SMALL, since water production from deep aquifers is not economically feasible, the groundwater quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity), and they are confined above by sufficiently thick, low permeability layers.

4.4.2.1.1.2.3 Shallow Aquifers

As discussed in Section 3.4 of this ER, there are no shallow aquifers (i.e., less than approximately 76 m [250 ft] from the surface) within the Crownpoint, Unit 1, or Church Rock Sections 8 and 17 project areas. Therefore, there will be no potential impacts to shallow aquifers.

4.4.2.1.1.3 Potential Aquifer Restoration Impacts

The potential impacts to groundwater during aquifer restoration primarily are related to consumptive use and injection of waste water into Class I deep disposal wells.

Aquifer restoration is discussed in Section 2.1.2 of this ER and will include a combination of groundwater sweep, RO, and brine concentration. Groundwater consumptive use will be large for groundwater sweep, because it involves pumping groundwater from well fields without returning it to the production zone aquifers. The rate of groundwater consumptive use will be lower during the RO phase, since pumped groundwater treated with RO will be reinjected into the aquifer. Groundwater consumptive use could be further decreased during the RO phase if brine concentration is used, in which case up to 99% of the withdrawn production zone aquifer water will be suitable for reinjection. In that case, the actual amount of water that is reinjected into the well fields may be limited by the need to maintain a negative water balance within the well field.

The consumptive use of groundwater during concurrent operation and aquifer restoration and aquifer restoration were calculated based on the use of HERO units. The total annual consumptive use during concurrent operation and aquifer restoration will range from 1.4×10^8 to

1.9×10^8L (113 to 153 ac-ft) for each project area. The annual consumptive use during aquifer restoration alone for each project area will range from 6.0×10^7 to 1.1×10^8 L (48 to 89 ac-ft). The calculations are based on a HERO reject of 10% and nine pore volumes, although these numbers are preliminary and are likely to change as well fields are delineated. To the extent that delineation provides changes in these core metrics the volumes will be recalculated each year and reported to NRC as part of LC 9.5 of SUA-1580.

Overall, the potential impacts of groundwater consumptive use during aquifer restoration will be SMALL.

4.4.2.1.1.4 Potential Decommissioning Impacts

Potential groundwater impacts during decommissioning will be associated with consumptive use of groundwater and well plugging and abandonment. Overall, the potential impacts during decommissioning are expected to be similar to potential impacts during construction. The consumptive groundwater use during decommissioning will include water use for dust suppression, revegetation, and reclamation of disturbed areas and would be less than consumptive use during operation and aquifer restoration. Based on the use of BMPs to minimize water use (described in Section 5.4 of this ER), impacts to groundwater resources from consumptive use during decommissioning will be SMALL.

Improperly plugged and abandoned wells could potentially impact groundwater quality by providing hydrologic connections between aquifers. HRI will implement mitigation measures discussed in Section 5.4 to plug and abandon all wells including hydrologic testing to confirm proper plugging and abandonment. These procedures will help ensure that abandoned wells will be isolated from the flow domain and the potential impacts will be SMALL.

4.4.2.2 No Action Alternative

Under the No Action Alternative, the CUP will not be constructed or operated and associated potential impacts to groundwater quality or quantity will not occur.

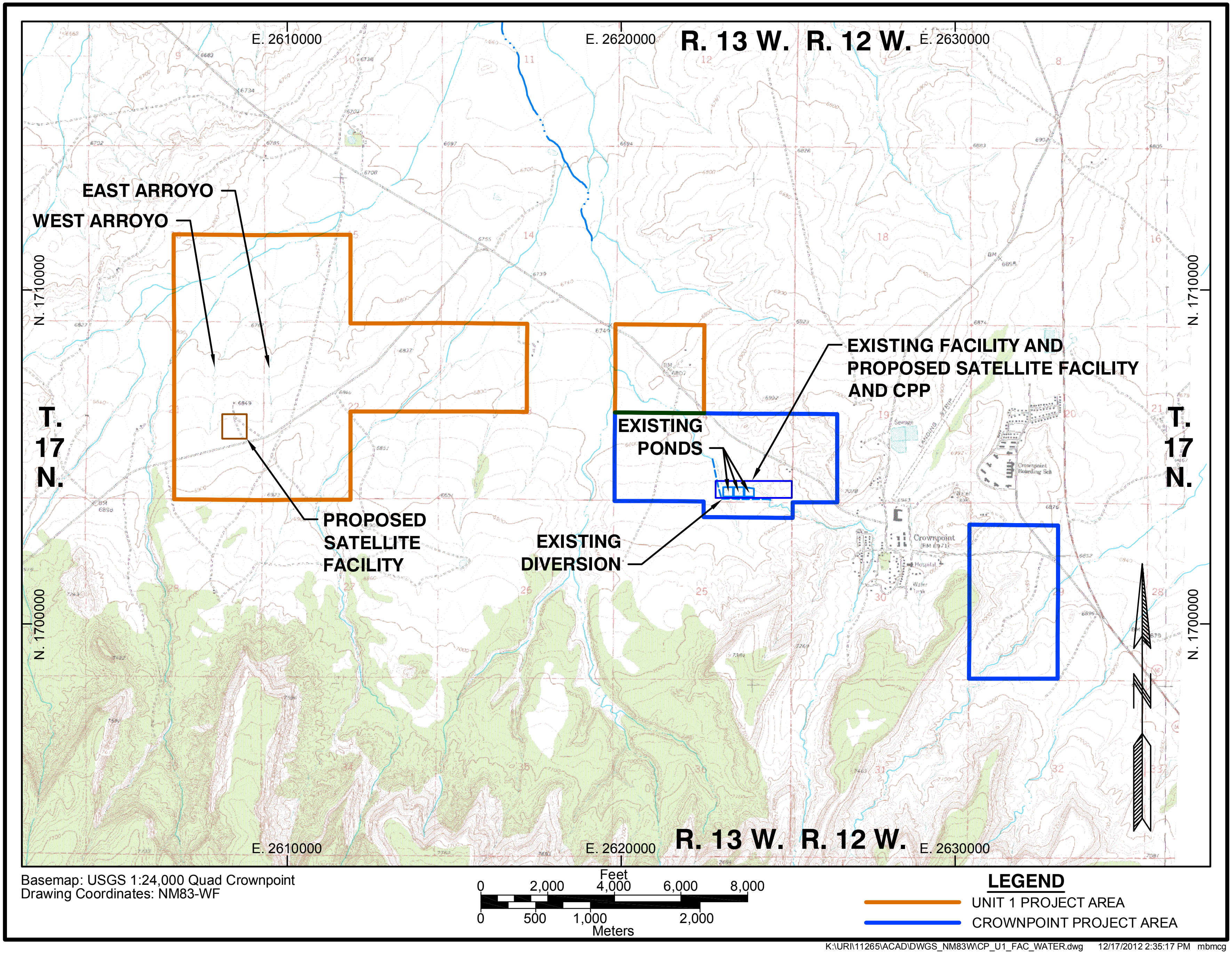


Figure 4.4-1. Proposed Facilities and Surface Water Features at the Crownpoint and Unit 1 Project Areas.

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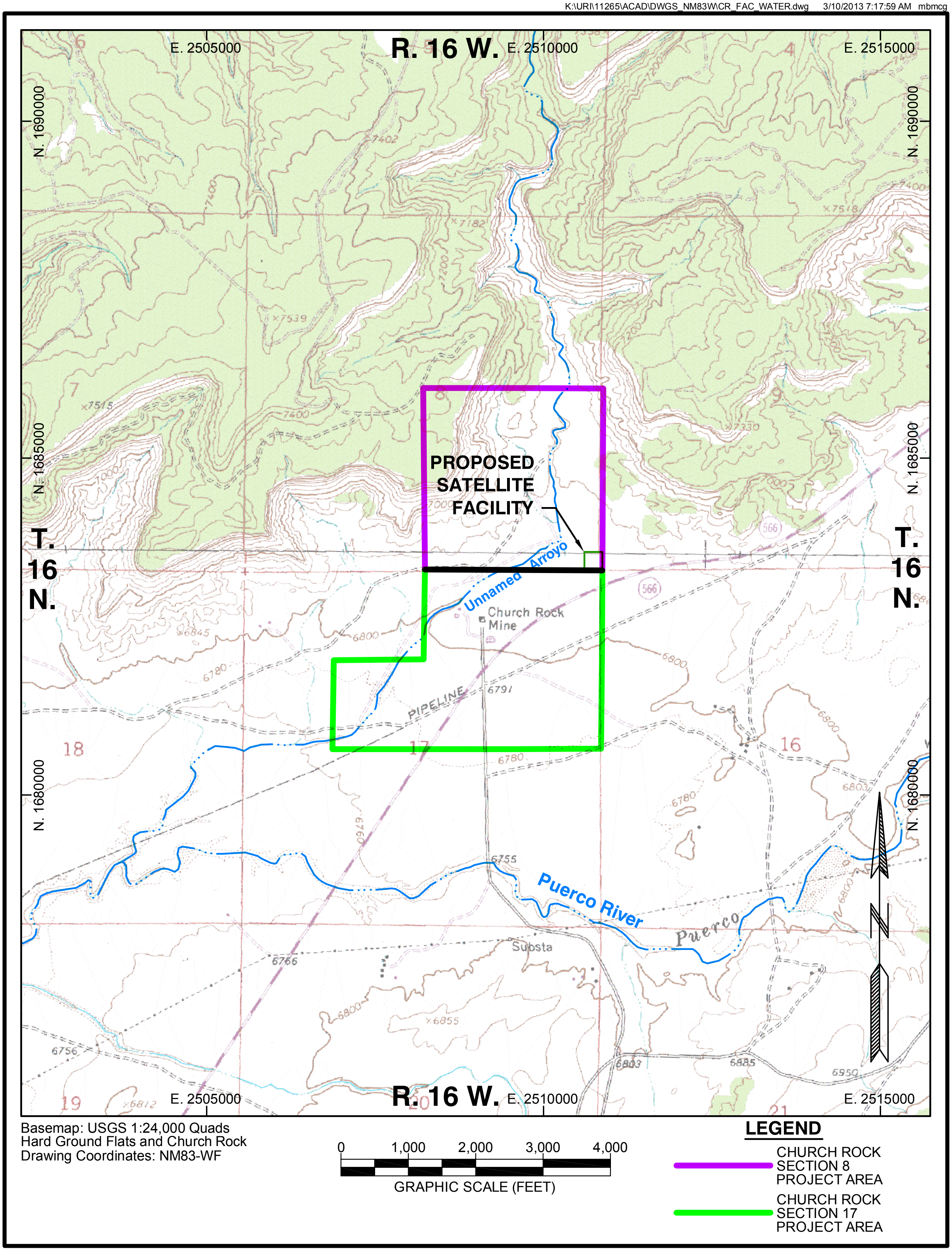

Figure 4.4-2 Proposed Facilities and Surface Water Features at the Church Rock Sections 8 and 17 Project Areas.

4.5 Potential Ecological Resources Impacts

No new regional ecological resources survey data have been collected since the publication of the CUP FEIS. Section 3.5.5 of the ISR GEIS includes general information regarding ecological resources in northwestern New Mexico. A summary of potential impacts by alternative is included below. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential ecological resources impacts.

4.5.1 Proposed Action

The type of disturbance associated with CUP will not result in large expanses of habitat or vegetation being dramatically transferred as in conventional mining and milling operations. Additionally, all disturbed areas will be reclaimed either at the completion of construction or during decommissioning. Potential impacts will be minimized by the low proportion (19%) of the project areas expected to be disturbed. A detailed description of vegetation, wildlife and T&E species associated with the project areas is provided in Section 3.5 of this ER. The following discusses the potential ecological impacts associated with each phase of the project. Mitigation measures designed to prevent or reduce potential ecological impacts are discussed in Section 5.5 of this ER.

4.5.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.5.1.1.1 Potential Construction Impacts

Construction will have the potential to alter flora and fauna in limited areas at each of the project areas. Most potential impacts will occur during initial facility construction, particularly at well fields and processing facilities. Construction activities will likely not adversely affect sensitive plant or animal species because of the low likelihood of encountering Federally- or State-listed or proposed T&E species or proposed or designated critical habitats within the project areas (Section 3.5 of this ER). Similarly, the absence of permanent surface water on the project areas limits potential impacts to aquatic resources (Section 3.5.1.3 of the CUP FEIS).

In general, potential construction-related impacts to vegetation, including juniper and pinyon pines, will be SMALL. As stated in Section 4.10 of the CUP FEIS, HRI will avoid disturbing juniper and pinyon pines within each of the project areas. In addition, the potential impacts resulting from the increased potential for noxious weeds in disturbed areas will be SMALL due to weed management. Mitigation measures are discussed in Section 5.5 of this ER.

Potential impacts to wildlife could result from habitat loss, displacement, and direct or indirect mortalities related to construction. The potential impacts to big game will be SMALL, since there are no critical big game habitats associated within the project areas. Although the exact location of the proposed power distribution lines and substations within each project area are unknown, potential impacts to raptors will be SMALL. Raptor species are not abundant in the project areas and any new power distribution lines will be constructed to reduce raptor electrocutions. Since no permanent aquatic habitats exist within the project areas, potential impacts to aquatic resources from construction will be SMALL.

Potential impacts to T&E species could result from habitat loss, displacement, and direct or indirect mortalities related to construction. As described in Section 3.5.1 of this ER, the black-footed ferret and the Zuni fleabane are the only T&E species that have the potential of occurring in the project areas. The Northern goshawk, Western burrowing owl, and Acoma fleabane are species of concern that could occur in the project areas. Western burrowing owls have been documented within 2.4 km [1.5 mi] of the Unit 1 project area and Gunnison's prairie dogs (prey for black-footed ferrets and burrowing owls) may be present on or near the Unit 1 and Church Rock Sections 8 and 17 project areas. If any of these species are identified in the project areas during surveys conducted prior to disturbance, potential impacts could range from SMALL to MODERATE to LARGE depending on site-specific conditions. However, as noted above, the absence of such species within the project areas suggests that overall potential impacts will likely be SMALL.

4.5.1.1.2 Potential Operation Impacts

Potential impacts to ecological resources during operation will be less than those during construction, since surface disturbance will be reduced during operation. Potential impacts to migratory birds and other wildlife from exposure to trace elements such as selenium and radionuclides in the retention ponds may occur but are expected to be SMALL, particularly since selenium was not detected in baseline groundwater quality samples collected from the Westwater Canyon aquifer (targeted for uranium recovery). In addition, no guidelines have been established concerning acceptable limits for radiation exposure for protection of species other than humans, and it is generally agreed that radiation protection standards for humans are conservative for other species (NRC 2004). In general, the concentrations of radionuclides in the retention ponds are not anticipated to result in significant radiation exposure to biota. Within each project area well fields, processing facilities, and retention ponds will be fenced to restrict access for safety reasons. Around the well fields HRI will install a barbed wire fence and a chain link security fence will be installed around the processing facilities and retention ponds. Although not specifically in place to restrict wildlife, the fencing will keep larger wildlife species from these areas. Avian species, particular waterfowl, may be attracted to the retention ponds. An avian deterrent system, such as visual and sound devices, may be required to deter waterfowl from landing on these ponds if necessary. Potential impacts to migratory birds and other wildlife from facility operation will be SMALL and will be minimized using BMPs discussed in Section 5.5 of this ER.

Potential impacts to aquatic resources and vegetation from facility operation will be SMALL and generally limited to potential spills and leaks. All spills and leaks will be mitigated using BMPs discussed in Section 5.5 of this ER. Mitigation measures will include leak detection systems and spill response plans to rapidly detect and connect a spill or leak, remove affected soils, and capture released fluids this will reduce the potential impact to aquatic resources and vegetation.

Similar to construction the potential may exist for wildlife mortalities resulting from vehicle collisions during facility operation, but the potential impacts are expected to be SMALL.

Potential impacts to T&E species during operation will be similar or less than during construction since surface disturbance generally will be completed. This will allow species to move back into the project areas. Based on the absence of T&E species within the project areas, potential impacts during operation would likely SMALL.

4.5.1.1.3 Potential Aquifer Restoration Impacts

Potential ecological impacts during aquifer restoration will be SMALL, since surface disturbing activities will be limited. Potential impacts associated with aquifer restoration activities will include vegetation and habitat alteration due to the response and cleanup of potential spills, noxious weeds, wildlife mortality from vehicle collisions and displacement due to noise, dust, and human/mechanical presence. Potential impacts are expected to be less than during operation due to a smaller workforce and decreased traffic.

4.5.1.2.4 Potential Decommissioning Impacts

Potential impacts to ecological resources during decommissioning will be similar to those during construction and will be short in duration. Pipeline removal will temporarily impact vegetation. Wildlife potentially could be impacted by the slight increase in workforce and traffic. During decommissioning, reclamation activities will revegetate previously disturbed areas and restore the disturbed areas to their preconstruction contours, allowing any temporarily displaced wildlife to return to the project areas. As a result, the potential impacts to ecological resources during decommissioning will be SMALL.

4.5.2 No Action Alternative

The No Action Alternative will result in no change to existing ecological conditions at the project areas or in the region. Land disturbance will be avoided and the area will continue to provide low to moderate quality vegetation communities and wildlife habitat typical of the region.

4.6 Potential Air Quality Impacts

Potential air quality impacts are discussed in Section 4.1 of the CUP FEIS. Section 4.5.6 of the ISR GEIS includes a general discussion of potential air quality impacts in northwestern New Mexico. Summaries of potential air emissions and air quality impacts are included below. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential air quality impacts.

4.6.1 Proposed Action

The ISR GEIS classifies air quality impacts as SMALL if the following three conditions are met for all four phases of the project.

- Gaseous emissions are within regulatory limits and requirements.
- Air quality in the region of influence is in compliance with NAAQS.
- The facility is not classified as a major source under the New Source Review or Federal Operating (Title V) permit programs.

Section 4.5.6 of the ISR GEIS and Section 3.6.2 of this ER describe how the project areas are classified as attainment areas for NAAQS. In addition, regional monitors have measured concentrations below the regulatory limits for gaseous emissions as presented in Section 3.6 of this ER.

Based on an analysis of potential emissions from construction and operations the project will be considered a “minor source” subject to New Source Review (NSR) permit requirements. Estimated emission rates for criteria pollutants are all well below the threshold values for “major sources” so no PSD review or permitting is necessary. Radon gas is not a criteria pollutant but radon emissions will be permitted through National Emission Standards for Hazardous Air Pollutants (NESHAP) permitting process.

The following sections describe the potential air quality impacts associated with each phase of the project, including impacts associated with transportation and non-transportation related combustion emissions as well as fugitive dust emissions. Emission results described in these sections are preliminary. Specific details, including equations, are provided in Addendum D to this ER.

<u>4.6.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17</u>

<u>4.6.1.1.1 Potential Construction Impacts</u>

Potential air quality impacts during construction would be similar to those described in Section 4.1.1.1 of the CUP FEIS and Section 4.5.6.1 of the ISR GEIS. The primary emissions during construction include fugitive dust and combustion emissions. Fugitive dust will be generated by heavy equipment used to construct facilities, well fields, and roads. Other sources of fugitive emissions would be dust from wind erosion. All fugitive emissions during construction will be short in duration. Combustion emissions will be associated with vehicle and drill rig exhaust and also will be temporary. Overall, potential impacts during construction will be SMALL. Mitigation measures are discussed in Section 5.6 of this ER and include dust suppression and proper maintenance of equipment.

Emissions during construction were estimated using EPA's NONROAD2008 emissions model and AP-42. Emission factors were obtained from the NONROAD2008 model for the equipment expected to be used at the CUP, while AP-42 provided guidance for transportation related combustion emissions and fugitive dust emissions associated with heavy construction operations, storage piles, and unpaved roads.

The preliminary emissions for total hydrocarbons (THC), NO_x, CO, SO_2, and PM_{10} during the construction phase are presented in Table 4.6-1. The preliminary emissions estimate assumes that all construction will be completed during the first year, with the exception of the well fields, which will continue until uranium recovery is no longer economically feasible. Emissions of NO_x and CO_2 are anticipated to be the highest of the pollutants evaluated at an estimated 60.4 and 6,788 t/yr, respectively. The preliminary emissions estimates presented in this ER are lower than the estimated annual gaseous and particulate emissions for well field activities presented in Table 4.3 of the CUP FEIS. The difference in the estimated emissions is attributed to the emission factors. The emission factors used in the CUP FEIS were obtained from an EPA report published in 1991, while the preliminary emissions estimated presented in this ER are based on more accurate EPA emission rates.

4.6.1.1.2 Potential Operation Impacts

Potential air quality impacts related to operation will be similar to those described in Section 4.1.1.2 of the FEIS and Section 4.5.6.2 of the ISR GEIS. Non-radiological emissions during operation will be less than during construction due to less traffic, fewer shipments, and reduced surface-disturbing activities. Radiological emissions will include radon vented from the well field pipeline vents and during loaded resin transfers from the IX columns. Section 4.5.6.2 of the ISR GEIS states that impacts related to emissions from these sources will be SMALL. A detailed discussion of potential impacts from radiological emissions is included in Section 4.12 of this ER. Mitigation measures to control radiological emissions are described in Section 5.6 of this ER and include the use of pressurized, down-flow IX columns and vacuum dryers.

A summary of the preliminary emissions associated with the operation phase is provided in Table 4.6-1. The results indicate that anticipated emissions during operations are considerably lower than those anticipated during the construction phase. Since activities during operation will not vary the annual estimated emissions are expected to be similar for all years of operation.

4.6.1.1.3 Potential Aquifer Restoration Impacts

Aquifer restoration will have similar potential air quality impacts to those during operation. Table 4.6-1 summarizes the combustion and fugitive emissions estimated for the aquifer restoration phase. The table shows that both combustion and fugitive emissions during aquifer restoration are anticipated to be the lowest of the four phases. The decrease in emissions compared to the operation phase can be attributed to fewer employees and activities during aquifer restoration. The potential impacts to air quality during aquifer restoration will be SMALL.

4.6.1.1.4 Potential Decommissioning Impacts

Potential impacts to air quality during decommissioning will be SMALL and similar to construction. Fugitive emissions will be generated from heavy equipment used to reclaim the project areas, trucks transporting equipment off-site, and trucks transporting waste off-site. Combustion emissions will also be produced by these trucks as well as vehicles transporting workers to and from the site. Table 4.6-1 summarizes the estimated emissions associated with decommissioning.

4.6.2 No Action Alternative

Under the No Action Alternative there will be no potential local or regional impacts to air quality since the CUP will not be developed.

Table 4.6-1. Preliminary Emissions Inventory for the CUP (t/yr)

Phase	THC	NO_x	CO	SO_2	CO_2	Combustion PM_{10}	Fugitive PM_{10}	Total PM_{10}
Construction	5.8	60.4	27	2.4	6,788	4.7	61.6	66.3
Operation	1.7	13.4	7.6	0.6	1,457	1.1	17.4	18.5
Aquifer Restoration	0.6	5.9	3.1	0.3	618	0.5	7.3	7.8
Decommissioning	1.7	19.7	8.9	0.9	2,916	1.7	33.5	35.2
Cumulative	**9.8**	**99.4**	**46.6**	**4.2**	**11,779**	**8.0**	**119.8**	**127.8**

4.7 Potential Noise Impacts

No new noise-related baseline data have been collected since the publication of the CUP FEIS. Section 3.5.5 of the ISR GEIS includes general information regarding ambient noise in northwestern New Mexico. This section discusses potential noise impacts to workers, which were not discussed in the CUP FEIS. In addition, neither the CUP FEIS nor ISR GEIS specifically addressed potential noise impacts to residences within and surrounding the project areas. These are addressed below. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential noise impacts.

4.7.1 Proposed Action

In general, uranium ISR facilities do not create significant sources of noise to offsite receptors except in two cases: construction/drilling in the well fields and truck traffic. Well field noise sources will only be present for a relatively short period of time during construction and decommissioning. Typically, the only noise sources associated with the facilities will be drilling and workover rigs and truck traffic resulting from maintenance, inspections, and material shipments. Construction of the well fields and transportation of materials will result in audible noises in and around residences, businesses, and public buildings in the immediate vicinity of the project areas. Noise levels have the potential to be annoying, but will either be short in duration (construction and decommissioning) or intermittent (operation and aquifer restoration). The following discussion details possible noise levels associated with each phase of the project.

4.7.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.7.1.1.1 Potential Construction Impacts

Potential noise impacts during construction will be similar to those described in Section 4.1.1.3 of the CUP FEIS and Section 4.5.7 of the ISR GEIS. Drilling rigs, construction vehicles, trucks, and other equipment used to construct the well fields and processing facilities will generate noise that will be audible above background levels. Representative noise levels for various equipment utilized at an ISR project are presented in Table 4.7-1.

Noise generated from construction equipment will be apparent locally over the short term when construction activities are occurring. Noise from point sources diminishes by about 6 dBA for each doubling of distance according to the following relationship, where it is assumed that the noise radiation is uniform, non-directional, and freely propagating (Bell and Bell 1994):

$$L_{p,1} - L_{p,2} = 20\ log\left(\frac{r_2}{r_1}\right)$$

In this equation $L_{p,1}$ and $L_{p,2}$ are the sound pressure levels at points 1 and 2, respectively. Construction equipment noise levels at 305 m [1,000 ft] and 1,610 m [5,280 ft] were calculated and presented in Table 4.7-1. Due to the presence of residences and public buildings within the project areas, construction noise levels are likely to exceed nuisance levels (greater than 55 dBA), although construction will be short in duration. The potential impacts associated with these noises will be SMALL to MODERATE depending on proximity to construction activities.

Section 5.7 of this ER includes mitigation measures that will be implemented to reduce potential noise impacts. When possible HRI will restrict construction activities to daytime (8 a.m. to 8 p.m.) hours where the noise threshold would affect nearby residences and public buildings.

The National Institute for Occupational Safety and Health (NIOSH) recommends an exposure limit for workplace noise of 85 dBA for a duration of 8 hours per day (NIOSH 1998). Since exposures at or above this level are considered hazardous, OSHA requires a hearing conservation program that accurately identifies employees exposed to noise at or above 85 dBA averaged over 8 working hours (OSHA 2012). A description of the hearing conservation program that will be implemented by HRI is presented in Section 5.7 of this ER. Since HRI will implement a hearing conservation program the potential noise impacts to employees will be SMALL.

Traffic associated with the CUP (workers traveling to and from the project areas and trucks transporting materials) will have a SMALL impact on noise levels near roadways with higher traffic volumes (Navajo 9 and NM 566). Roads with lower or traffic counts (e.g., Navajo 11) will have higher relative increases in traffic-related noise impacts, especially when facilities are experiencing peak employment (construction and operation), resulting in SMALL to MODERATE impacts.

As discussed in Section 3.7 of this ER, there are sensitive areas within the region (i.e., areas of special significance to the Native American culture) that should be considered, but because of decreasing noise levels with distance, construction activities will have only SMALL and short-term noise impacts for sensitive areas located more than 305 m [1,000 ft] from noise-generating activities.

During construction, wildlife likely will avoid areas where noise-generating activities are ongoing. Since the project areas have limited wildlife, potential noise impacts will be SMALL.

4.7.1.1.2 Potential Operation Impacts

Potential noise impacts during operation will be less than during construction due to reduced construction-related activities. Noise sources specifically resulting from operation include processing facility operations, vehicle traffic related to employees traveling to and from the project areas, material transportation, and well field equipment (MIT and work over operations).

Operational noise at the processing facilities will be generated by pumps and other equipment. Except for material shipments to and from the facilities, most noise will be abated by closed buildings and will not significantly impact nearby residents. Similarly, well field equipment will be contained within metering houses and well pumps will be submerged. Overall potential operational-related noise impact will be SMALL.

The major noise source during operation will be attributed to vehicles traveling to and from the project areas. Truck traffic associated with material shipments and traffic noise related to commuting will have a SMALL, temporary impact on nearby residences. Traffic-related noise impacts will be less than those experienced during construction due to a smaller workforce and less frequent material shipments.

4.7.1.1.3 Potential Aquifer Restoration Impacts

Potential noise impacts during aquifer restoration will be similar to those during operation, but smaller since the anticipated workforce will be smaller and shipments fewer. Overall noise impacts during aquifer restoration will be expected to be SMALL to MODERATE.

4.7.1.1.4 Potential Decommissioning Impacts

Potential noise impacts during decommissioning will be similar to or less than construction. The noise generated at the project areas will be mostly around the processing facilities. Well field noise will include equipment required to plug and abandon wells. Potential noise impacts during decommissioning will be SMALL to MODERATE and will be short in duration.

4.7.2 No Action Alternative

The No Action Alternative will result in no change to existing noise conditions at the project areas or in the region.

Table 4.7-1. Average Noise Levels from Representative Construction Equipment

	Average Noise Level		
Equipment	**At 15 m[1] (dBA)**	**At 305 m (dBA)**	**At 1,610 m (dBA)**
Drill Rig	100 (at 2 m)	57	42
Heavy Truck	82–96	56-70	42-56
Bulldozer[2]	92–109	66-83	52-69
Grader	79–93	53-67	39-53
Excavator	81–97	55-71	41-57
Crane	74–89	48-63	34-49
Concrete Mixer	75–88	49-62	35-48
Compressor	73–88	47-62	33-48
Backhoe	72–90	46-64	32-50
Front Loader	72–90	46-64	32-50
Generator	71–82	45-56	31-42
Jackhammer/Rock Drill	75–99	49-73	35-59
Pump	68–80	42-54	28-40

[1] WSDOT 2006
[2] Spencer and Kovalchik 2007

4.8 Potential Historical and Cultural Resources Impacts

Potential general impacts to historic and cultural resources are discussed in Section 4.11 of the CUP FEIS and Section 4.5.8 of the ISR GEIS. Since the Section 106 process was ongoing when the CUP FEIS was published in 1997, it does not address the Class III cultural resource survey findings. The Section 106 process was completed for all areas included in HRI's 5-year disturbance plan (Church Rock Sections 8 and 17 and Crownpoint Section 24) in 1999. The ISR GEIS provides a general discussion of direct and indirect impacts associated with historic and cultural resources. The following summarizes potential impacts to historic and cultural resources based on completion of the Section 106 process for HRI's 5-year disturbance plan and conditions in license SUA-1580. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential historical and cultural resources impacts.

4.8.1 Proposed Action

4.8.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

The ISR GEIS (Section 4.5.8) provides steps that should be completed to address historic and cultural resources prior to engaging in land disturbing activities. These steps include:

- Review existing literature and records to determine presence of known historic and cultural resources.
- Complete a comprehensive cultural resources inventory that meets the requirements of federal, state, and local agencies. The cultural resources inventory should identify previously documented sites as well as new cultural resource sites, including sites eligible for inclusion on the NRHP.
- Consult with state and tribal agencies to determine appropriate measures should new resources be discovered during land disturbing activities.
- Adhere to license conditions regarding the unanticipated discovery of previously undocumented cultural resources during each project phase.

As described in Section 3.8 of this ER, HRI has completed the required steps for the areas included in the 5-year disturbance plan (Church Rock Sections 8 and 17 and Crownpoint Section 24). The disturbance plan is part of the phased Section 106 process approved by NRC, NMSHPO, NNHPD, and BLM. In the letter concluding the Section 106 process, NRC imposed three conditions described in Section 3.8 of this ER: 1) activities are restricted to the areas included in HRI's 5-year disturbance plan, 2) fencing is required around eligible properties; and 3) all ground-disturbing activities must be monitored by an archaeologist and discovery of a previously undetected cultural resources must be reported to NRC, NNHPD, and NMSHPO. In addition to these conditions, LC 9.12 of SUA-1580 requires HRI to conduct cultural resource inventories prior to disturbances not previously assessed by the NRC and cease work for all activities that result in discovery of previously undocumented cultural artifacts. HRI also is required to contact the local SHPO and THPO for consultation.

Impacts to cultural resources (historic, cultural, archaeological, and TCPs) can be direct or indirect and can occur during any phase of ISR. The following presents the potential impacts for each phase.

4.8.1.1.1 Potential Construction Impacts

As described in Section 4.5.8.1 of the ISR GEIS, most potential direct and indirect impacts to cultural resources occur during construction. During construction buried cultural features and deposits not visible on the surface could be discovered. Construction activities could have a direct impact on specific archaeological sites determined as eligible for the NHRP. However, impacts to these areas will be minimized since all eligible and potentially eligible historic properties identified during the Class III cultural inventories will have been fenced. If avoidance is not possible, mitigation measures described in Section 5.8 will be utilized. The potential impacts to historic and cultural resources during construction will be SMALL because all known sites will be avoided or mitigated and, as noted above, because of LC 9.12 of SUA-1580, which requires a cultural resource inventory for areas not previously assessed by the NRC and cease work if previously unknown cultural artifacts are discovered.

4.8.1.1.2 Potential Operation Impacts

Potential impacts to cultural resources during operation are expected to be less than during construction since less land disturbance will occur. Potential impacts could result from maintenance and repair of existing facilities. Any work that results or could result in disturbance of a previously unidentified cultural artifact will be ceased immediately and the local SHPO and THPOs will be notified per LC 9.12 of SUA-1580. Based on the small amount of disturbance associated with the operation of the project, overall impacts during operation will be SMALL.

4.8.1.1.3 Potential Aquifer Restoration Impacts

During aquifer restoration, potential impacts to cultural resources will be similar to or less than during operation. Potential impacts could result from surface disturbing activities associated with the maintenance and repair of existing facilities. Potential impacts to cultural resources during aquifer restoration will be SMALL, since any previously unidentified resources encountered during aquifer restoration will cause work to cease in accordance with LC 9.12 of SUA-1580.

4.8.1.1.4 Potential Decommissioning Impacts

Surface disturbing activities will increase during decommissioning; however, potential impacts will be less than during construction since most of the decommissioning activities will occur in previously disturbed areas. Any land disturbing activities outside of the previously disturbed activities will follow the conditions of the license, including ceasing work if any previously unidentified resources were encountered. Overall the potential impacts associated with decommissioning will be SMALL.

4.8.2 No Action Alternative

Under the No Action Alternative the project areas will not be developed and associated disturbance and potential impacts to historic and cultural resources will not occur. As described in Section 4.11.4 of the CUP FEIS, a disadvantage of the No Action Alternative will be that no new cultural resources will be discovered and identified that may assist archaeologists in gaining knowledge about ancient cultures.

4.9 Potential Visual and Scenic Resources Impacts

Potential visual and scenic resources impacts are discussed in the CUP FEIS under the heading of Aesthetics (Section 4.10). Section 4.5.9 of the ISR GEIS includes general information regarding potential visual and scenic resources impacts in northwestern New Mexico. Summaries of potential visual and scenic resources impacts, including a new discussion on potential light impacts, are included below. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential visual and scenic resources impacts.

4.9.1 Proposed Action

Most potential visual and scenic resources impacts associated with drilling and other land-disturbing construction activities will be temporary. As described in Section 4.1 of this ER, the total anticipated disturbance is approximately 19% of the total CUP area. In general, roads and structures will be more long lasting, but will be removed and reclaimed during decommissioning. All of the project areas are identified as VRM Class IV as discussed in Section 3.9 of this ER. As indicated in the ISR GEIS, the general visual and scenic resources impacts associated with ISR facility construction are anticipated to be temporary and SMALL.

Potential visual and scenic resource impacts to locals and visitors is speculative as discussed in Section 4.10 of the CUP FEIS.

> "For those opposed to uranium mining or believing that the rewards of mining are distributed unjustly or that the risks are too high, the network of pipes, wells, vehicles, and processing facilities could become a reminder of the implications of the project. To the extent that the land might be seen as not supporting Navajo life, it might be seen as *not beautiful* (see Section 3.8). For other persons, the sight of increased economic activity might not be displeasing. Other potential meanings (e.g., the potential for emigration from the area or the potential for selective "non-immigration" by those offended by the presence of the mining operations) are possible. However, NRC staff believe that the overall aesthetic impacts of project operations would not be significant."

Potential visual and scenic resources impacts could occur from facility, vehicle, and construction equipment lighting. HRI will use both continuous and intermittent lighting systems during all phases of the project to ensure safe and secure operations. Continuous lighting will be used at location where operations are required during the night, such as the processing facilities. Intermittent lighting systems will be used in areas where periodic nighttime work may be completed (e.g., well fields). Historically, lighting has not been an issue at ISR facilities, even those that operate in suburban environments (e.g., the URI Kingsville Dome Project).

Potential impacts from lighting will depend on receptor location and existing light sources. Existing sources of light in the project areas include exterior lighting at the local residents, lights from occasional traffic on the local roads, and sky glow from the City of Gallup and the towns of Crownpoint and Church Rock. The frequency and intensity of these depend on meteorological conditions (particularly cloud cover).

The following sections discuss the potential visual and scenic resources impacts by phase, including potential impacts associated with lighting.

4.9.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.9.1.1.1 Potential Construction Impacts

Potential visual and scenic resources impacts during construction will be similar to those described in Section 4.10.1 of the CUP FEIS and Section 4.5.9.1 of the ISR GEIS. The greatest potential for impacts will result from the construction of new facilities developed in rural, previously undeveloped areas or within view of sensitive regions. As described in Section 3.9 of this ER there are no Class I, II or III VRM classification areas near project areas. As stated in Section 4.10 of the CUP FEIS, HRI will not disturb any juniper or pinyon pines within the project areas. The avoidance will allow HRI to maintain the preconstruction appearance of the project areas. Potential visual and scenic resources impacts associated with construction are anticipated to be temporary and SMALL.

During construction intermittent lighting systems may be required around drilling rigs and heavy equipment. Although most activities will be completed during the daytime hours, some activities, including well field construction may continue through the night. These activities will be temporary, and lighting will be directed to the area of construction. Therefore, potential impacts will be SMALL. HRI will minimize the potential impacts by implementing protection and mitigation measures, as discussed in Section 5.9. In addition to directing light toward the area of construction, these include minimizing the intensity of the light and using lights that are less likely to cause lighting impacts.

4.9.1.1.2 Potential Operation Impacts

Potential visual and scenic resources impacts during operation will be similar to those described in Section 4.10.1 of the CUP FEIS and Section 4.5.9.2 of the ISR GEIS. The greatest potential for visual impacts will be from the facilities. Overall, the potential impacts to visual and scenic resources during operation will be SMALL.

Although the potential for lighting impacts could occur during all phases of the CUP, the greatest potential will be during operation and aquifer restoration. The potential impacts will be greatest for areas from which the facilities will be visible. The potential sources (and anticipated duration) of lighting during operation will include:

- Processing facilities (continuous)
- Administrative/warehouse building (continuous)
- Security gates (continuous)
- Parking areas (continuous)
- Deep disposal wells (intermittent)
- Mobile equipment (intermittent)
- Metering houses (intermittent)

Potential lighting impacts will be minimized by implementing protection and mitigation measures discussed in Section 5.9 of this ER. This will help ensure that the potential visual and scenic resources impacts from lighting will be SMALL during operation.

4.9.1.1.3 Potential Aquifer Restoration Impacts

Potential impacts to visual and scenic resources during aquifer restoration will be similar to those described in Section 4.10.1 of the CUP FEIS and Section 4.5.9.3 of the ISR GEIS. During aquifer restoration the potential for lighting impacts will be similar to operation. Overall, the potential visual and scenic resources impacts from aquifer restoration will be SMALL.

4.9.1.1.4 Potential Decommissioning Impacts

Potential impacts to visual and scenic resources during decommissioning will be similar to those described in Section 4.10.1 of the CUP FEIS and Section 4.5.9.4 of the ISR GEIS. The potential impacts will be SMALL and temporary. Decommissioning activities will occur after facilities have been in operation for a number of years. The main purpose of the decommissioning process is to remove surface infrastructure and reclaim the area to preconstruction conditions. This will result in less visual contrast for the facilities. Overall potential impacts from decommissioning will be the same as or less than those for construction.

4.9.2 No Action Alternative

The No Action Alternative would result in no change to visual and scenic resources in the project areas.

4.10 Potential Socioeconomic Impacts

Potential socioeconomic impacts are discussed in Section 4.9 of the CUP FEIS. Section 4.5.10 of the ISR GEIS includes general information regarding potential socioeconomic impacts of ISR development in northwestern New Mexico. Since the CUP FEIS was prepared, the major change that has occurred that might affect the local and regional economy is the price of yellowcake, which directly affects tax revenues. Other socioeconomic factors such as wages and property values are higher than when the CUP FEIS was prepared, but more as a result of inflation than any underlying socioeconomic changes in the State, County, or local communities. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential socioeconomic impacts.

4.10.1 Proposed Action

The potential socioeconomic impacts associated with drilling and other land-disturbing construction activities will be temporary. Individual well fields will last approximately 4 years, from construction through aquifer restoration, and will be replaced on an ongoing basis as uranium is depleted in one area and new areas are developed. A portion of the construction workforce, primarily those employed to construct well fields and associated piping and control systems, will therefore be employed throughout the construction and at least a portion of operation. Severance tax revenues and royalties will occur only during the operation phase and the early stages of aquifer restoration, after which the uranium will be depleted. As indicated in Section 4.5.10 of the ISR GEIS, the overall socioeconomic impacts for typical ISR projects will range from SMALL to MODERATE. However and as described in the following sections, from a local perspective, any economic activities that can provide jobs and employees who can purchase local goods and services can have positive impacts on the local standard of living.

Uranium production is planned in Church Rock Section 8 for approximately 6 years. According to current plans, Church Rock Section 17 will be next, with production lasting for 4 years. Construction of Unit 1 will tentatively begin about 2.5 years following commencement of operations in the Church Rock Section 8 project area. Production will last for approximately 6 years. Construction at Crownpoint will commence 4.5 years following the beginning of operations at the Church Rock Section 8 project area. Production is estimated to last 14 years.

At each project area, aquifer restoration will commence as soon as the initial well field is depleted of economic reserves and will be completed within about 2 years after production ends at each location. Decommissioning at each project area will commence after aquifer restoration has been completed and approved per license conditions. Production of uranium will occur for about 20 years. These projections are tentative and subject to change depending upon market conditions, availability of proven recoverable reserves, and other factors.

<u>4.10.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17</u>

<u>4.10.1.1.1 Potential Construction Impacts</u>

Potential construction-related impacts to socioeconomic resources will be similar to those described in Section 4.9 of the CUP FEIS and Section 4.5.10.1 of the ISR GEIS except for project timing. HRI estimates that construction employment at each project area will average 66 employees, including staff and contract employees. Construction employment may increase briefly as facilities for each project area are constructed, and this will be handled by temporarily increasing use of contractors.

According to the estimated workers described in Section 4.2 of this ER, about 66 and 33 employees will be required during initial construction of the Church Rock Section 8 and 17 project areas, respectively. About 66 workers will be required during construction of the Unit 1 facilities and the Crownpoint facilities. Because of the discontinuous nature of facility construction, a higher proportion of construction jobs will be met with contract compared to the operation jobs.

As of December 2011, McKinley County unemployment totaled 2,134 out of a labor force of 26,219 (New Mexico Department of Workforce Solutions 2012). The estimated 66 construction employees represent about 3% of the unemployed workers in the county. If all employees were hired from within the county, this will reduce the unemployment rate from 8.1% to 7.9%. This is a SMALL impact for the county and is within monthly and seasonal fluctuations in McKinley County employment levels. However, as stated in Section 4.9 of the CUP FEIS, this will represent a significant portion of the Crownpoint Chapter labor force, which totaled 917 in 2009, of whom 240 or 26% were unemployed (USCB 2012d). If Navajo hirees are selected from within the Crownpoint area, the employment will be a significant benefit to the Crownpoint Chapter. Wages for the construction workers are estimated to average $70,000 with benefits, for a total construction payroll of about $4.6 million. This amount represents less than 0.7% of the total wages in McKinley County (annualized total based on the third quarter of 2011) and therefore is considered a SMALL impact (New Mexico Department of Workforce Solutions 2011b). The average construction wages are higher than McKinley County median family income and higher than average manufacturing wages in McKinley County and the State (see Section 3.10.2 of this ER). HRI estimates that about 70% of the construction employees could come from the local community. The median family income for the Crownpoint Chapter in 2009 was $26,037 (USCB 2012d), so if hirees come from the Crownpoint area this could create a significant increase in income for members of the Crownpoint Chapter. The remaining 30% of employees will require specialized training and experience that has not been required in this area before, and therefore these employees are likely to come from outside the area. Some construction activities, such as construction of new well fields as old well fields are depleted of uranium, will occur fairly continuously throughout the project until the last well field is completed.

It is likely that most of the employees hired from outside the area will reside in Gallup or Grants, because these are the largest communities within commuting distance from the project areas. As described in Section 3.10.4 of this ER, the number of vacant houses in Gallup and McKinley counties greatly exceeds the number of employees that will be brought into the area. These people will have a SMALL impact on housing, schools and medical facilities. Locally hired employees will have no direct impact on these facilities.

4.10.1.1.2 Potential Operation Impacts

Potential operations-related impacts to socioeconomic resources will be similar to those described in Section 4.10.1 of the CUP FEIS and Section 4.5.9.2 of the ISR GEIS. The greatest potential for socioeconomic impacts will be from the employment opportunities in relatively high-paying jobs, from the property taxes on the value of mineral produced and on the capital facilities, and from severance taxes and business activities taxes collected by the Navajo Nation.

Approximately 75 employees will be hired for operations in each project area, including professional and technical staff, plant employees and field personnel. Because of the duration of operations, continuing for approximately 20 years according to current plans, the operational employees will be primarily full-time staff, with contract employees used on an as-needed basis. Operational employment levels are estimated to number about 75 for years 3.5 years and then increase to 150 for 6 years before declining to 75 for the last 10.5 years of operation. Total employment during most years of operation when construction and aquifer restoration activities will be concurrent with operation will be about 80 for 3 years and then ramp up to a peak of about 220 for 1 year, when operation at the Church Rock Section 8 and 17 project areas coincides with construction at the Crownpoint and Unit 1 project areas and aquifer restoration at Church Rock Section 8 project area. Then employment will decline to about 160, a level that will remain fairly steady for 6 years. For the last 10 years, employment levels will decline until all operations are scheduled to cease. These employment levels are consistent with the estimates provided in Section 4.5.10 of the ISR GEIS.

HRI estimates that about 70% of the operational staff will come from the local community; the remainder will require specialized training and experience in such fields as management, finance, health physics, safety and environmental resources. Salaries for operations employees are expected to average about $70,000 per year, similar to the average for construction employees. With an average operational employment level of about 160, the annual payroll will average about $11.2 million, and this will last for up to 24 years. This annual payroll represents a 1.8% increase in McKinley County wages based on the third quarter of 2011, which is a SMALL impact. As stated above, if employees are hired from within the Crownpoint area the residents of the Crownpoint Chapter could see a significant increase in employment and income-earning opportunities.

As discussed in Section 3.10.5 of this ER, the facilities at the CUP will be taxed as a business asset. HRI presently estimates the facilities would cost $26,312,000. This cost could be depreciated down to a floor of 12.5% ($3,289,000). Assuming a 10-year depreciation period, the average valuation of the CUP facilities for the first 10 years would be about $14,800,000. When compared to the 2011 total McKinley County taxable value of $747,809,236, this represents an increase in total county valuation of about 2% (New Mexico Department of Finance and Administration 2011). The property tax levied by the County on these facilities will average about $467,000 per year for the first 10 years. The facilities will remain in place through completion of operations and aquifer restoration, or about 21 years. Assuming the facilities are depreciated to the minimum value of 12.5% of original value after 10 years, the property taxes paid on these facilities for the final 11 years of their useful lives will be about $103,000 per year.

As discussed in Section 3.10.5 of this ER, the assessed value of uranium production for tax purposes is 50% of the sales price. Assuming a long-term contract price of $65 per pound, the assessed valuation of produced uranium would be about $32.50 per pound. At an average production rate of 1 million pounds per year, the annual assessed value of production will be about $32.5 million. This represents about 4.3% of the 2011 tax year total valuation for McKinley County, which could be considered a MODERATE positive impact. The annual taxes on this amount and value of production will amount to over $1 million per year that would be paid to McKinley County.

The State of New Mexico will impose a 3.5% severance tax on the taxable value of the uranium produced and sold. Assuming a sales price of $65 per pound, the taxable value would be 0.5 x $65 or $32.50 per pound. At a rate an average production rate of 1 million pounds per year, the severance tax would amount to $1.1 million per year. Considering that the total hard mineral taxes (coal, copper, molybdenum, and other minerals) collected by New Mexico in FY2010 was $27,044,282, this 4% increase in severance taxes could be considered a SMALL to MODERATE beneficial impact (New Mexico Taxation and Revenue Department 2012). The severance tax is payable monthly based on the amount of uranium produced or sold in the prior month.

New Mexico imposes a conservation tax; the tax rate is 0.75% of an amount that is computed as 25% of the taxable value of the product sold after deducting 25% of the amount of any royalties paid to a tribe. Under the production and prices assumed for this report, the conservation tax could total about $180,000 per year without the deduction for tribal royalties. Since the minerals in the project areas are owned by the Federal government, HRI, or other private interests, there will be no deduction for Tribal royalties.

New Mexico also imposes a resources excise tax. The tax rate is 0.75% of the value of the product sold without deductions and will amount to about $1,462,000 per year under the assumed price and production amounts given above.

HRI will also be subject to New Mexico's Corporate Income Tax. Because this tax is based on net income rather than gross income or sales it cannot be estimated at this time.

As discussed in Section 3.10.5 of this ER, the Navajo Nation can levy taxes in an area classified as "Indian country." According to 18 U.S.C. Section 1151, "Indian country" includes allotted land, trust land and land within a dependent Indian community. All of the Church Rock Section 17 project area and 51% of the Crownpoint project area are Tribal trust surface, and all of the Unit 1 project area is allotted surface. Thus, about 65% of the total CUP is classified as "Indian country" and could be subject to the Navajo Nation business activities tax. The current tax rate is 5% and is assessed on business gross receipts after applying a 10% standard deduction or $125,000, whichever is greater, and after deducting for compensation paid to members of the Navajo Nation and purchases of Navajo goods and services. Assuming that mineral production from "Indian country" is proportional to surface ownership (i.e., 65%) and that the total production averages 0.5 million kg/yr [1 million lb/yr], about 0.3 million kg/yr [0.65 million lb/yr] will be subject to the business activities tax. The average amount payable under this tax will be calculated as follows:

0.65 million lb/yr x $65/lb (assumed price) x 5% = $2,112,000 per year less deductions.

The deductions would amount to 10% or $211,200 plus salaries or compensation paid to members of the Navajo Nation. After applying the 10% deduction, the remaining tax amount would be $1,900,800 per year (on average). At an annual compensation of $70,000 per year (see above), it can be seen that employment of only about 27 members of the Navajo Nation would be enough to offset the business activities tax. Construction activities are considered a service and are taxed at 60% of the rate on goods, or 3%. For the construction of the facilities ($26,312,000) this could amount to as much as $789,000 before any applicable deductions. These figures are provided only as illustrations; final determinations will be based on actual production, prices, application of deductions, and other factors. The taxes imposed by the Navajo Nation would be considered a SMALL to MODERATE beneficial impact.

4.10.1.1.3 Potential Aquifer Restoration Impacts

Potential aquifer restoration-related impacts to socioeconomic resources will be similar to those described in Section 4.9 of the CUP FEIS and Section 4.5.9.3 of the ISR GEIS. Aquifer restoration will be ongoing at each project area as each well field is depleted of economic reserves. The potential impacts during aquifer restoration will be the loss of the construction and operation jobs and associated payroll benefits and the loss of the tax base as the uranium deposit is depleted. HRI estimates that during aquifer restoration, after production ceases, the average employment level will drop to about 10 persons, just enough to keep the facilities operating during aquifer restoration of the final well fields. These employees will include plant personnel, a safety officer, and a field technician. Environmental and regulatory support and management will be provided by the corporate office. Field work will be minimal since there will be no construction activities. The primary field activities will be monitoring and equipment maintenance. These changes will occur gradually over the final few years of operations and could be delayed if more reserves are discovered and/or market conditions change. The potential socioeconomic impacts from aquifer restoration will be SMALL.

4.10.1.1.4 Potential Decommissioning Impacts

Potential decommissioning-related impacts to socioeconomic resources will be similar to those described in Section 4.9 of the CUP FEIS and Section 4.5.10.3 of the ISR GEIS. The main purpose of the decommissioning process is to remove surface infrastructure and reclaim the area to preconstruction conditions. HRI estimates that employment during decommissioning at each project area would range from about 11 to 22 persons, an increase from the aquifer restoration phase due to reclamation and decommissioning and stepped-up monitoring and regulatory activities. This includes periodic use of contractors to demolish buildings, haul away waste materials, and conduct surface reclamation. The potential socioeconomic impacts from decommissioning will be SMALL.

4.10.2 No Action Alternative

The No Action Alternative will result in no change to existing socioeconomic conditions at the project areas or in the region. Employment and the local tax base will be unaffected.

4.11 Potential Environmental Justice Impacts

Potential environmental justice impacts are discussed in the CUP FEIS (Section 4.12). Section 6 of the ISR GEIS includes procedural information regarding analysis of environmental justice impacts of ISR development in general and specifically in the Northwestern New Mexico Uranium Milling Region. The environmental justice of the CUP was litigated as part of Phase I in 1999. During litigation the Licensing Board and Commission determined that there were no substantial adverse impacts on environmental justice in the community.

Section 4.12 of the CUP FEIS presented several NRC staff recommendations that will help avoid or mitigate potential environmental justice impacts and possibly remove the perception by some that adverse impacts are likely to occur. These recommendations are still appropriate and are repeated below.

4.11.1 Groundwater

- In the event a groundwater excursion is confirmed by groundwater monitoring, it is recommended that HRI notify the Navajo Nation (executive director, NNEPA, Shiprock Office), the BIA (branch chief, Minerals Section, Branch of Real Estate Services, BIA Navajo Area Office), and the BLM (minerals team leader, Albuquerque Field Office) by telephone within 24 hours, and by letter within 7 days from the time the excursion is confirmed.
- It is recommended that a written report be submitted to the Navajo Nation (executive director, NNEPA, Shiprock Office), the BIA (branch chief, Minerals Section, Branch of Real Estate Services, BIA Navajo Area Office), and the BLM (minerals team leader, Albuquerque Field Office) within 60 days of excursion confirmation. The report should contain the same information as the report submitted to the NRC.
- In the event that retention pond standpipe water analyses indicate that a pond is leaking, it is recommended that HRI notify the Navajo Nation (executive director, NNEPA, Shiprock Office), the BIA (branch chief, Minerals Section, Branch of Real Estate Services, BIA Navajo Area Office), and the BLM (minerals team leader, Albuquerque Field Office) by telephone within 48 hours of verification.
- It is recommended that a written report be filed with the Navajo Nation (executive director, NNEPA, Shiprock Office), the BIA (branch chief, Minerals Section, Branch of Real Estate Services, BIA Navajo Area Office), and the BLM (minerals team leader, Albuquerque Field Office) within 30 days of first notifying the agencies that a retention pond leak exists. The report should contain the same information as the report submitted to the NRC.
- It is recommended that HRI notify the Navajo Nation (executive director, NNEPA, Shiprock Office), the BIA (branch chief, Minerals Section, Branch of Real Estate Services, BIA Navajo Area Office), and the BLM (minerals team leader, Albuquerque Field Office) by telephone within 48 hours of any spill or embankment failure which may have a radiological impact on the environment. It is recommended that such notification be followed, within 7 days, by submittal of a written report to the agencies detailing the

conditions leading to the failure or potential failure corrective actions taken, and results achieved.

- It is recommended that HRI work with the EPA and the State of New Mexico to ensure that the Navajo Nation be involved in UIC permitting. Specifically, NNEPA should be a party to all negotiations regarding UIC permitting, and its concerns should be reflected in the permitting decisions and/or conditions. However, the outcome of such negotiations would affect only the permitting of the proposed action and is not to be construed as having implications for other jurisdictional disputes.
- It is recommended that HRI facilitate negotiations between NMOSE and NNDWR that will develop an approach and process through which HRI's applications for utilization of water rights will be considered.

4.11.2 Transportation Risk

- It is recommended that all delivery trucks used to transport project materials [loaded resin, yellowcake, process chemicals and 11e.(2) by-product material] should carry the appropriate certifications of safety inspections.
- It is recommended that all delivery truck drivers hold appropriate licenses.

4.11.3 Ecology

- If birds begin to use the retention ponds, it is recommended that any bank vegetation that would provide cover for birds should be removed, and visual or sound devices should be installed to ward off birds. If these measures fail to keep birds from the ponds, wire screens should be placed over the water's surface.

4.11.4 Socioeconomics

- It is recommended that HRI, with input from and review by the BIA and officials of the six local chapters, should develop a hiring plan that outlines how members of local chapters will be informed of job opportunities in a timely manner.
- It is recommended that HRI provide an annual report to the BIA and the six local chapters indicating the number of employees who are Navajo, their chapter affiliation, and the number of non-Navajo employees.

4.11.5 Cultural Resources

- It is recommended that HRI's cultural resources specialist consult with traditional practitioners of the Crownpoint and Church Rock chapters to ascertain whether specific ceremonies or blessings are in order. Based on these consultations, the cultural resource specialist should identify those ceremonies that must be facilitated by HRI (e.g., by HRI's granting access to the site or supplying resources required for the ceremony).

4.12 Potential Public and Occupational Health and Safety Impacts

Detailed potential public and occupational health and safety impacts discussions are included in Section 4.6 of the CUP FEIS (Health Physics and Radiological Impacts). Section 4.5.11 of the ISR GEIS includes general information regarding public health and occupational safety impacts in northwestern New Mexico. Two new radiological characterization surveys were conducted on or adjacent to the Church Rock Sections 8 and 17 project areas in May 2009, the results of which are described in Section 3.12 of this ER. In addition the results of a reevaluation of the meteorological and individual receptor location parameters used in the MILDOS-AREA modeling also are discussed. Based on the information presented in this section and as summarized in Table 1.1-1 of this ER there is no significant change between the CUP FEIS and this ER in regards to potential public and occupational health and safety impacts.

4.12.1 Proposed Action

This section describes the analysis of potential public and occupational health and safety radiological and non-radiological impacts to the environment and the population that will result from the CUP. Potential project-related radiological impacts to the environment could result from accidental release of radiologic material. The primary potential project-related non-radiological impacts could result from accidental release of hazardous chemicals used at the facilities.

As discussed in Section 3.12.2.2 of this ER, new radiological studies were conducted within and surrounding the Church Rock Sections 8 and 17 project areas in 2009. These studies investigated the potential for transport of constituents from the historical uranium mines and attempted to determine if soils and dwellings in the area had unsafe levels of radium-226.

4.12.1.1 Crownpoint, Unit 1, and Church Rock Sections 8 and 17

4.12.1.1.1 Potential Construction Impacts

Potential construction-related public and occupational health and safety impacts will be similar to those described in Section 4.6.1 of the CUP FEIS and Section 4.5.11.1 of the ISR GEIS. Construction activities involve building well fields, surface processing structures, and support roads. Fugitive dust will result from construction activities and vehicle traffic but will be of short duration. Construction equipment likely will be diesel powered and will result in diesel exhaust, which includes combustion emissions. During the construction phase of the project, potential impacts to public and occupational health include: fugitive dust, combustion emissions, noise, and occupational hazards associated with construction of the well field and associated facilities. Potential impacts from fugitive dust and combustion emissions are described in Section 4.6 of this ER. As described in the ISR GEIS, fugitive dust likely will not result in any significant radiological dose as long as soils show low levels of radionuclides.

Comprehensive radiological baseline studies indicate that the background dose rates from cosmic and terrestrial sources range from 1.25 to 1.53 mSv/yr [125 to 153 mrem/yr] (Section 3.11 of this ER). Results of 2009 surveys at or adjacent to the Church Rock Sections 8 and 17 project areas indicate that there were no residual impacts from historical uranium recovery activities outside of the project areas.

Overall, the construction-related impacts are expected to be SMALL because the background radiation dose rates from terrestrial sources are low and the fugitive dust emissions releases are usually of short duration and are dispersed readily into the atmosphere. Construction is expected to have a SMALL impact on the workers and general public. Mitigation measures described in Section 5.12 of this ER will reduce potential public and occupational health and safety risks.

4.12.1.1.2 Potential Operation Impacts

Potential operations-related public and occupational health safety impacts will be similar to those described in Section 4.6.1 of the CUP FEIS and Section 4.5.11.2 of the ISR GEIS. Summary discussions of potential operations impacts from radiological and non-radiological sources are included below.

4.12.1.1.2.1 Potential Radiological Impacts from Normal Operations

Potential radiological impacts from normal operations could results from (1) exposure to radon gas from the well fields, (2) IX loaded resin transfer operations, and (3) venting during processing activities. Workers also have potential to be exposed to uranium particulates during maintenance activities. Any areas in which employees potentially will have access to yellowcake will be defined as a restricted access area as defined in 10 CFR § 20.1003. Potential public exposure to radiation could occur from radon releases from the well fields.

As part of the license application HRI utilized MILDOS-AREA modeling to calculate potential radiation doses to individuals and populations from releases occurring at the project areas. The model utilized several input parameters, including meteorology, population distribution, and individual receptor locations. HRI reevaluated the meteorological parameters (Section 3.6 of this ER) and individual receptor (Section 3.1 of this ER) and determined that the corresponding parameters used in the model still are valid. Detailed results of the MILDOS-AREA modeling are presented in Section 4.13.6 of the CUP FEIS. The estimated dose to members of the public for a combined CUP total population dose is less than 0.01 mSv/yr [1 mrem/yr] (as determined as part of the MILDOS-AREA modeling), which is well below the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] and the 40 CFR Part 190 annual limit of 0.25 mSv [25 mrem/yr] excluding radon.

Estimated doses at the CUP ISR facilities will not exceed regulatory limits, and overall impacts to public and occupational health and safety will be SMALL. Potential radiological impacts will be reduced using mitigation measures discussed in Section 5.4. These include using pressurized, down-flow IX columns and vacuum dryers.

4.12.1.1.2.2 Potential Radiological Impacts from Accidents

During operations there will be potential for radiological impacts from various types of accidents, including: tank failure, plant pipe failure, well field spill/pipeline failure, and transportation accidents. The following describes the potential associated with each accident scenario. Overall, the potential consequences resulting from a potential unmitigated radiological accident will have a SMALL effect on the general public and, at most, a MODERATE effect on the workers. Mitigation measures to reduce or eliminate these potential impacts are discussed in Section 5.12.

Tank Failure

The processing facilities will contain various vessels to hold and process liquid solutions. The principal vessels may include the chemical tanks, IX columns, elution columns, and yellowcake precipitation tanks. Other tanks will hold barren eluant and yellowcake slurry. General specifications for all of the vessels are provided in Section 2.4 of the COP. Overall, a spill of the materials contained in the process tanks will present a minimal radiological risk. The most likely tank failure will be a small leak in which the contents of the tank will be transferred to another tank and a repair or replacement will be made. If a tank or process vessel were to have a major failure, such as a rupture, fluids will be captured in secondary containment structures (concrete berms) in the process buildings. As described in Section 2.2 of the COP, the pad curb and sump will be adequate to contain the volume of the largest tank on the process pad.

Plant Pipe Failure

The rupture of a pipe within the processing facilities will be easily detected by operating staff and will be quickly controlled. Spilled solution will be contained by secondary containment curbs and sumps as described above.

Well Field Spill/Pipeline Failure

The rupture of an injection or production feeder line or individual flow line in a well field, or a trunk line between a well field and the processing facilities, will result in a release of fortified groundwater recovery solution which has potential to contaminate the ground. To ensure that leaks are not present HRI will monitor trunk lines, feeder lines, and individual flow lines for changes in pressure or flow. Significant variation either in flow or pressure will signal audible alarms, which will prompt an investigation of the potential leak.

Transportation Accidents

Potential transportation impacts are described in Section 4.2 of this ER including shipments of 11e.(2) byproduct material, yellowcake, and loaded resin. All shipments will be transported by properly licensed and certified drivers and subject to both federal and state transportation regulations. Extensive emergency response programs will be in place along with environmental emergency response programs for spill cleanups as described in Section 4.2 of this ER and Section 9.14 of the COP.

4.12.1.1.2.3 Potential Non-Radiological Impacts from Normal Operations

Potential non-radiological pubic and occupational health impacts from normal operation will be related to fugitive dust, combustion emissions, and contamination of water supplies. The following sections describe the potential impacts by pathway of exposure. Overall, potential non-radiological impacts will be SMALL. Mitigation measures to reduce or eliminate potential non-radiological impacts are discussed in Section 5.12 of this ER.

4.12.1.1.2.3.1 Potential Exposures from Air Pathways

Non-radioactive airborne effluents at the CUP will include fugitive dust and vehicle combustion emissions as described in Section 4.6 of this ER. Fugitive dust emissions will be generated by vehicles traveling on unpaved roads, while combustion emissions will be generated by equipment used within the project areas and vehicles and trucks traveling to and from the project areas.

4.12.1.1.2.3.2 Potential Exposures from Water Pathways

As discussed in Section 4.4 of this ER, the town of Crownpoint water supply wells are located in proximal distance to the Crownpoint project area and may have potential to be impacted. Prior to commencing operations at the Crownpoint project area, HRI, as required in LC 10.27 of SUA-1580, will replace the town of Crownpoint's water supply wells, construct the necessary water pipeline, and provide funds to NTUA and BIA for connection to the new wells.

The majority of rural residents within and near the project areas have been connected to a public water supply, as described in Section 3.4 of this ER. However, some private wells are used for livestock watering. Since water quality impacts from normal operation will be confined to the portions of the production zone within the aquifer exemption boundary, there will be no public health impacts to nearby water wells from normal operations.

4.12.1.1.2.4 Potential Non-Radiological Impacts from Accidents

Potential non-radiological impacts from accidents will include work-related accidents and chemical accidents. Since the likelihood of a work-related or chemical accident will be reduced by mitigation measures, including emergency response procedures, the impacts will be SMALL. Mitigation measures to reduce or eliminate potential non-radiological impacts are discussed in Section 5.12 of this ER.

4.12.1.1.2.4.1 Work-Related Accidents

Accidents involving human safety associated with uranium ISR typically have far less severe consequences than accidents associated with underground and open-pit mining methods, since ISR operation does not involve extensive heavy equipment operations, high walls, or many of the other hazards associated with conventional mining. Accidents that may occur in ISR operations are generally minor when compared to accidents that typically occur in other industries.

NRC has previously evaluated the effects of accidents at conventional milling facilities in NUREG-0706 and uranium ISR facilities in NUREG/CR-6733. These analyses demonstrate, for most credible potential accidents, consequences are minor so long as effective emergency procedures and properly trained personnel are used. HRI will develop emergency response procedures to ensure that all personnel are adequately trained to respond to all potential emergencies.

4.12.1.1.2.4.2 Chemical Accidents

Process-related chemicals that will be stored on site may include the following:

- Salt (NaCl)
- Hydrochloric acid (HCl)
- Sulfuric acid (H_2SO_4)
- Sodium bicarbonate ($NaHCO_3$)
- Sodium carbonate (Na_2CO_3)
- Hydrogen peroxide (H_2O_2)
- Carbon dioxide (CO_2)
- Sodium hydroxide (NaOH)
- Oxygen (O_2)
- Diesel oil
- Bottled gases
- Liquefied petroleum gas (LPG)

Bulk chemicals will be stored in the chemical storage area of the processing facilities or in the well field near the metering houses. Chemicals will be stored to minimize the potential hazard to the public or to workers' health and safety. HRI will have strict SOPs regarding receiving, storing, handling, and disposal of chemicals to ensure the safety of the public and workers. Industrial safety aspects associated with the use of chemicals will be regulated by EPA and NMED in addition to the State Mine Inspector.

4.12.1.1.3 Potential Aquifer Restoration Impacts

Since the activities during aquifer restoration overlap with similar operational activities (e.g., operation of well fields, waste water treatment and disposal), the types of potential impacts on public and occupational health and safety are expected to be similar. The reduction of some operational activities (e.g., yellowcake production and drying, remote IX) as aquifer restoration progresses will further limit the relative magnitude of potential worker and public health and safety hazards. Therefore, aquifer restoration is expected to have a SMALL impact on workers and the general public.

4.12.1.1.4 Potential Decommissioning Impacts

Potential decommissioning-related public and occupational health and safety impacts are expected to be similar to those discussed in construction. The potential impacts during decommissioning will be expected to decrease as hazards are removed or reduced, surface soils and structures are decontaminated, and disturbed lands are reclaimed. To ensure the safety of workers and the public during decommissioning, the NRC requires licensed facilities to submit a decommissioning plan for review. Such a plan includes details of how a radiation safety program complaint with 10 CFR Part 20 be implemented during decommissioning to ensure worker and public safety is maintained and that the program is in compliance with applicable safety regulations. A combination of (1) expert license supervision and training, (2) NRC review and approval of these plans, (3) the application of site-specific license conditions where necessary, and (4) regular NRC inspection and enforcement activities to ensure compliance with radiation safety requirements will constrain potential public and occupational health impacts during decommissioning to SMALL levels.

4.12.2 No Action Alternative

Under the No Action Alternative, the CUP will not be constructed or operated and associated potential public and occupational health and safety impacts will not occur.

4.13 Potential Waste Management Impacts

A comprehensive discussion of potential waste management impacts was not included in Chapter 4 of the CUP FEIS, but potential liquid waste disposal impacts were discussed in Section 4.6.1.1 of the CUP FEIS. A general discussion on waste management impacts in northwestern New Mexico is included in Section 4.5.12 of the ISR GEIS. The following provides a detailed discussion of potential waste management impacts associated with the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas.

4.13.1 Proposed Action

Uranium ISR facilities produce airborne effluents, liquid wastes, and solid wastes that must be handled and disposed properly. Potential impacts resulting from airborne effluents are described in Section 4.6 of this ER. Liquid and solid wastes are divided into two general categories: AEA-regulated waste and non-AEA-regulated waste. AEA-regulated waste includes liquids and solids meeting the definition of 11e.(2) byproduct material as defined by 10 CFR § 40.4: "The tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." AEA-regulated liquid wastes include excess recovery solution, brine, decontamination waste water, spent eluate and other process liquids. AEA-regulated solid wastes include process solids (e.g., filter media), contaminated soil, and parts, equipment, debris, and PPE that cannot be decontaminated for unrestricted use.

Radiation safety associated with the collection, handling, and storage of waste materials is maintained at all ISR facilities through the implementation of an NRC-approved radiation safety program compliant with the requirements at 10 CFR Part 20. Before operations begin, NRC requires an ISR facility to have an agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material. Such an agreement ensures sufficient disposal capacity for 11e.(2) byproduct material will be available throughout the life of the facility.

4.13.1.1 Proposed Waste Management Systems

The following sections describe the AEA-regulated and non-AEA-regulated wastes that may be generated as the CUP, waste management systems, and potential impacts associated with each type of waste.

4.13.1.1.1 AEA-Regulated Waste

4.13.1.1.1.1 Excess Recovery Solution

The major continuous stream of process waste will be the process bleed, amounting to about 1% of plant flow rate. The process bleed will be treated using RO and reinjected into the aquifer or used as process water, or disposed in a permitted Class I deep disposal well. Disposal methods and potential impacts for the brine generated from RO are discussed in the following section.

Potential impacts from excess recovery solution and disposal using deep disposal wells are addressed in Section 4.4 of this ER.

4.13.1.1.1.2 Brine

Brine will be generated from RO treatment of the process bleed and, potentially, brine concentration of the aquifer restoration water. Brine will be disposed in lined retention ponds or deep disposal wells as discussed in Section 2.1.2 of this ER. All retention ponds will include double liners and leak detection systems and will be inspected routinely in accordance with SUA-1580 license conditions. Deep disposal wells are the most cost-effective method of disposal. As described in Section 2.1.2 of this ER, a test well completed by Mobil/TVA near Crownpoint found two zones (Abo and Yeso formations) that met the criteria for deep well disposal.

Potential impacts from brine management include potential leaking pipes in the waste water collection system, potential leaks from the lined retention ponds, and potential deep disposal well impacts, including potential pipeline leaks and potential groundwater impacts. These potential impacts are described with potential water resources impacts (Section 4.4 of this ER) and potential soil impacts (Section 4.3 of this ER). Potential radiological impacts from the use of deep disposal wells are addressed in Section 4.12 of this ER.

4.13.1.1.1.3 Other 11e.(2) Liquid Waste

Other 11e.(2) liquid waste streams at the processing facilities will include depleted eluant and dilute process streams after uranium precipitation, potential spills from transportation of well field waste water (e.g., resulting from well work over) to the retention ponds, filter wash water, and plant wash down water. These wastes will be piped by pipeline to retention ponds and managed in the same way as process bleed, described above.

4.13.1.1.1.4 Solid 11e.(2) Byproduct Material

Solid 11e.(2) byproduct material will be generated during all phases of the project with the exception of construction. Types of solid 11e.(2) byproduct material that will be generated during operation, aquifer restoration and decommissioning include:

- Filtrate and spent filter media
- Sludge, scale, etc. from maintenance operations
- Contaminated soil collected from spill areas
- Spent/damaged IX loaded resin
- Well solids from injection/production well work over operations
- Contaminated PPE

During decommissioning all contaminated material will be reused for licensed activities, decontaminated below release limits and disposed in an approved landfill or reused, or disposed at a licensed 11e.(2) byproduct material disposal area. Materials disposed at an 11e.(2) byproduct material disposal area may include the following:

- Well field piping, trunk lines, and downhole well piping

- Equipment and piping in the processing facilities
- Retention pond sludge, retention pond liners, and leak detection systems

During operation and aquifer restoration, solid 11e.(2) byproduct material will be stored in the 11e.(2) storage and preparation area within the processing facilities. The 11e.(2) storage and preparation areas will be locked and posted as restricted. Sealed containers with 11e.(2) byproduct material will be transported by an appropriately licensed transporter to the White Mesa disposal facility in Blanding, Utah as described in Section 4.2 of this ER.

Potential impacts resulting from the management and disposal of 11e.(2) byproduct material include potential spills (Section 4.4) and potential transportation impacts (Section 4.2).

4.13.1.1.2 Non-AEA-Regulated Waste

4.13.1.1.2.1 Solid Waste

Solid waste generated at the project areas will include office trash, boxes, miscellaneous wood packaging and products, steel, pipes, and decontaminated material and equipment. These materials will be stored in commercial sized dumpsters and will be periodically disposed in an appropriately permitted solid waste disposal facility. As discussed in Section 4.2 of this ER, the Red Rocks regional landfill near Thoreau will likely be used for solid waste disposal. According to the NMED-SWB (2011), the Red Rocks regional landfill disposed of approximately 48,000 tons of municipal solid waste and about 14,000 tons of construction debris in 2009.

4.13.1.1.2.2 Hazardous Waste

Hazardous waste generated at the CUP may include small quantities of used batteries, expired laboratory reagent, fluorescent light bulbs, solvents, cleaners, and degreasers. Small amounts of hazardous waste are expected to be generated during all phases of the project. Hazardous waste will be stored in secure containers at the processing facilities. All hazardous waste will be transported to an off-site treatment; disposal or recycling facility that is licensed by NMED-HWB or a nearby state. Used oil primarily will be generated by motor vehicle maintenance in the maintenance shop at each facility. Heavy equipment such as construction equipment typically will be owned and maintained by a contractor and will not be serviced in the maintenance shop. Used oil will be accumulated separately from hazardous waste. In addition, used oil filters and oily rags will be generated as a result of maintenance activities in the maintenance shop and will also be accumulated separately from hazardous waste. Potential waste management impacts from hazardous waste and used oil include potential releases to the surface (Section 4.3 of this ER) and potential transportation impacts (Section 4.2 of this ER).

4.13.1.1.2.3 TENORM

TENORM includes drilling fluids and drill cuttings from monitor wells and from the construction and development of production and injection wells prior to operation. TENORM drilling fluids will be stored and disposed on-site in mud pits constructed adjacent to the drilling pad. Potential waste management impacts include temporary disturbances to land use (Section 4.1 of this ER), soil disturbance (Section 4.2 of this ER), sediment transport due to soil disturbance and vegetation removal (Section 4.4 of this ER), and potentially disturbing cultural resources (Section 4.8 of this ER).

4.13.1.1.2.4 Domestic Sewage

Domestic sewage from the processing facilities will be serviced by conventional septic tank/leach field systems. These systems will only receive waste water from restrooms, shower facilities, and miscellaneous sinks located throughout the offices and change rooms. The conventional septic tank/leach field systems will be permitted through the NMED Liquid Waste (Septic Tank) Program. Potential waste management impacts from domestic sewage will include temporary disturbances to land use (Section 4.1) and soil disturbance (Section 4.2).

4.13.1.2 Potential Construction Impacts

During construction potential waste management impacts will be SMALL because of the relatively small scale of construction activities. All of the waste generated during construction will be non-AEA-regulated waste and may include solid waste, hazardous waste, used oil, and TENORM.

4.13.1.3 Potential Operation Impacts

During operation, non-AEA-regulated waste generation will be similar to or less than during construction, except that little or no TENORM will be generated during operation. AEA-regulated waste generated during operation will include solid 11e.(2) byproduct material (including filtrate and spent filter media, sludge, scale, etc. from maintenance operations, contaminated soil collected from spill areas, spent/damaged IX loaded resin, well solids from injection/production well work over operations, and contaminated PPE) and 11e.(2) liquid waste (including excess recovery solution, brine, and other 11e.(2) liquid waste described above).

The treatment and disposal methods described above are effective at separating wastes to reduce waste volumes destined for disposal at an approved facility, thereby reducing potential waste-related environmental impacts. Since state permitting actions, NRC license conditions, and NRC inspections ensure proper practices will be used the potential waste management impacts will be SMALL. Specific SUA-1580 license conditions associated with waste management are described below.

As required in LC 10.26 of SUA-1580, retention ponds will be constructed, operated, and monitored for leakage in accordance with NRC regulations at 10 CFR Part 40, Appendix A. Leaks may still occur over the operational life of a retention pond; however, the retention pond design helps to contain leaks and the monitoring will detect leaks before a significant release of material to the environment occurs (LC 10.5 of SUA-1580). In addition, HRI is required to maintain sufficient reserve capacity in the retention pond system to enable the contents of a pond to be transferred to other ponds in the event of a leak (LC 10.5 of SUA-1580). The residual solid waste materials normally remain in ponds until the retention ponds are decommissioned and sludges are disposed of as 11e.(2) byproduct material at a licensed disposal facility, according to LC 9.6 of SUA-1580.

As required in LC 9.6 of SUA-1580, solid wastes generated from operations that are classified as 11e.(2) byproduct materials will be sent to a licensed facility for disposal. Contaminated materials, equipment, and buildings will be disposed or decontaminated and released for unrestricted use according to NRC requirements. Nonradioactive hazardous wastes will be segregated and disposed at a hazardous waste disposal facility. Nonradiological uncontaminated wastes will be disposed as ordinary solid waste at a municipal solid waste facility.

4.13.1.4 Potential Aquifer Restoration Impacts

Waste management activities during aquifer restoration utilize the same treatment and disposal options implemented for operations; therefore, impacts associated with aquifer restoration will be similar to the operational impacts described above. Additional waste water volume and the associated volume of water treatment wastes could be generated during aquifer restoration; however, this will be offset to some degree by the reduction in production capacity from the removal of well fields from production activities. Section 4.3.1 of the CUP FEIS discusses aquifer restoration and provides experience regarding the number of pore volumes required for aquifer restoration in past efforts. As outlined in LC 10.28 of SUA-1580, prior to commencing operations in the CUP, HRI must complete an aquifer restoration demonstration at the Church Rock Section 8 project area to determine the number of pore volumes that will be required to restore a production-scale well field. Furthermore, LC 9.6 of SUA-1580 will ensure that disposal capacity and the associated agreement for disposal of byproduct materials are addressed. As a result, potential waste management impacts from aquifer restoration will be SMALL.

4.13.1.5 Potential Decommissioning Impacts

Potential decommissioning waste management impacts during decommissioning are expected to be similar to the potential impacts discussed above since the management practices, waste management safety and environmental concerns, waste management regulations, and relevant aspects of the NRC licensing are not expected to change significantly (either in practice or effectiveness). Although the volume of construction debris and solid 11e.(2) byproduct material (retention pond sludge, liners, equipment, etc.) will be greater during decommissioning, the required preoperational agreement for disposal of byproduct material, NRC review and approval of a decommissioning plan and radiation safety program suggest that the potential waste management impacts will be SMALL.

4.13.2 No Action Alternative

Under the No Action Alternative, none of the facilities will be constructed and potential waste management impacts will not occur.

5.0 MITIGATION MEASURES

This chapter describes the mitigation measures that will be implemented to minimize the potential impacts described in Chapter 4 of this ER. The mitigation measures are described for the Proposed Action only, since the No Action Alternative will not involve mitigation. The CUP FEIS did not provide a separate chapter for mitigation; mitigation measures were included in Chapter 4. Since this ER is written in accordance with NUREG-1748, the following sections provide mitigation measures to reduce potential impacts associated with the Proposed Action. The mitigation measures discussed in this section are based on NRC staff recommendations identified in the CUP FEIS, SUA-1580 license conditions, and HRI commitments identified in the COP. In addition, mitigation measures described in Chapter 7 of the ISR GEIS are included based on relevancy to the potential impacts described in Chapter 4 of this ER.

5.1 Mitigation of Potential Land Use Impacts

The following presents mitigation measures for potential land use impacts during construction, operation, aquifer restoration, and decommissioning.

5.1.1 Construction

Potential impacts to land use during construction are discussed in Section 4.1 of this ER and include changes and disturbances to land use, restrictions to access, affecting mineral rights or land use by lessees and Unit 1 allottees, restrictions to grazing, and altering ecological and cultural resources. The following discusses the mitigation measures to minimize potential construction impacts to land use.

Changes and Disturbances to Land Use

Changes and disturbances to land use will be mitigated by using the following measures:

- phasing well field development;
- restricting well fields to 24 ha [60 ac];
- restoring and reseeding disturbed areas;
- using existing roads (where possible);
- following existing topography; and
- locating access roads, pipelines, and utilities in common corridors.

Restrictions to Access

Potential impacts from restricting access will be mitigated by limiting controlled areas (fenced areas) within each project area. Throughout the project controlled areas will be limited to the well fields, retention ponds, and processing facilities. Based on anticipated disturbance the total controlled area will be approximately 17% of the CUP; however, due to phased well field development, the actual controlled area during construction will likely be less.

Affects to Residences, Public Buildings, and Allottees

HRI will minimize the potential impacts to residences and public buildings within the project areas, including the allottees in Unit 1, by limiting the areas of disturbance. As described in Section 3.1 of this ER there are no residences or public buildings located within HRI's anticipated controlled area for each project area.

Restriction to Grazing

To minimize potential impacts to individuals holding livestock grazing permits within the project areas HRI will provide compensation for temporary reduction in available grazing land. The compensation will be either direct (for private land) or indirect through relevant tribal (for tribal lands) or Federal (BIA for allotted lands) agencies. An additional mitigation measure to reduce potential impacts to livestock grazing will be to reclaim disturbed areas disturbed promptly during the construction phase.

Altering Historic and Cultural Resources

The following presents how HRI will mitigate potential impacts to historic and cultural resources as it relates to land use. Additional mitigation measures are discussed in Section 5.8 of this ER.

- Avoiding disturbance to sites identified by the Class III inventory as potentially eligible for the NRHP.
- Consulting with SHPO and THPOs, where appropriate.
- Updating and implementing the CRMPs prior to disturbance of potentially eligible sites that cannot be avoided.
- Conducting pre-construction surveys to identify any previously undiscovered cultural artifacts or cultural resource sites.
- Employing a full-time archaeologist to oversee surface disturbance activities.
- Ceasing any work associated with the discovery of previously unknown cultural artifacts until appropriate action is taken to preserve the site or recover the artifacts.

5.1.2 Operation and Aquifer Restoration

Mitigation measures to address potential land use impacts during operation and aquifer restoration include:

- Implementing cultural resources mitigation measures, as described above, for any surface disturbance that occurs during operation or aquifer restoration.

5.1.3 Decommissioning

The following described the mitigation measures that will be implemented during decommissioning to ensure that there are no long-term impacts to land use associated with the project areas.

5.1.3.1 Road Reclamation

Access roads and roads within the project areas will be removed and reclaimed unless exempted from reclamation by the request of lessees/allottees, in which case the lessees/allottees will assume responsibility for long-term maintenance.

Prior to road reclamation, HRI will test for and remove any contaminated soil or gravel. The excavated material will be transported as 11e.(2) byproduct material to a licensed facility for disposal. In addition, petroleum-contaminated soil will be disposed at a permitted disposal facility. Roads will be removed by first removing any surfacing material and then ripping the road surface and shallow subsoil to minimize compaction. All culverts will be removed and arroyos will be remediated in compliance with ACOE regulations and permits. Affected areas will be graded to a contour approximate with the surrounding topography. Topsoil will be distributed uniformly and the area revegetated.

5.1.3.2 Well Field Decommissioning

Well field decommissioning will commence when well fields receive NRC and NMED approval for successful aquifer restoration. Well field decommissioning will include plugging and abandoning wells and removal and decontamination of well field piping, fittings, and other surface equipment.

All production and injection wells will be plugged and abandoned in accordance with the procedures described in Section 10.3.3 of the COP. The procedures include removing any piping, pumps, and equipment suspended in the well casing, filling the casing from the total depth to just below the ground surface with approved cement or similar material via a tremmie pipe, cutting the casing approximately 1 m [3 ft] below the ground surface, and restoring and reseeding the disturbed area.

Well field equipment will also be removed including injection and production well pipelines, buried electrical cable, and wellhead covers. Trunk lines, feeder lines, valve manholes, and metering houses also will be removed. Wherever possible, equipment will be decontaminated for release for unrestricted use, including disposal in a nearby municipal landfill or re-use at another ISR facility. In the event that well field equipment cannot be decontaminated to meet standards for unrestricted use, it will be disposed as 11e.(2) byproduct material.

Following well field equipment removal and disposal, the affected areas will be recontoured, topsoil will be replaced, and the areas will be revegetated.

5.1.3.3 Process Facilities and Equipment Decommissioning

Following successful reclamation in the final well field within each project area and determination that the processing facilities are no longer needed, the processing facilities and equipment will be decommissioned. A radiological survey of all process equipment will be conducted during decommissioning. Based on survey results, the equipment will either be relocated to another project area for further use or decontaminated to meet unrestricted use criteria for release.

Decontamination of salvageable building materials, equipment, pipe, and other materials to be released for unrestricted use will be accomplished by completing a preliminary radiological survey to determine the location and extent of contamination. Upon completion of the decontamination process, final alpha and, as needed, beta-gamma surveys will be performed. LC 9.9 of SUA-1580 indicates that facilities and equipment will be decontaminated to levels specified in “Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material.” The release limits in the guidance document (NRC 1987) include acceptable surface contamination levels and acceptable soil contamination levels.

The ALARA principle will apply to the decontamination of surfaces to reduce surface contamination to levels as far below the limits as practicable. Equipment that cannot be decontaminated to these standards will be sent to an NRC or agreement state-licensed facility for disposal.

All processing equipment, including tanks, filters, IX columns, pipes, and pumps will be decontaminated as necessary for use at another location or dismantled and disposed in accordance with application regulations. Contaminated equipment will be disposed as 11e.(2) byproduct material.

Structures will be decontaminated as necessary and moved to a new location, salvaged, or disposed at an appropriately licensed solid waste facility. Concrete flooring, foundations, and foundation materials will be decontaminated as required, broken up, and disposed at an appropriately licensed facility. Sludge accumulations in lined retention ponds will be disposed with pond liners and leak detection systems as 11e.(2) byproduct material.

Records of equipment decontamination, distribution, disposal, and related decommissioning activities will be maintained, and any necessary decontamination activities will be conducted in accordance with the operating procedures for the project.

5.1.3.4 Final Contouring, Topsoil Replacement and Revegetation

All disturbed areas within the project areas will be contoured to approximate preconstruction topography and any affected arroyos will be restored to preconstruction conditions. Topsoil will be redistributed on disturbed areas to a depth approximately equal to preconstruction conditions. As needed, the subsoil will be ripped to minimize compaction prior to revegetation. Disturbed areas will be revegetated in accordance with the NRC-approved RAPs. Seeding mixtures will be utilized as recommended by the NRC and described in Section 5.5 of this ER.

5.2 Mitigation of Potential Transportation Impacts

This section presents mitigation measures for potential transportation impacts. Potential transportation impacts are described in Section 4.2 of this ER and generally result from increased traffic and material transport.

5.2.1 Mitigation of Potential Traffic Impacts

Potential traffic impacts are described in Section 4.2.1. Traffic projections presented in Section 4.2.1 indicate that the added traffic resulting from the Proposed Action will have a SMALL to MODERATE impact on traffic volumes. Potential mitigation measures for traffic impacts include:

- working with McKinley County, NMDOT, and the NNDOT to improve signage;
- implementing a policy to enforce speed limits for HRI employees and contractors; and
- performing a safety analysis of the affected roads to identify areas of concern.

5.2.2 Mitigation of Potential Accidents during Material Transport

As required by LC 9.8 of SUA-1580, a written SOP will be established to address specific mitigation measures applicable to all material shipments, which includes coordination with local emergency response personnel, EMTs, firefighters, and municipal, tribal and county law enforcement personnel. For each type of material, specific information will be provided about the physical and chemical characteristics, hazards, potential exposure pathways, and spill response, containment, and cleanup procedures. Additional mitigation measures to reduce potential impacts from material shipment accidents are discussed in the following. The training will be ongoing and will include updates on a routine schedule or as new materials are transported to or from the project areas.

HRI will implement specific mitigation measures for shipments of yellowcake, loaded resin, and 11e.(2) byproduct material. These shipments will be transported by appropriately licensed transport companies specializing in shipments of radioactive materials. The transport companies will have extensive response programs including spill response equipment on board. Drivers will be trained in emergency response procedures and there will be constant monitoring of truck locations. The transport companies will have standing contracts with environmental emergency response contractors for spill cleanup if the spill occurs outside the vicinity of the CUP. HRI will have a cleanup team trained in radioactive spills and will also train local emergency services. Section 9.14 of the COP describes HRI's contingency plan for transportation accidents. The section identifies procedures to be followed in the event of a highway accident involving AEA-regulated material, including containment, cleanup equipment and procedures, and notification.

5.3 Mitigation of Potential Geology and Soil Impacts

Potential impacts to geology and soils are discussed in Section 4.3 of this ER. The following describes mitigation measures to minimize potential impacts to geology and soils.

5.3.1 Mitigation of Potential Geologic Impacts

The potential geologic impacts associated with the CUP include unintended hydraulic fracturing of formations associated with Class I and III injection wells and potential damage to facilities from earthquakes. To ensure hydraulic fracturing does not occur, HRI will maintain the injection pressures at levels that do not exceed the fracture gradient of the receiving formations. The potential for damage to facilities from earthquake will be mitigated by designing buildings and structures to the 2,500-year seismic probability standards in the IBC.

5.3.2 Mitigation of Potential Soil Impacts

5.3.2.1 Soil Loss Mitigation Measures

Mitigation measures to reduce or eliminate potential soil loss impacts include utilizing BMPs for topsoil handling, revegetation, storm water control, sediment control, and wind erosion protection. Each of these practices is described below.

HRI will remove topsoil from building sites, retention pond sites and other areas requiring significant grading or surface disturbance. The topsoil will be removed, stockpiled, and stabilized. To reduce wind and water erosion the topsoil stockpiles will be seeded with an NRC-approved seed mixture described in Section 5.5 of this ER. Topsoil in the well field areas will be bladed to one side and respread over the area immediately following construction. All disturbed areas will be revegetated in accordance with an approved reclamation plan and in the NRC-approved RAPs.

Soil loss from storm water will be mitigated by implementing engineering controls to route storm water away from disturbed areas. The processing facilities will route storm water away from disturbance using diversion channels. Section 5.4.1 of this ER describes the diversions that will be used at each of the project areas. In addition, storm water runoff will be controlled through a SWPPP as described in Section 4.4.1 of this ER.

Sediment control mitigation measures to minimize soil loss and water quality impacts will include using sediment control BMPs such as silt fencing, sediment ponds, and hay bales (Section 5.4.1 of this ER); and revegetating areas as soon as possible following disturbance. The potential impacts associated with wind erosion will be mitigated by wetting disturbed soils during construction and restoring vegetation as soon as possible following disturbance.

5.3.2.2 Soil Compaction Mitigation Measures

Potential soil compaction will be minimized by using existing roads, when possible. Construction of secondary roads will be minimized to the extent possible. During decommissioning the roads not turned over to lessees/allottees will be reclaimed and revegetated, including ripping soil and subsoil to minimize compaction.

5.3.2.3 Soil Contamination Mitigation Measures

Potential impacts resulting in soil contamination are described in Section 4.3 of this ER and include spills or leaks of fuels, oils or drilling fluids during construction, leaks or ruptures of pipelines or retention pond liners during operation and aquifer restoration, and transportation accidents of hazardous chemicals, loaded resin, yellowcake or 11e.(2) byproduct material. To minimize potential TENORM impacts, HRI will direct drilling fluids and muds into mud pits during construction. Fuel and oil leaks will be promptly corrected and contaminated soils will be removed and disposed at an appropriately licensed facility.

Soils contaminated from spills or leaks of process fluids will be sampled, removed, and transported as necessary to a licensed 11e.(2) byproduct material disposal facility. Soil surveys will be completed to assist with cleanup and ensure that all contaminated soil is treated appropriately or inventoried for future cleanup.

5.4 Mitigation of Potential Water Resources Impacts

5.4.1 Mitigation of Potential Surface Water Impacts

This section presents mitigation measures for the potential surface water impacts described in Section 4.4 of this ER. Potential surface water impacts could occur from erosion, sedimentation, flooding, spills, leaks, and wetland encroachment. HRI will minimize potential surface water impacts by limiting soil disturbance and compaction, diverting and controlling runoff, avoiding or promptly detecting and correcting accidental spills and leaks, and completing reclamation activities in a timely manner.

5.4.1.1 Erosion and Sedimentation

Prior to construction, HRI will prepare and submit a SWPPP to address mitigation measures for erosion and sedimentation. The SWPPP will describe the construction activities, identify the potential sources of pollution, and select the final erosion and sedimentation BMPs (e.g., silt fence, sediment logs, straw bale check dams, etc.).

Prior to operation of the facilities, HRI will update the existing SWPPP or prepare a new SWPPP to describe the operational controls that will be used during operation to ensure that storm water discharges do not cause a violation of surface water quality standards. Qualified personnel will inspect storm water BMPs as required and maintain the inspection records on-site. The SWPPP will be updated as needed, such as in response to potential problems identified during inspections or changes in operation.

Erosion and sedimentation will be mitigated by constructing roads and pipelines away from arroyos where possible. Where it is necessary to cross an arroyo, the crossing will be made perpendicular to the arroyos and BMPs will be used to reduce sediment load. HRI anticipates that the only arroyo crossing in the CUP will be in the Church Rock Section 8 project area. Pipeline crossings will be constructed in the same corridor as road crossings where possible to minimize disturbance.

Wells will not be constructed in arroyos, but some wells may be constructed in the 100-yr floodplain within the project areas. BMPs will be implemented to minimize sediment transport due to well installation and to protect the injection, production, and monitor wells from flooding by installation of cement seals around the well casings and use of watertight well caps.

5.4.1.2 Flood Protection

The following discusses the hydraulic analysis results for each project area as well as a discussion of mitigation measure HRI will implement to reduce potential flooding impacts. Prior to operations and as required by LC 10.26 of SUA-1580, HRI will provide and receive NRC acceptance for the hydraulic design of the diversion and retention ponds proposed at each project area.

5.4.1.2.1 Crownpoint Flood Protection

As discussed in Section 3.4.1.2 of this ER, there is currently a man-made channel that diverts storm water runoff along the southern boundary of the Crownpoint project area in a westerly direction away from three existing ponds. As part of the license application HRI performed a surface water hydrologic analysis to determine the adequacy of the diversion channel and berms. The model indicates that based on the existing channel conditions, all three of the ponds will be inundated by the PMF due to the drainage channel being undersized. In the event that HRI elects to maintain the existing ponds and drainage channel, erosion protection improvements will be performed. The improvements will protect the two uppermost ponds and abandon the lowest pond by lowering and widening the existing channel to a 12 m [40 ft] bottom width with 3:1 side-slopes connecting to existing ground. The channel flow line also will be lowered, resulting in a slope of approximately 1.5 mm/mm [0.005 ft/ft] with two 1 m [3 ft] drops lined with rock riprap. Rock riprap also will be laid on the embankment between the ponds and the drainage channel to protect that slope from erosive water velocities.

5.4.1.2.2 Unit 1 Flood Protection

As discussed in Section 3.4.1.2 of this ER, the Unit 1 project area lies on a high ridge between two existing shallow arroyos. Based on the modeled flows, overtopping of the arroyos likely will occur during the PMP; however, the 152 m [500 ft] separation between the arroyos and the processing facility and retention ponds should be more than enough to avoid the PMF floodplain. A trapezoidal diversion channel to direct flow away from the processing facility may be required.

5.4.1.2.3 Church Rock Sections 8 and 17 Flood Protection

As discussed in Section 3.3.2.4 of the CUP FEIS, HRI has analyzed the surface water hydrology at the Church Rock Sections 8 and 17 project areas. Based on the results of this analysis HRI concludes that the nearby, unnamed arroyo tributary of the Puerco River will not affect the processing facility or retention ponds in the PMF event.

5.4.1.3 Spills and Leaks

This section outlines the potential for leak or spill pollution events and describes HRI's plan to recognize, control, and safely cleanup any leaks or spills.

The potential for liquid waste pollution will be minimized by adhering to SUA-1580 and NRC design criteria for uranium ISR recovery facilities, designing adequate spill containment and leak detection systems, training employees on monitoring procedures for process parameters and recognizing potential upset conditions before leaks or spills occur, training employees on inspection procedures for spill control BMPs in the SWPPP, frequently inspecting waste management systems and effluent control systems, and training employees in spill detection, containment and cleanup procedures.

Hazardous and nonhazardous chemicals will be used throughout the life of the project. Hazardous chemicals with the potential to affect radiological safety will be stored in a separate area of each processing facility. Hazardous chemicals also will be stored away from incompatible chemicals and away from areas frequented by workers to reduce the risk of injury during an accidental release. All hazardous chemicals at the project areas will be handled and stored in accordance with Federal, State and local regulations, including the CFR, OSHA, and EPA.

Process fluids will be contained in process vessels and pipes during operation. Instrumentation, controls, and alarms will monitor the flows, pressures, and tank levels to maintain parameters within prescribed limits. If a tank or process vessel fails the fluid will be contained in the process building. The fluid will be collected in the plant sumps and then pumped to other process vessels or a lined retention pond. After the fluids have been removed, the area will be washed down with plant water. The water will be collected in the plant sump system and pumped to a lined retention pond, thereby mitigating potential environmental impacts due to tank failures.

Secondary containment in the form of curbs and sumps will be installed around all chemical storage tanks, process vessels, and piping and equipment inside the processing buildings and chemical storage areas. The process pad at each processing facility will be made of concrete and underlain by a synthetic liner that will capture potential leakage through cracks in the concrete. Thicker footers will be provided where heavy equipment and vessels will be located. The pad curb and sump will be adequate to contain the volume of the largest tank on the pad.

Spills or leaks also could occur from piping or equipment outside of the processing facilities. In such an event, operational controls and alarms will signal an alarm (e.g., low pipeline pressure or water in a sump), the leak or spill will be contained, and fluids will be captured and transported to the lined retention ponds for disposal. All areas affected by such a failure or leak will be surveyed and any contaminated soils or material will be removed and disposed in accordance with NRC and State requirements.

In the event of a piping failure within the processing facilities, low pressure sensors will trigger alarms and the pump system will shut down, preventing any further release. Any liquid waste released in the processing facilities will be transported to the lined retention ponds for disposal.

Metering houses will be equipped with leak detection equipment that will signal alarms at the processing facilities. In addition, routine periodic inspections of metering houses and wellheads will be conducted by qualified personnel. Well field operators will visually inspect all piping and equipment within metering houses, wellheads, and valve vaults at least weekly. In the event of a leak, the affected soil will be surveyed for contamination and the area of the spill will be documented. If contamination is detected, the soil will be sampled and analyzed for the appropriate radionuclides. Contaminated soil will be removed and disposed in accordance with NRC and State requirements.

Flow monitoring and spill response procedures are expected to limit the impact of potential spills to surficial aquifers. In New Mexico, storm water runoff are controlled by a SWPPP issued by EPA.

5.4.1.4 Lined Retention Ponds

Lined retention ponds will be designed in accordance with NRC Regulatory Guide 3.11. Prior to commencing construction of retention ponds at any project area, HRI will submit for NRC approval detailed drawings and analysis/calculations for the pond embankment locations, diversion channels, and erosion protection design. Additionally, HRI will demonstrate through detailed engineering analyses that the ponds and diversion channels around the ponds will be stable under a PMF condition, as required by LC 10.26 of SUA-1580.

The lined retention ponds will include liners and leak detection systems meeting the requirements of LC 10.5 of SUA-1580. Standard provisions for the ponds will be two impermeable synthetic membrane liners: an inner 30-mil Hypalon liner, or equivalent, and an outer liner 36 mils thick made of Hypalon, or equivalent (1 mil=0.001 inch). A space to 102 to 127 mm [4 to 5 in] thick between the two liners will contain sand or some other (granular) porous medium and a drainage network of open piping, forming an underdrain leak detection system. The (outer) liner will provide secondary containment for any leakage that may occur. HRI will measures and document pond freeboard and leak detection sumps fluid levels daily.

If fluid levels greater than 15 cm [6 in] are detected in the leak detection sumps, the fluid in the sumps will be sampled and analyzed for specific conductance and chloride. Elevated levels of these COCs will confirm a retention pond liner leak at which time HRI will notify the NRC and other agencies by telephone within 48 hours and take the following corrective actions: (a) analyze standpipe water quality samples for leak detection COCs once every 7 days during the leak period, and once every 7 days for at least 14 days following repairs; and (b) locate and repair the area of liner damage. After a confirmed leak, HRI also shall file a report to NRC and other agencies within 30 days of the leak confirmation, pursuant to LC 12.2 of SUA-1580.

At all times, HRI will maintain sufficient reserve capacity in the retention pond system to enable transferring the contents of one pond to the other ponds. The freeboard requirements may be suspended during the repair period in the event of a leak and subsequent transfer of flow.

5.4.2 Mitigation of Potential Groundwater Impacts

5.4.2.1 Groundwater Quantity

Potential impacts to groundwater quantity are discussed in Section 4.4.2 of this ER. The following sections describe mitigation measures designed to minimize potential impacts.

Mitigation measures to minimize water quantity impacts include properly abandoning exploration and delineation boreholes, employing on-site engineering/geologic supervision during well drilling and development, using proper well construction techniques, implementing an approved MIT program, relocating nearby municipal wells, and monitoring existing water supply wells. The following describes each of these mitigation measures.

Abandoning Exploration and Delineation Boreholes

HRI, Inc. has exploration drill hole survey locations for every exploration hole at each of the four project areas. The status of plugging records for each project area is discussed in Section 8.4 of the COP. Prior to operations, HRI will ensure that all exploration and delineation boreholes are plugged and abandoned by conducting hydrologic tests simultaneous with well field development. If during operational testing individual holes become suspect, the holes can be found because their locations are surveyed and mapped, and corrective action (plugging) will be performed. In addition to routine hydrological testing and corrective action, well field operations and the physical characteristics of the old exploration holes themselves allow containment of the leaching solutions by self-sealing of clays as described in Section 8.4 of the COP. HRI's procedures for plugging and abandonment are described in Section 2.1.3 of this ER and Section 10.5 of the COP. Plugging and abandonment procedures include filling the hole from the total depth to just below the ground level with approved cement or similar material via a tremmie pipe.

Drilling Supervision

HRI will employ on-site geologic/engineering oversight during any drilling project for all phases of well drilling, installation, and abandonment.

Well Construction Techniques

All wells will be constructed so as to perform for the life expectancy of the well. Well construction is discussed in Section 2.1.2.4 of this ER and Section 6.4 of the COP. All holes will be rotary-drilled with water well-type drill rigs, which are capable of circulating drilling fluids to the surface. Casings of injection, production and monitor wells will be either of threaded fiberglass, PVC, or steel, and perforated, under reamed or screened (LC 10.4 of SUA-1580 requires HRI to use steel or fiberglass well casing at Crownpoint and Unit 1 for all wells completed in the Dakota Sandstone, Westwater Canyon, and Cow Springs aquifers). The casing will include centralizers, spaced between 45 to 60 m [150 to 200 ft] along the total casing length. The casing will include a cap at the bottom with a weep hole to allow the cement to flow below and around the casing and back to the surface in the annular volume of the hole. If the casing will be used for integral screen completion it will include a cement basket between the casing and screen. The cement basket packs off the annular space between the casing and wellbore wall to isolate the screen from the cement. Once the casing is run into a well, it will be cemented from bottom to top using a slurry of Class A cement, approximately 2% bentonite gel and water with a weight of approximately 1.6 kg/L (13 lb/gal). The cement will be pumped through the casing, through the weep holes in the cap or basket, and up the annular volume between the casing and borehole to the surface. The slurry volume will be sufficient to fill the annular volume, a portion of the lower casing volume, and to provide enough excess volume to fill any potential washouts with returns to the surface. After the entire slurry volume is pumped down the well, it will be displaced in the casing with water or a weighted fluid to a depth considered sufficient to ensure that enough cement remains in the casing to properly seal the bottom weep holes. The well will be sealed with the displacement fluid in the casing to prevent backflow and allowed to set for 48 hours to cure the cement. The properly designed displacement fluid will assure that the casing does not collapse prior to the curing of the cement.

MIT Program

HRI will implement an approved MIT program to test well casings for possible leaks. As required by LC 10.24 of SUA-1580, HRI will perform MIT on all injection, production, and monitor wells. HRI also will conduct fracture tests on the Westwater Canyon aquifer within the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas, but outside of the future well field areas to determine the formation parting pressure (FPP) (LC 10.31 of SUA-1580). Procedural details for MIT are presented in Section 2.1.2.4 of this ER and Section 6.4.3 of the COP. HRI will retest the integrity of injection, production, and monitor wells at a minimum frequency of every 5 years.

Nearby Municipal Wells

Due to the proximity of the town of Crownpoint municipal wells to the Crownpoint and Unit 1 project areas, HRI will replace the wells, construct the necessary water pipeline, and provide funds to NTUA and the BIA to connect the new wells to the existing water supply system in accordance with LC 10.27 of SUA-1580. Since all of the residents in the vicinity of the project area are on NTUA public water supplies, there will be no additional potential impacts to drinking water supplies within and surrounding the project areas.

Existing Water Supply Wells

During operations, existing water supply wells within a 2 km [1.2 mi] radius of the project areas will be sampled on a quarterly basis as described in Section 6.1.4 of this ER. Measures designed to limit or mitigate potential impacts to existing water supply wells may include providing an alternate water source of water of equal or better quality and quantity.

Minimizing Consumptive Use

The following mitigation measures will ensure that consumptive use of groundwater is minimized during operation and aquifer restoration:

- Designing balanced well fields.
- Minimizing the process bleed through continuous adjustments to injection and production rates in order to keep the well field balanced while simultaneously limiting the amount of process bleed necessary to maintain an inward hydraulic gradient. This will also limit the potential for an excursion, which would result in consumptive use to recover fluids.
- Employing RO and, potentially, brine concentration to treat process bleed and restoration fluids.
- Completing an aquifer restoration demonstration at Church Rock Section 8 to determine the number of pore volumes required to restore a well field, as required by LC 10.28 of SUA-1580.
- Implementing the extensive experience in aquifer restoration that HRI has gained from URI operations in Texas. This knowledge will allow HRI to minimize consumptive use at the CUP.

5.4.2.2 Groundwater Quality

Potential impacts to groundwater quality will be mitigated by excursion monitoring and aquifer restoration. In addition, the mitigation measures described in the previous section for groundwater quantity also will minimize potential groundwater quality impacts.

5.4.2.2.1 Excursion Monitoring

Excursions are defined in LC 10.12 of SUA-1580 as the exceedance of UCLs for two or more excursion indicators or one excursion indicator exceeding a UCL by 20% in a monitor well. To mitigate the potential for excursions HRI will implement an extensive groundwater monitoring program described in Section 6.2 of this ER and Section 8.6.2 of the COP. The groundwater monitoring program will include the sampling intervals, sampling water quality COCs, and the UCLs for particular water quality constituents (specified in LC 10.22 of SUA-1580).

The groundwater monitoring program will include the construction of production zone monitor wells and non-production zone monitor wells. The function of the monitor wells will be to detect the migration of any recovery solutions outside of the production zone. If an excursion occurs, HRI will increase sampling and commence corrective actions. Excursions can typically be reversed by increasing the overproduction rate and drawing the recovery solution back into the production zone. Monitor well spacing is discussed in Section 2.1.2.4 of this ER and Section 6.3 of the COP. The monitor well spacing will meet the requirements of LC 10.17 of SUA-1580, which requires monitor wells in the Westwater Canyon aquifer at a distance within 122 m [400 ft] from the edge of the production wells and no greater than 122 m [400 ft] between each monitor well.

In addition, LC 10.18 of SUA-1580 requires HRI to complete monitor wells in the Dakota Sandstone aquifer at a minimum density of one well per 4 acres at the Unit 1 and Crownpoint project areas, and LC 10.19 of SUA-1580 requires HRI to complete a minimum of three monitor wells in the Dakota Sandstone between the well fields and the town of Crownpoint water supply wells. At the Church Rock Sections 8 and 17 project areas, LC 10.20 of SUA-1580 requires HRI to complete monitor wells in the Brushy Basin “B” sand aquifer at a minimum density of one well per 1.6 ha [4 ac] and the Dakota Sandstone aquifer at a minimum density of one well per 8 acres. If a vertical connection is found to exist between the Westwater Canyon aquifer and the Cow Springs aquifer in any well field, monitor wells will be required to be completed at a minimum density of one well per 1.6 ha [4 ac] (LC 10.25 of SUA-1580).

Monitor wells installed in the production zone monitor well ring, and those installed in the overlying, and underlying aquifers (where applicable) will be sampled and analyzed for the UCL COCs every 2 weeks during production unless unable to do so because of uncontrollable events such as snowstorms or flooding. Water levels in the monitor wells also will be measured in order to provide an early warning of a potential excursion, potentially allowing HRI to correct the well field imbalance before an actual excursion occurs. In the event of a vertical excursion in the Dakota Sandstone aquifer at the Crownpoint and Unit 1 project areas, HRI will sample monitor wells to determine if the vertical excursion has impacted any other overlying aquifers that could sustain yields greater than 150 gpd (LC 10.14 of SUA-1580).

5.4.2.2.2 Pump Tests

HRI will conduct pump tests prior to starting operations in a well field to determine aquifer parameters (e.g., aquifer transmissivity and storage coefficient) and to ensure that confining layers above and below the production zone will preclude the vertical movement of fluid from the production zone into the overlying and underlying aquifers (LC 10.23 of SUA-1580). As required by LC 10.32 of SUA-1580, prior to commencing operations, HRI will collect data from the Cow Springs aquifer beneath the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas to characterize the water quality of the aquifer, thereby making excursions geochemically recognizable. HRI also will conduct pump tests to demonstrate that the Cow Springs aquifer beneath the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas is hydrologically isolated from the Westwater Canyon aquifer.

5.4.2.2.3 Aquifer Restoration

Groundwater will be restored consistent with the groundwater protection standards presented in Criterion 5(B)(5) on a constituent-by-constituent basis using BPT. If the restoration activities are unable to achieve the background or MCL, whichever is greater, in Criterion 5(B)(5), HRI will return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR § 141.62 or 143.3.

Groundwater TRVs representative of baseline water quality will be established as required by LC 10.21 of SUA-1580 and described in Section 6.2 of this ER and Section 8.6 of the COP. TRVs will be calculated as a function of the average baseline water quality and likely will use the EPA-sponsored ProUCL statistical program.

As required by LC 10.29 of SUA-1580, HRI has submitted RAPs for each project area that include: (a) a proposed restoration schedule; (b) a general description of the restoration methodology; and (c) a description of post-restoration groundwater monitoring. The RAPs for each project area have been approved by NRC as discussed in Section 1.2 of this ER.

Restoration Procedure

Aquifer restoration will be achieved by a combination of groundwater sweep, RO, and potentially, brine concentration. The restoration of groundwater at the CUP will have the benefit of a previously engineered array of injection and production wells that will be installed in a configuration to maximize sweep efficiently throughout the production zone and maximize uranium recovery. The same engineering principals hold for maximum sweep efficiently during the restoration phase.

Restoration Progress

Restoration rates will be monitored through analysis of water produced from the production zone. A sample will be taken weekly from the composite production line and analyzed for conductivity, chloride and uranium. These data will be compiled monthly and reported biannually to the NRC and NMED.

When the data indicate that restoration is at or near completion, each original baseline well will be sampled and analyzed for calcium, sodium, bicarbonate, sulfate, chloride, conductivity, and uranium. If the well field value for each chemical constituent is consistent with TRVs, restoration will be considered to be complete and the stability period will begin. Stability will be determined by three sample sets taken at 2-month intervals from the original baseline wells and analyzed for the COCs in Table 6.2-1 of this ER.

Stability monitoring results will be evaluated to determine whether there are any significant trends in constituents. Constituents with increasing trends or identified hot spots will allow HRI to determine further actions. Hot spots or wells with elevated concentrations will be evaluated to determine the potential impact on the water quality outside of the exempted aquifer. This analysis could include extended stability monitoring or flow and transport modeling. If the evaluation reveals that groundwater outside of the exempted aquifer could potentially be affected, HRI will resume active restoration to resolve the issue. The following describes the methods of corrective action for an excursion occurring during the restoration stability monitored period that may be employed by HRI.

- A preliminary investigation will be completed to determine the probable cause and the area affected.
- Affected wells will be analyzed for COCs listed in Table 6.2-1 of this ER.
- An assessment will be performed to determine what actions are necessary to protect groundwater outside the exempted aquifer.
- If groundwater has potential to impact groundwater outside the exempted aquifer, active restoration will be resumed until the issue is resolved.
- HRI will maintain a process bleed until the groundwater has been determined by NRC to be fully restored (LC 10.15 of SUA-1580).

Following successful stability monitoring, HRI will submit a final restoration report to the NRC and NMED for final approval. The restoration report will include the results of all stability monitoring, statistical trend and hot spot analyses, and the results of any flow and transport modeling to assess potential impacts outside of the exempted aquifer. Following NRC approval, all wells will be plugged and abandoned in accordance with regulatory requirements.

5.4.2.3 Deep Well Disposal

HRI may use Class I deep disposal wells as a method of liquid disposal as discussed in Section 2.1.2.8 of this ER. The wells will be constructed according to NMED and EPA Class I disposal well construction standards. Mobil/TVA drilled a test well at Crownpoint to establish the availability of deep seated confined aquifers containing water in excess of 10,000 mg/L TDS, which also met the confinement criteria. Two zones meeting these criteria were determined: the Abo and Yeso formations.

5.5 Mitigation of Potential Ecological Resources Impacts

Potential impacts to ecological resources are discussed in Section 4.5 and include vegetation and wildlife. The following sections describe mitigation measures designed to minimize potential impacts.

Primary impacts (areas of disturbance) will affect approximately 19% of the total CUP and are associated with the construction of well fields, processing facilities, and associated infrastructure. Secondary impacts will extend away from areas of primary impacts, with the area of potential effect varying according to the species of vegetation or wildlife involved.

5.5.1 Vegetation

Potential impacts to vegetation are discussed in Section 4.5 of this ER. Mitigation of potential vegetation impacts will consist of avoidance of juniper and pinyon pines and temporary and permanent revegetation of disturbed areas. Revegetation practices will be conducted in accordance with a reclamation plan reviewed and approved by the BIA, BLM, EPA, NMED, and/or the NNEPA, depending on the agency jurisdiction on the section of land involved. Disturbed areas will be seeded to reestablish a vegetative cover to minimize wind and water erosion and the invasion of undesired plant species. Two permanent reclamation seed mixtures (species for sandy sites and species for pinyon/juniper and ponderosa pine clay and loamy sites), recommended by NRC in the CUP FEIS, will be used to reseed disturbed areas. The recommended permanent seed mixtures are included in Table 5.5-1. Well field areas will be fenced as necessary to prevent livestock access, which will enhance the establishment of temporary vegetation.

5.5.2 Wildlife

Potential impacts to terrestrial species are discussed in Section 4.5 of this ER. The potential for impacts associated with construction, operation, aquifer restoration, and decommissioning activities will be minimized due to the relatively small area of surface disturbance within each project area and limited surface water. Given these factors and the limited use of the project areas by most vertebrate species of concern, impacts to those species are expected to be minimal. Nevertheless, regulatory guidelines and requirements designed to prevent or reduce impacts to wildlife will include one or more of the following, as addressed by the various regulating and permitting agencies:

- Use measures to control erosion, dust, and particulates that may affect ecological resources during construction, operation, aquifer restoration, and decommissioning;
- Use dust suppression measures to minimize wind and water erosion and aid recovery on disturbed areas;
- Conduct pre-construction surveys to evaluate changes in important ecological resources and habitats and to determine the reclamation potential of sites;
- Implement measures to relocate or avoid sensitive species if present;
- Collect data to plan to restore disturbed areas and minimize impacts to sensitive habitats before ground-disturbing activities;

- Phase construction to the extent practicable;
- Limit grading activities to the phase immediately under construction and limit ground disturbance to areas necessary for project-related construction activities;
- Construct power distribution lines following guidance in Avian Power Line Interaction Committee (2006);
- Revegetate with appropriate native species to minimize potential for invasive species; and
- Use weed control, as necessary.
- Discourage waterfowl from retention ponds by limiting bank vegetation, constructing ponds with steep embankments, using visual and sound devices to frighten birds, or placing wire screens over the water surface.
- Use fencing around wells fields, processing facilities, and retention ponds to deter wildlife.

Table 5.5-1 Permanent Seeding Mixtures Recommended by NRC Staff in CUP FEIS

	Northern Desert Plant Species[a] (sandy sites)	Pinyon/Juniper and Ponderosa Pine[a] (clay and loamy sites)
Western wheatgrass (Arriba)	3.0	3.0
Pubescent wheatgrass (Luna)	0.0	0.0
Fairway crested (Hycrest)	3.0	0.0
Fairway crested (Ephraim)	0.0	3.0
Slender wheatgrass (San Luis)	0.0	3.0
Alkali sacaton (Native Hachita)	2.0	0.0
Indian ricegrass (Paloma)	3.0	3.0
Galleta (Viva)	2.0	0.0
Sand dropseed (Native)	2.0	2.0
Blue grama (Lovington)	0.0	2.0
Sideoats grama	2.0	2.0
Fourwing saltbush	2.0	2.0
Scarlet globemallow (Native)	0.5	0.5
Lewis flax	0.0	0.5
Rocky mountain penstemon (Bandera)	0.5	0.0
Palmer penstemon (Cedar)	0.0	0.5
Total pounds per acre	**20.0**	**21.5**

[a] In pounds per acre.
Name in parenthesis () is the cultivar name.

5.6 Mitigation of Potential Air Quality Impacts

Potential impacts to air quality include non-radiological and radiological emissions. Non-radiological emissions are related to fugitive dust and gaseous emissions. Fugitive dust will be generated during each phase of the project as a result of land disturbing activities and operation of vehicles and equipment. Gaseous emissions will be released from vehicles and equipment and the processing facilities and well fields. Radiological emissions will be limited to radon gas released in small quantities from the well fields, processing facilities, and lined retention ponds. Mitigation measures to reduce or eliminate potential air quality impacts will include the following:

- Use of dust suppression such as water or magnesium chloride;
- Promptly revegetate disturbed areas and stockpiles;
- Ensure that diesel-powered equipment is equipped with best available control technology (BACT), properly tuned and maintained, and does not idle unnecessarily;
- Use pressurized, down-flow IX columns, pressure piping, and modern vacuum dryers to limit radon gas emissions and eliminate radiological particulate emissions; and
- Ensure that the vacuum dryer is operated according to manufacturer recommendations and equipped with audible alarms (LC 10.9 of SUA-1580).

5.7 Mitigation of Potential Noise Impacts

As a result of the remote location of the project areas and the low population density of the surrounding area, noise impacts are expected to be SMALL. As discussed in Section 4.7 of this ER, the major noise sources will occur from construction/drilling in the well fields and truck traffic during operation.

To minimize noise disturbance HRI will coordinate drilling activities to recognize that the tolerance for noise typically decreases at night. HRI will restrict construction activities, when possible, to daytime hours (8 a.m. to 8 p.m.) in areas where the annoyance noise threshold could be exceeded at nearby residences. HRI also will limit noise impacts in sensitive areas by limiting use of equipment with loud engines, unrestricted exhaust systems, and engine brakes.

HRI will implement a hearing conservation program to ensure that proper PPE is worn and engineering controls are in place to protect workers from potentially damaging noise. Any employee working at the drilling or construction site will be required to wear hearing protection.

5.8 Mitigation of Potential Historical and Cultural Resources Impacts

Historic and cultural resource protection within the project areas is an important aspect of the CUP. As stated in Sections 3.8 and 4.8 of this ER, the NHPA process has been completed for the areas included in HRI's 5-year disturbance plan (Church Rock Sections 8 and 17 and Crownpoint Section 24). SUA-1580 includes a license condition (LC 9.12) to address unanticipated discovery of historic and cultural resources as described in Section 3.8.

Mitigation measures that will be implemented at the CUP to minimize potential impacts to historic and cultural resources include the following:

- Avoidance, where practical, of all cultural resources;
- Consultation/communication with SHPO and appropriate THPOs;
- Adherence to license conditions and conditions stipulated in NRC's NHPA conclusion letters (Section 3.8 of this ER);
- HRI will employ a full-time archaeologist that will oversee all construction activities within the CUP;
- HRI will finalize a CRMP for all project areas pursuant to the NHPA Section 106 review and consultation process. The plan will provide specific procedures for implementation of HRI's policy of avoiding cultural resources. The plan will include archaeological and TCP surveys of all project areas, identification of protection areas where land disturbing activities will be prohibited, archaeological testing (by an archaeologist contracted by HRI and holding permits from the Navajo Nation and the State of New Mexico, as appropriate) before subsurface disturbance occurs at a specific location, and archaeological monitoring during all land disturbing activities; and
- Any work resulting in the discovery of previously unidentified cultural resources or human remains will cease. The artifacts will be inventoried and evaluated in accordance with 36 CFR Part 800, and no disturbance will occur until written authorization in received by the SHPO and appropriate THPOs.
- Historic and cultural resources that cannot be avoided will undergo data recovery and mitigation prior to land disturbing activities. HRI will work with the Museum of New Mexico Office of Archaeological Studies to develop the data recovery plan.

5.9 Mitigation of Potential Visual and Scenic Resources Impacts

Potential visual and scenic resources impacts are discussed in Section 4.9 of this ER. Operation of the CUP will increase industrial activity in the area. As discussed below, HRI will implement mitigation measures to reduce the visual effects of the well fields, processing facilities, access roads, and drill rigs during all phases of development.

Within the well fields, all production, injection, and monitor wells will be equipped with wellhead covers. The wellhead covers will be approximately 1 m [3 ft] tall. HRI will choose a neutral color for the wellhead covers to further screen the locations. When aquifer restoration is complete and regulatory approval is granted in specific well fields, HRI will reclaim and reseed those areas, which will minimize visual impacts and reduce the industrial look of the area.

Facilities such as processing plants, offices and the maintenance buildings will be at one central location at each project area (Church Rock Sections 8 and 17 project areas will share one processing facility). Centralization will minimize the area devoted to industrial use. The buildings will be painted a neutral color that will blend in with the existing terrain. Roads constructed to access the facilities and well fields will blend with the terrain, and existing roads will be used where possible.

Proper lighting techniques will reduce potential light impacts from both continuous and intermittent sources. HRI will minimize these potential impacts by implementing protection and mitigation measures at the site that are anticipated to include the following:

- Designing lighting plans with an emphasis on the minimum lighting requirements yet fully assuring operations, safety, environmental protection, and security;
- Utilizing light sources of minimum intensity (measured in lumens) necessary to accomplish the light's purpose;
- Specifying lighting fixtures that direct light to only where it is needed (shine down, not out or up) in conjunction with shielding that directs the light to the work area;
- Turning lights off when not needed using timers, occupancy sensors, or manually, as discussed at the proposed intermittent light locations;
- Adjusting the type of lights used so that the light waves emitted are those that are less likely to cause light pollution problems such as high pressure sodium lamps;
- Fitting building windows with shades, where appropriate, to block light emissions, including the processing facilities; and
- Utilizing screens (i.e., placing facilities to take advantage of topography, shutter systems on buildings, and other man-made structures) to reduce perceptible light.

Dust will be minimized by using dust suppression, such as water or magnesium chloride.

5.10 Mitigation of Potential Socioeconomics Impacts

Potential socioeconomic impacts related to the proposed project area are discussed in Section 4.10 of this ER and will primarily be positive. The CUP will result in increased revenues for the State of New Mexico, McKinley County, the Navajo Nation, and local businesses. Project implementation also will result in increased employment in the area. In addition to the additional tax base afforded by the project, HRI also will implement mitigation measures to enhance the potential for positive socioeconomic impacts. Mitigation measures will include purchasing materials from local vendors, as appropriate, and hiring local employees and contractors to the extent practicable.

5.11 Mitigation of Potential Environmental Justice Impacts

Environmental justice means that people of all races, cultures, and incomes are treated fairly with regard to the development and implementation (or lack thereof) of environmental laws, regulations, and policies. Executive Order 12898 makes it clear that environmental justice matters apply to programs involving Native Americans (CEQ 1997). Because the population near the project areas is made up almost entirely of Native Americans, many of whom live in poverty, any significant adverse environmental impact resulting from the project will be an environmental justice impact.

Potential environmental justice impacts related to the proposed project areas are discussed in Section 4.11. The greatest potential environmental justice impacts are associated with land use, transportation, water resources, ecology, socioeconomics, and public occupational health and safety.

The mitigation measures for these individual resources are included in this chapter. HRI will implement the mitigation measures included in these sections to reduce or eliminate potential environmental justice impacts during the construction, operation, aquifer restoration, and decommissioning phases. In addition, HRI will implement the NRC staff recommendations described in Section 4.11 of this ER.

The environmental justice of the CUP was litigated as part of Phase 1 in 1999. As part of the litigation, the Intervenors attempted to show that serious environmental costs would be imposed on the communities of Church Rock and Crownpoint from the CUP. The ASLB Presiding Officer concluded that based on the information presented in the CUP FEIS and a recent site visit to the Church Rock Section 8 project area, there will be no serious adverse impact on the environmental justice population (LBP-99-30).

5.12 Mitigation of Potential Impacts to Public and Occupational Health and Safety

Section 4.12 of this ER describes the potential impacts to public and occupational health and safety. Mitigation measures to minimize potential impacts include:

- Use of fencing to restrict access to the well fields, processing facilities, and retention ponds throughout the duration of the project.
- Use of ventilation to keep radon levels ALARA;
- Use of pressurized, down-flow IX columns;
- Use of vacuum dryers, bag filters, and vapor filtration system to minimize or eliminate particulate emissions during yellowcake drying;
- Use of high-efficiency particulate air filters or similar air particulate controls;
- Use of audible alarms on pipeline and processing equipment to alert of upset conditions;
- Use of dust suppression such as water or magnesium chloride;
- Designing task procedures to reduce potential accidents;
- Section 10 of SUA-1580 provides requirements HRI will implement to minimize radiation exposure during ISR operations;
- As required by LC 9.8 of SUA-1580, HRI will institute SOPs that will establish emergency procedures to manage accidents and minimize any radiation exposure resulting from accidents, if they occur. Additional measures will be in place to protect workers and members of the public. Employee personnel dosimetry programs will be required. As part of worker protection, respiratory protection programs will be in place as well as bioassay programs that detect uranium intake in employees. Contamination control programs involve surveying personnel, clothing, and equipment prior to their removal to an unrestricted area;
- HRI will provide training for local first responders/emergency response personnel regarding procedures for response to potential accidents; and
- Designing adequate spill containment and leak detection systems, training employees on monitoring procedures for process parameters and recognizing potential upset conditions before leaks or spills occur, training employees on inspection procedures for spill control BMPs in the SWPPP, frequently inspecting waste management systems and effluent control systems, and training employees in spill detection, containment and cleanup procedures.

5.13 Mitigation of Potential Waste Management Impacts

Section 4.13 of this ER describes the anticipated quantities, proposed waste management systems, and potential impacts resulting from the management of AEA-regulated and non-AEA regulated liquid and solid waste. This section describes measures to waste management impacts.

5.13.1 AEA-Regulated Waste

Brine will be generated from RO treatment of the process bleed and RO treatment of the aquifer restoration water. Brine will be disposed in lined retention ponds or injected into Class I deep disposal wells, as discussed in Section 4.12 of this ER. Lined retention ponds will be designed, constructed, and inspected in accordance with NRC Regulatory Guide 3.11 and LC 10.26 of SUA-1580. The residue from the retention ponds will be disposed as 11e.(2) byproduct material.

Potential impacts of brine disposal will be mitigated by reducing the amount of brine produced. This will be done by employing two stages of RO. The brine from the first stage of production and restoration RO will be further treated in a second stage. In addition, HRI is evaluating the use of HERO units that would further reduce the brine volume requiring disposal. The use of brine concentrators could also reduce the volume of brine requiring disposal. Typically, for each 379 L [100 gal] of brine treated, 375 L [99 gal] of distilled water and 3.8 L [1 gal] of solid 11e(2) byproduct material are formed.

Product water from the RO units will be injected into the well field, recycled to the processing facilities as make-up water, or injected into Class I deep disposal wells. Product water management and disposal will be mitigated by minimizing the amount of excess product water produced. By using HERO units, and brine concentrators, HRI will maximize product water production and minimize brine production. Excess product water will be minimized by recycling the product water to the processing facilities and well fields.

Potential impacts from AEA-regulated solid waste will be mitigated by minimizing the amount of material through process design, decontamination, and volume reduction during decommissioning. Where possible, equipment and building surfaces will be decontaminated for unrestricted release.

5.13.2 Non-AEA-Regulated Waste

Non-AEA-regulated waste is discussed in Section 4.13 and includes solid waste, hazardous waste, used oil, TENORM, and domestic sewage. The following discusses the mitigation measures that will be used to reduce or eliminate potential impacts associated with waste management.

Potential impacts from solid waste will be mitigated by recycling to minimizing the amount of waste produced. Recyclable materials that will be taken to approved municipal landfills could include newspaper, magazines, phone books, cardboard, aluminum and steel cans, and plastic.

HRI will mitigate any potential impacts from hazardous waste and used oil by minimizing the amount of hazardous waste and used oil generated at the CUP. This will be done by servicing vehicles and equipment at off-site facilities and by limiting the volume of cleaners and degreasers.

TENORM will be mitigated by minimizing the quantity of drilling fluids. Other mitigation measures that will minimize potential impacts from TENORM waste disposal include backfilling, restoring and reseeding mud pits, typically within a single construction season, using sediment control BMPs, avoiding construction in areas with previously identified, potentially NRHP-eligible cultural sites, and stopping work if any previously undiscovered cultural resources are encountered during construction or reclamation of mud pits. Mud pits will be included in the decommissioning gamma surveys to ensure that there are no potential long-term impacts from radioactivity in mud pits.

Potential impacts from domestic sewage will be mitigated by complying with NMED standards for designing septic tank/leach field systems and performing routine maintenance such as septic tank pumping when needed and leach field inspection for ponding.

6.0 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

This chapter describes HRI's environmental measurement and monitoring programs for the CUP. In accordance with NUREG-1748 the following sections discuss radiological monitoring and physiochemical monitoring. In addition, historic and cultural resources monitoring also is discussed. The information presented in this chapter reflects commitments made in the COP, some but not all of which were included in the CUP FEIS.

6.1 Radiological Monitoring

The following describes the radiological monitoring program for the CUP. The purpose of this program is to ensure the health and safety of the public and to maintain worker ALARA by characterizing and evaluating the radiological environment and identifying exposure principal radiation pathways.

This operational radiological monitoring program is based on the recommendations of NRC Regulatory Guide 4.14, 4.15, and 8.37 to meet the requirements of 10 CFR 20 and 10 CFR 40. HRI will not commence operations until NRC has reviewed and approved of the environmental monitoring plan. The plan will indicate SOPs such as sampling methods and equipment, analytical procedures, and lower limits of detection. The plan will also indicate proposed environmental monitoring locations based on "as built" construction, and provide the rational for their selection. The approved NRC monitoring plan will form the basis for HRI's operational SOP which will describe the details of the environmental monitoring program. A summary of the major elements of the operational environmental monitoring program is presented in Table 6.1-1.

6.1.1 Radiation Monitoring

6.1.1.1 Ambient Monitoring

The operational airborne radiation monitoring program will consist of five stations at each project area: one station upwind of the processing facilities, two stations downwind of the processing facilities, and at the nearest residence or occupied structure within 10 km [6 mi] of the processing facilities, and one control. Each station will be equipped with passive gamma and radon monitoring devices. One sample will be collected at each station per quarter and results will be documented and maintained on site.

6.1.1.2 In-Plant Monitoring

As described in Section 2.1.2 of this ER, the Crownpoint, Unit 1, and Church Rock Sections 8 and 17 project areas will include satellite facilities that will load uranium onto resin. The loaded resin will be transported to either the CCP or licensed production facilities in Texas for drying and processing into yellowcake. Within the facilities, the exposure to uranium particulates is expected to be low. Nonetheless, HRI will conduct air monitoring within the facilities. As part of the in-plant monitoring program, HRI will monitor gamma, radon decay products, alpha releases, and uranium. Conceptual locations for the monitors in the CCP and satellite facilities are depicted on Figures 6.1-1 and 6.1-2, respectively.

The drying and packaging areas within the CCP will be monitored continuously for airborne uranium particulates. During drying and packaging activities the filters of the continuous air monitors will be changed and analyzed every several days. During periods of intermittent drying, the filters will be exchanged and analyzed for the period of batch operation. In addition to the continuous samplers, breathing zone samplers will be utilized when workers have the potential to be exposed to airborne uranium particulates.

The processing facilities also will be monitored for radon decay products on a monthly basis. The measurements will be made in locations, and at times, when there is potential for the release of radon or radon decay products. In addition to the monitors, the in-plant area will be subjected to the surveys summarized in Table 6.1-2.

6.1.2 External Radiation Monitoring Program

The external radiation monitoring program will ensure the safety of workers and the public. This program is discussed in Section 9.6.1 of the COP. As part of the external radiation monitoring program all personnel will be issued personal monitoring devices such as TLDs for at least the first year of operations. The badges will be analyzed on at least a quarterly basis by a vendor and the results will be reported to the NRC. Following the first year of operations, the data will be analyzed to determine if exposures exceeded the 5 mSv [500 mrem] administrative action limit. If it determined after the first year of operation that the annual dose to workers at assigned locations is less than 10% of the 0.05 Sv [5 rem] annual limit (10 CFR § 20.1201(a)) then the monitoring frequency will be reduced or eliminated at the discretion of the radiation safety officer (RSO).

HRI will perform quarterly surveys at specified locations throughout the processing facilities to ensure the “Radiation Areas” are properly identified. Radiation areas include areas measuring 0.05 to 1 mSv/hr [5 to 100 mrem/hr] at a distance of 30 cm [12 in] from the source.

6.1.3 Soils and Sediment Monitoring

During operation and aquifer restoration, soil and sediment samples will be collected on an annual basis. The samples will be collected from upstream and downstream surface waters passing through each project area as well as impoundments within the project areas and impoundments adjacent to the project areas subject to drainage. The samples will be analyzed for natural uranium and radium-226.

6.1.4 Surface and Groundwater Monitoring

The following discusses the HRI operational water monitoring program that will used to identify potential impacts to water resources in the area. Section 6.2 of this ER describes the physiochemical monitoring including excursion monitoring and monitoring associated with aquifer restoration.

6.1.4.1 Surface Water Monitoring

Quarterly samples will be collected from impoundments within the project areas and impoundments adjacent to the project areas subject to drainage and upstream and downstream of surface waters passing through each project area if water is present. The samples will be analyzed for dissolved and suspended natural uranium, total and soluble radium-226, thorium-230, polonium-210, and lead-210.

6.1.4.2 Groundwater Monitoring

During operation and aquifer restoration, existing water supply wells within a 2 km [1.2 mi] radius of the project areas will be sampled on a quarterly basis. The samples will be analyzed for dissolved and suspended natural uranium, radium-226, thorium-230, lead-210, polonium-210, gross alpha, and gross beta. Monitor wells within each of the project areas also will be analyzed as part of the physiochemical monitoring program discussed in Section 6.2 of this ER.

6.1.5 Vegetation Monitoring

During the grazing season, HRI will collect three separate samples from grazing areas near the processing facility (in the direction of the highest predicted radionuclides). The samples will be analyzed for radium-226 and lead-210.

6.1.6 Septic System Monitoring

Sludge in the septic tanks will be analyzed for natural uranium, radium-226, and lead-210 prior to removal and prior to requesting license termination. In addition, HRI will sample soil in the leach fields prior to requesting termination of the license. The soil samples will be analyzed for natural radium, radium-226, and lead-210.

Table 6.1-1. CUP Operational Environmental Monitoring Summary

Type of Sample	Number	Location	Method	Sample Frequency	Analysis Frequency	Type of Analysis
Air Radon Gas	5 (1 from each location)	One upwind and two downwind of the processing facilities, one at the nearest residence or occupied structure within 10 km of the processing facilities, one control	Continuous Trak Etch	Continuous	Quarterly	Rn-222
Process Fluids	2	Fortified groundwater trunk lines in and out of process. One from fortified groundwater intake and one from fortified groundwater outlet.	Grab	Quarterly	Quarterly	Rn-222
Groundwater – Existing Water Supply Wells	1 from each well	Potable, livestock, and irrigation water supply wells within 2 km of the project areas	Grab	Quarterly	Quarterly	Dissolved and suspended U-Nat, Ra-226, Th-230, Pb-210, Po-210, gross alpha, gross beta
Groundwater – Monitor Wells	1 from each well	As designated in NRC License and NMED Discharge Plan	Grab	Bi-monthly	Bi-monthly	EC, Cl, Dissolved U-Nat, HCO_3
Surface Water	1 from each impoundment and a minimum of two from each stream	Permanent impoundments and upstream and downstream in surface waters passing through the project areas; also adjacent impoundments subject to drainage from the project areas	Grab	Quarterly	Quarterly	Dissolved and suspended U-Nat, total and soluble Ra-226, Th-230, Po-210, Pb-210
Soil and Sediment	Same as surface water	At surface water sampling locations	Grab	Quarterly	Quarterly	U-Nat, Ra-226, Pb-210
Vegetation Forage	3	Grazing area near each processing facility in the direction of the highest predicted radionuclide values	Grab	Three times during grazing season	Each sample	Ra-226, Pb-210
Direct Radiation	5	At radon gas sampling locations	TLD	Continuous	Quarterly	γ exposure rate
Soil	1	Septic system leach field	Grab	Once	Prior to requesting termination of license	U-Nat, Ra-226, Pb-210
Sludge	1	Septic tank	Grab	Once	Prior to sludge removal from tank and prior to requesting termination of the license	U-Nat, Ra-226, Pb-210

Source: COP

Table 6.1-2. Summary of Survey Frequencies

Type of Survey	Type of Area	Survey Frequency	Lower Limit of Detection (LLD)
Yellowcake	Filter press, special maintenance involving high airborne concentrations of yellowcake	Monthly grab samples, extra breathing zone grab samples	$1x10^{-11}$ µCi/mL
	Dryer building, downwind of dryer building	Continuous	
Radon Decay Products	Scaffolding	Monthly grab samples	0.03 WL
External Radiation: Gamma	Throughout processing facilities	Quarterly	0.001 mSv/hr [0.1 mrem/hr]
Surface Contamination	Yellowcake areas	Daily	Visual
	Eating rooms, change rooms, control rooms, offices	Monthly	5,000 dpm alpha per 100 cm^2
Skin and Personal Clothing	Yellowcake workers who shower, non-yellowcake workers who do not shower	Each day before leaving	1,000 dpm alpha per 100 cm^2
Equipment to Be Released	Equipment to be released that may be contaminated	Once before release	5,000 dpm alpha per 100 cm^2

Source: CUP

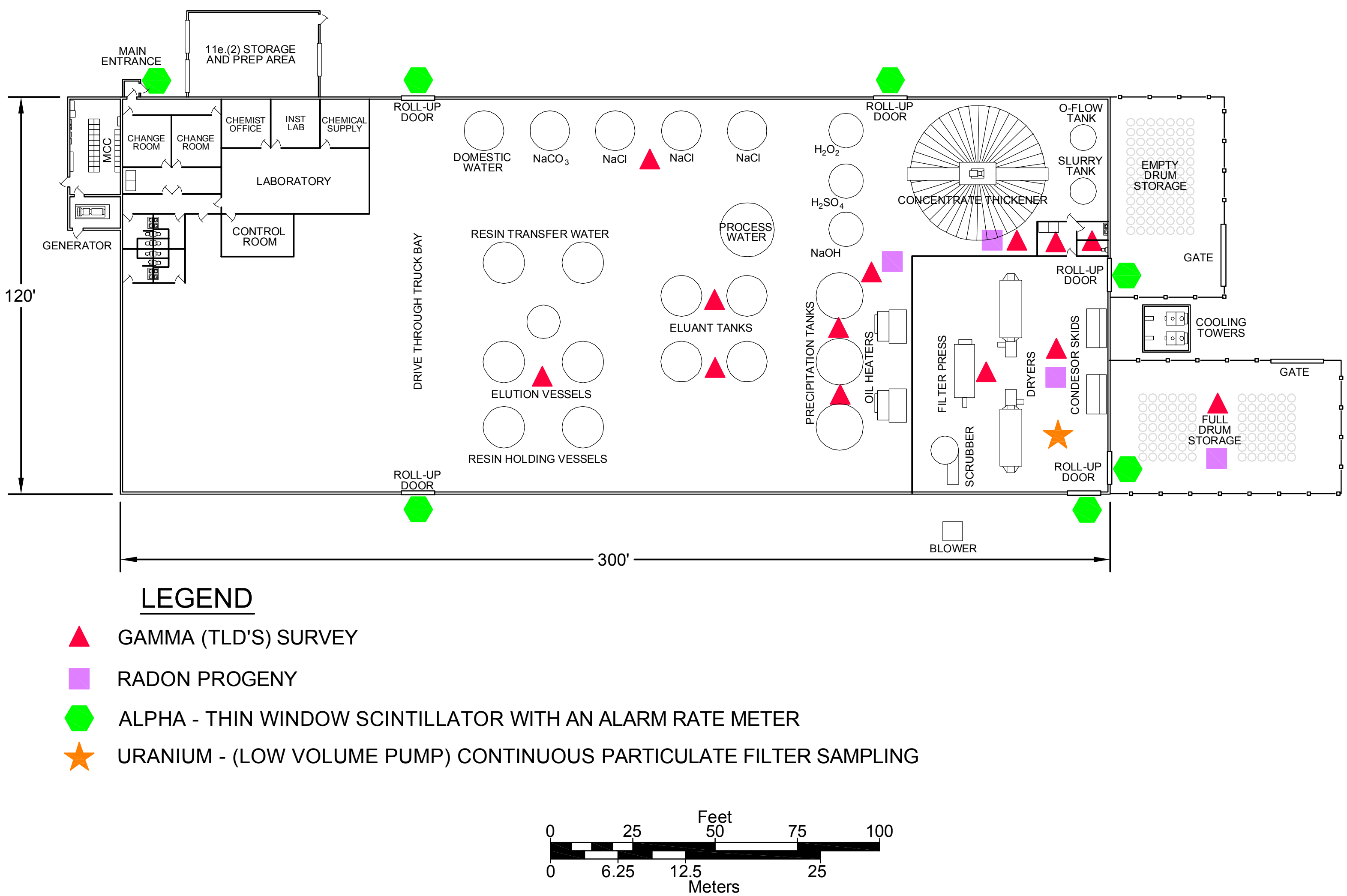

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Figure 6.1-1. Conceptual Operational Radiological Survey Plan at the CCP.

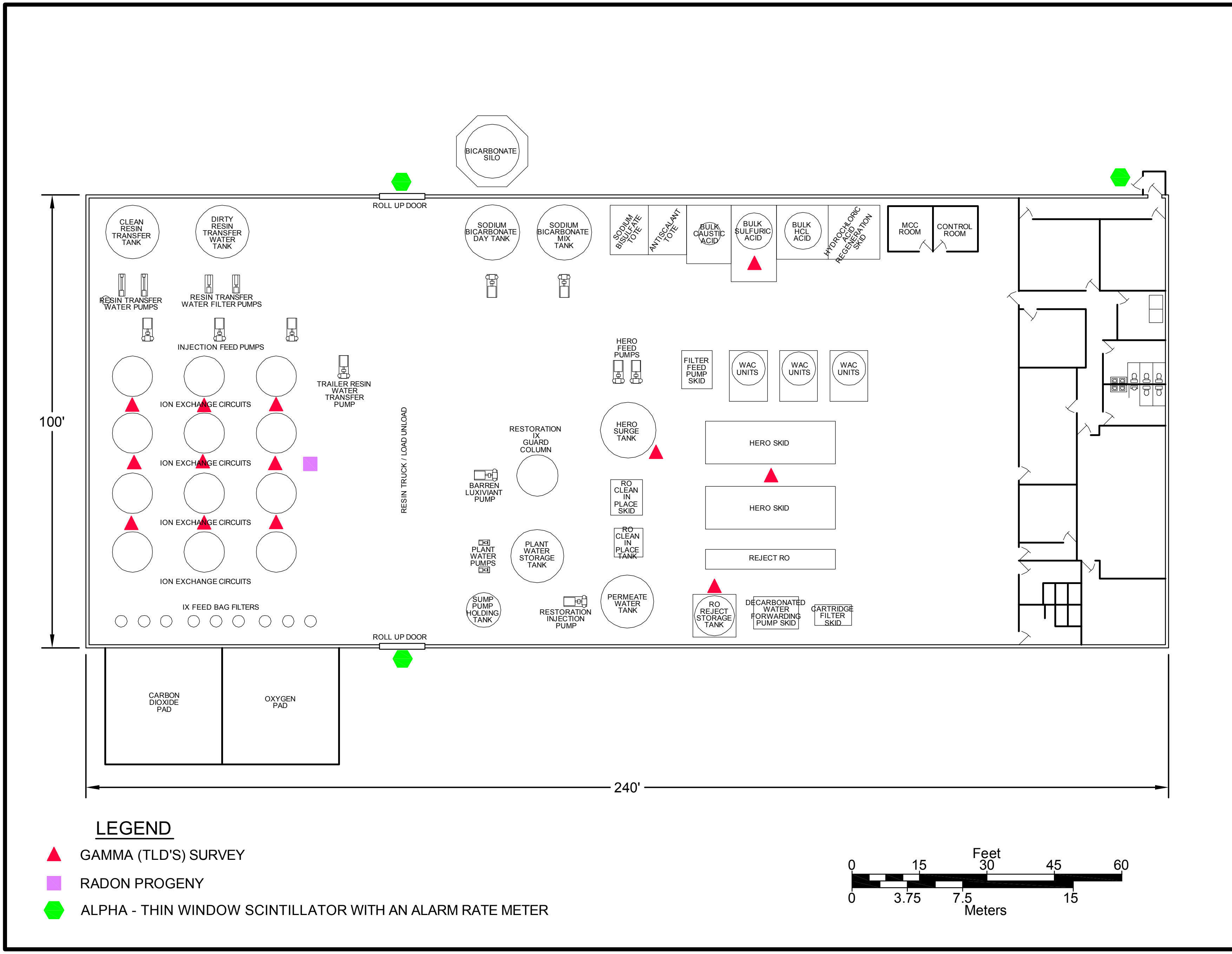

Figure 6.1-2. Conceptual Operational Radiological Survey Plan at the Satellite Facilities.

6.2 Physiochemical Monitoring

This section summarizes HRI's physiochemical monitoring program, which is discussed in Section 4.3.1 of the CUP FEIS and Section 8.0 of the COP. The monitoring program will be used to establish baseline conditions and to assist HRI in identifying unintended or unexpected events (excursions or leaks/spills).

6.2.1 Baseline Physiochemical Monitoring

6.2.1.1 Groundwater Monitoring

Prior to operations HRI will implement a groundwater monitoring program to determine UCLs for identifying excursions and to define the aquifer restoration goals. All wells used as part of the groundwater monitoring program will pass MIT described in Section 2.1.2 of this ER. Selected wells will be monitored for water level and sampled for certain water quality COCs on a regular basis to ensure that the injected fortified groundwater stays within the defined production zone. Locations of monitor wells will be chosen to maximize detection of potential excursions of recovery solution migration outside the production zone. Thus, with routine water quality determinations from monitor wells, early detection of this migration will be possible, allowing prompt remedial action and excursion prevention.

Production zone monitor wells will be completed in the ore-bearing aquifer, encircling each well field at a distance of no more than 122 m [400 ft] from the peripheral production or injection wells, and at spacing of not more than 122 m [400 ft] apart. The angle formed by lines drawn from any production well to the two nearest monitor wells will not be greater than 75 degrees. This spacing was originally determined through practical experience to locate monitor wells near enough to the operational areas to prevent broad areas of potential solution contamination, yet beyond the normal extent of the radially transported fortified groundwater.

In the Church Rock Sections 8 and 17 project areas, monitor wells will be located by treating historical mine workings like they were injection or production wells. Therefore, monitor wells will encircle each well field at a distance of 122 m [400 ft] from the edge of the production wells, injection wells, or mine workings, and will be spaced no more than 122 m [400 ft] apart. The angle formed by lines drawn from any production well, injection well, or mine working to the two nearest monitor wells will not be greater than 75 degrees. This will ensure that the detection of potential horizontal excursions will not be influenced by the presence of the mine workings.

Shallow monitor wells, or non-production zone monitor wells, will be completed in the aquifers overlying the production zone. These wells will be located in the first overlying aquifer at a minimum of one well per every 1.6 ha [4 ac] of production wells. If a second overlying aquifer is identified, and evaluation of the thickness and integrity of the intervening aquitard will conservatively require its monitoring, then wells will be spaced in the second overlying aquifer at one well per 3.2 ha [8 ac] of production wells. LC 10.25 of SUA-1580 requires HRI to construct monitor wells in the underlying Cow Springs aquifer if there is a vertical connection to the Westwater Canyon aquifer. The monitor wells will be at a minimum density of one well per 4 acres.

LC 10.21 and 10.22 of SUA-1580 specify the collection and analysis requirements for establishing aquifer restoration goals and UCLs, respectively. The following summarizes these license conditions.

LC 10.21 of SUA-1580 requires HRI to establish aquifer restoration goals by analyzing three independently collected samples of formation water from: (1) each monitor well in the well field and (2) a minimum of one production/injection well per acre of well field. Individual well samples will be collected at a minimum of 14 days apart and analyzed for the constituents listed in Table 6.2-1. The restoration goal for each of the constituents will be established by calculating the baseline mean of the data collected. The primary restoration goal will be to restore groundwater to groundwater protections standards contained in Criterion 5(B)(5) on a constituent-by-constituent basis using BPT. If the restoration activities are unable to achieve the background or MCL, whichever is greater, in Criterion 5(B)(5), HRI will return water quality to the maximum concentration limits as specified in Section 20.6.2.3103 NMAC or 40 CFR § 141.62 or 143.3.

As required by LC 10.22 of SUA-1580 HRI will use chloride, bicarbonate, and conductivity as excursion indicators. The concentrations of these will be established for each well field by calculating the baseline mean of the UCL constituent concentration and adding five standard deviations.

HRI is committed to using EPA's "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Guidance" for the treatment of outliers. However, with uranium ISR facilities a known local anomaly is present in the rock (uranium mineralization, which is lognormally distributed).

HRI believes the normal distribution should be validated with additional statistical analysis. To check reasonableness, HRI will utilize ProUCL 4.00.04 (Singh et al. 2009), an EPA-sponsored statistical program suited for this purpose. It is a comprehensive statistical software package equipped with statistical methods and graphical tools needed to address environmental sampling and statistical issues described in various CERCLA and RCRA guidance documents. ProUCL first determines if the data for a given constituent follow a normal, gamma, or logarithmic distribution. If the data follow one of these statistical distributions, a relevant UTL may be calculated. If the data follow no discernible distribution a non-parametric UTL is calculated. In the case of data with non-detects, the Kaplan-Meier non-parametric method is used. With the ProUCL validation of data, HRI will work with regulatory authorities to determine if more reasonable baseline values such as those prescribed by a UTL calculation are appropriate for the purpose of establishing UCLs and TRVs.

6.2.2 Operational Physiochemical Monitoring

6.2.2.1 Groundwater Monitoring

6.2.2.1.1 Excursion Monitoring and UCLs

During operation and aquifer restoration, HRI will implement a groundwater monitoring program to detect potential excursions. Two samples per month will be collected from the monitor wells and analyzed for conductivity, chloride, and bicarbonate.

A possible excursion will be declared if any two excursion indicators in any monitor well exceed a UCL value or a single excursion indicator exceeds the UCL by 20% as required by LC 10.12 of SUA-1580. A verification sample will be collected within 24 hours after the initial results are received. If the second sample does not indicate that UCLs have been exceeded a third sample will be collected within 48 hours after results from the second sample are received. If neither the second nor third sample results indicate UCLs are exceeded, the first sample will be considered in error. If the second or third samples indicate that UCLs are exceeded the excursion is confirmed. Section 8.7.2 of the COP discusses the corrective action procedures for an excursion. As required in LC 10.13 of SUA-1580, in the event that an excursion is not corrected within 60 days of confirmation, injection in the vicinity of the monitor well will be terminated until aquifer restoration is complete, or an increase (agreeable by NRC) in the financial assurance will be arranged to cover the cost of correcting the excursion.

In the event of a confirmed excursion per LC 12.1 of SUA-1580, HRI will notify the EPA or NMED and NRC by phone within 24 hours and by letter within 7 days. A written report also will be submitted to the NRC within 60 days of the excursion confirmation describing the excursion event, corrective actions taken, and the corrective action results. If a well is still on excursion status when the report is submitted, the report also will contain a schedule for submitting additional reports to the NRC describing the excursion event, corrective action taken, and the results obtained. In the case of a confirmed vertical excursion, the report also will include a projected completion date for characterization of the extent of the vertical excursion.

In the event of a vertical excursion in the Dakota Sandstone at the Crownpoint or Unit 1 project areas, HRI will sample the monitor wells to determine if any other overlying aquifers (sustaining yields greater than 570 Lpd [150 gpd]) have been impacted (LC 10.14 of SUA-1580). The specific aquifers to be monitored will be identified in the 60-day excursion report.

6.2.2.1.2 Aquifer Restoration Monitoring

Aquifer restoration will be completed in two phases: active restoration and stability monitoring. During active restoration HRI will collect weekly samples from the composite production line to be analyzed for conductivity and uranium. When the data indicate that restoration is at or near completion, the baseline wells will be sampled and analyzed for calcium, bicarbonate, sodium, sulfate, chloride, conductivity, and uranium. Active aquifer restoration will be complete when the well field average values for each COC are consistent with the groundwater target goals discussed in Section 2.1.3.5 of this ER.

Stability monitoring will consist of collecting four sample sets at 3-month intervals from the original baseline wells. The samples will be analyzed for COCs listed in Table 6.2-1. Following successful stability monitoring, HRI will submit a final restoration report to the NMED and NRC for final approval.

6.2.2.2 Lined Retention Pond Leak Detection Monitoring

Each retention ponds will be equipped with a leak detection system and inspected on a daily basis for leakage. Fluid levels greater than 15 cm [6 in] found in the leak detection system will be cause for immediate corrective action, including immediately notifying the NRC and other agencies.

LC 10.5 of SUA-1580 requires daily measurement and documentation of pond freeboard and fluid levels in the leak detection system. If fluid levels exceed 15 cm [6 in] in the leak detection sumps a sample will be collected and analyzed for specific conductance and chloride. If concentrations are elevated, repairs will be initiated and HRI will analyze standpipe water quality for specific conductance and chloride once every 7 days during the leak period and once every 7 days for at least 14 days following repairs.

Table 6.2-1. Constituents List for Baseline Water Quality Analysis and Primary and Secondary Restoration Goals

Constituent	Units	LLD[1]	Primary Restoration Goal	Secondary Restoration Goal[1]
Alkalinity	mg/L	1	WF AVG	WF AVG
Ammonium	mg/L	0.01	WF AVG	10.0
Arsenic	mg/L	0.001	WF AVG	0.05
Barium	mg/L	0.01	WF AVG	1[2]
Bicarbonate	mg/L	1	WF AVG	WF AVG
Boron	mg/L	0.01	WF AVG	WF AVG
Cadmium	mg/L	0.001	WF AVG	0.01
Calcium	mg/L	0.001	WF AVG	WF AVG
Carbonate	mg/L	1	WF AVG	WF AVG
Chloride	mg/L	1	WF AVG	250
Chromium	mg/L	0.001	WF AVG	0.05
Copper	mg/L	0.001	WF AVG	1
Electrical Conductivity	µmho/cm	1	WF AVG	WF AVG
Fluoride	mg/L	0.01	WF AVG	2[2]
Gross Alpha	pCi/L	0.1	WF AVG	15
Iron	mg/L	0.01	WF AVG	0.3
Lead	mg/L	0.01	WF AVG	0.05
Magnesium	mg/L	0.001	WF AVG	WF AVG
Manganese	mg/L	0.001	WF AVG	0.05
Mercury	mg/L	0.0001	WF AVG	0.002
Molybdenum	mg/L	0.01	WF AVG	WF AVG
Nickel	mg/L	0.01	WF AVG	0.1
Nitrate	mg/L	0.01	WF AVG	10
pH	s.u.	0-14	WF AVG	6.5-8.5
Potassium	mg/L	0.01	WF AVG	WF AVG
Radium-226 and 228	pCi/L	0.1	WF AVG	5
Selenium	mg/L	0.001	WF AVG	0.05
Silver	mg/L	0.001	WF AVG	WF AVG
Sodium	mg/L	0.001	WF AVG	WF AVG
Sulfate	mg/L	1	WF AVG	250
TDS	mg/L	1	WF AVG	500
Uranium	mg/L	0.001	WF AVG	0.030[3]
Vanadium	mg/L	0.1	WF AVG	WF AVG
Zinc	mg/L	0.001	WF AVG	5

WF AVG – well field arithmetic average
1 – LLD may vary depending upon the laboratory used.
2 – 40 CFR § 141.62 or 143.3 unless otherwise noted
3 –10 CFR Part 20, Appendix B, Table 2

6.3 Historical and Cultural Resources Monitoring

Mitigation measures for historic and cultural resources are discussed in Section 5.8 of this ER. Prior to engaging in any land disturbing activities, HRI will finalize a CRMP to address cultural resources within the project areas pursuant to the NHPA Section 106 review and consultation process. The plan will include archaeological and traditional cultural property surveys of all project areas, identification of protection areas where human activity will be prohibited, archaeological testing (by an archaeologist contracted to HRI and holding permits from the Navajo Nation and the State of New Mexico as appropriate) before subsurface disturbance occurs at a specific location. The plan will be provided to local tribes for review and consultation. Archaeological monitoring will be employed during all ground disturbing construction, drilling, and operation activities. In the event that previously unidentified cultural resources or human remains are discovered during project activities, the activity in the area will cease, appropriate protective action and consultation (SHPO and THPO's) will be conducted, and if indicated, the artifacts or human remains will be evaluated for their significance.

7.0 COST-BENEFIT ANALYSIS

Potential costs and benefits of the proposed project are discussed in the CUP FEIS (Chapter 5). The CUP will be a private venture and, as such, will not have a direct public purpose. However, because the project has potential to provide a domestic source of uranium that will eventually be used in nuclear reactors to generate electricity, it will have a public benefit. The NRC recognizes that the viability of the domestic uranium industry is a Federal concern and that there is a public interest in the uranium supply. HRI will benefit from the revenues that will result from the sale of processed uranium. HRI's costs will include expenses for land, labor, and capital required to produce the uranium and comply with all environmental, safety, and other regulatory standards. As stated in the CUP FEIS, the benefits and costs that are internal to HRI are not subject to government regulation and are not assessed in this ER. The following sections describe the benefits and costs of the project for members of the local communities, local governments, and the State of New Mexico.

7.1 General

Section 5.0 of the CUP FEIS noted the large discrepancy between domestic production and purchasing of uranium, stating that in 1994 domestic uranium production was less than 5 million pounds, while uranium imports totaled more than 16 million kg [35 million lb] (CUP FEIS, p. 5-1). Domestic uranium production reached a low of about 0.7 million kg [1.6 million lb] in 2003 and increased to about 1.5 million kg [3.3 million lb] (a 106% increase) by 2010 (WNA 2012b). Owners and operators of U.S. civilian nuclear power reactors purchased a total of 25 million kg [55 million lb] of U_3O_8e (yellowcake equivalent) of deliveries from domestic and foreign suppliers during 2011, an 18% increase compared with the 2010 total of 21 million kg [47 million lb] U_3O_8e (EIA 2012b).

Nine percent of the U_3O_8e delivered in 2011 was U.S.-origin uranium at a weighted-average price of $52.12 per pound. Foreign-origin uranium accounted for the remaining 91% of deliveries at a weighted-average price of $55.98 per pound (EIA 2012b). The CUP, which will produce up to about 1.5 million kg [3 million lb] of uranium per year, will have the beneficial effect of helping the United States offset this deficit in domestic production.

The EIA published an early release of the Annual Energy Outlook 2012 (AEO2012) on January 23, 2012. Projections in the AEO2012 Reference case focus on the factors that shape U.S. energy markets in the long term, under the assumption that current laws and regulations remain generally unchanged throughout the projection period (2010 – 2035). The AEO2012 Reference case provides the basis for examination and discussion of energy market trends and serves as a starting point for analysis of potential changes in U.S. energy policies, rules, or regulations or potential technology breakthroughs. Some of the highlights in the AEO2012 Reference case are provided in the following paragraphs.

The rate of growth of energy use is projected to slow over the projection period, reflecting an extended economic recovery and increasing energy efficiency in end-use applications. Transportation energy demand is projected to grow at an annual rate of 0.2% from 2010 through 2035, and electricity demand by 0.8% per year. Energy consumption per capita is projected to decline by an average of 0.5% per year from 2010 to 2035. The energy intensity of the U.S. economy, measured as primary energy use in British thermal units (Btu) per dollar of gross domestic product (GDP) in 2005 dollars is projected to decline by 42% from 2010 to 2035.

Electricity generation from nuclear power plants is projected to grow by 11% in the AEO2012 Reference case, from 807 billion kWh in 2010 to 894 billion kWh in 2035, accounting for about 18% of total generation in 2030 (compared with 20% in 2010). Nuclear generating capacity is projected to increase from 101 gigawatts in 2010 to a high of 115 gigawatts in 2025, after which a few retirements will result in a decline to 112 gigawatts in 2035. AEO2012 incorporates new information about planned nuclear plant construction, as well as an updated estimate of the potential for capacity upgrades at existing units. A total of 10 gigawatts of new nuclear capacity is projected through 2035, as well as an increase of 7 gigawatts achieved from upgrades to existing nuclear units. About 6 gigawatts of existing nuclear capacity will be retired, primarily in the last few years of the projection, as not all owners of existing nuclear capacity apply for and receive license renewals to operate their plants beyond 60 years.

At the end of 2011, five U.S. uranium ISR facilities were operating with a combined capacity of 4.9 million kg [10.8 million lb] yellowcake per year (Crow Butte Operation in Nebraska; Alta Mesa Project and Hobson ISR Plant/La Palangana in Texas; Smith Ranch-Highland Operation and Willow Creek Project in Wyoming) (EIA 2012a). Kingsville Dome and Rosita ISL plants in Texas were on standby with a total capacity of 0.9 million kg [2.0 million lb] yellowcake per year. Nichols Ranch ISR Project was under construction in Wyoming. There are nine ISR facilities planned in Colorado, New Mexico, South Dakota, Texas, and Wyoming.

HRI has evaluated the costs and the benefits associated with uranium production in order to formulate the CUP. Because of increasing demand for uranium, associated price increase, and improved and tested technologies, HRI believes the benefits now outweigh the costs. Although the amount of yellowcake produced will depend on the market price and the cost of production, HRI anticipates producing up to approximately 1.5 million kg [3 million lb] of uranium per year. Based on current information and projections, the anticipated life of the CUP is about 24 years. Current demand/supply projections indicate that the price should remain adequate to support the CUP over that time frame.

7.2 Potential Economic Benefits

Monetary benefits will accrue to the community from the presence of the CUP, such as local expenditures of operating funds and the federal, state and local taxes paid by HRI. Against these monetary benefits are any potential monetary costs to the communities involved that will occur if the project requires new or expanded schools and other community services.

It is not possible to precisely quantify all the economic benefits and costs of the project for any one community because many of the benefits, such as tax revenues, depend upon prevailing market prices, which are subject to change due to unpredictable economic and political factors. This section discusses the potential economic impacts of the Proposed Action and compares these impacts to the No Action Alternative.

Uranium ISR methods have been improved over the years to increase efficiencies and minimize costs. The primary recovery method for uranium is now ISR rather than conventional surface or underground mining. ISR has lower operating costs and also reduces exposure of radioactive materials to the atmosphere.

7.2.1 Tax Revenues

Section 4.10 of this ER summarizes the potential tax revenues from the CUP. Future tax revenues are dependent on uranium prices which cannot be forecast with any accuracy; however, these taxes are also dependent on the number of pounds of uranium produced by HRI. To the extent that uranium prices remain approximately at current levels (spot market price was $52.00 per pound U_3O_8e on April 30, 2012 when this benefit-cost analysis was done). In 2011, owners and operators of U.S. civilian nuclear power reactors signed 79 new purchase contracts with deliveries in 2011 of 10 million pounds of U_3O_8e at a weighted-average price of $56.07 per pound. Seventy-seven were new spot contracts and two were new long-term contracts (EIA 2012b). Despite the Fukushima accident, the prospects for new worldwide reactor construction continue to be strong, with uranium requirements projected to rise by 70% between 2010 and 2031 (WNA 2012c). In order to provide an estimate of the tax revenues that might be generated by the CUP, the following assumptions were made:

- Production will average 0.5 million kg [1 million lb] yellowcake for a period of 20 years.
- Sales price will average $65 per pound for purposes of illustration;
- 65% of total production will be from “Indian country” and therefore subject to the Navajo Nation business activities tax. However, as shown in Section 4.10, employment of 27 or more members of the Navajo Nation, comprising less than 20% of the average workforce at CUP, will be enough to offset the business activities tax. Therefore it is assumed that deductions will more than offset the business activities tax.
- The mineral production will be in McKinley County, and the mill levy will remain constant at 31.567 mills.
- The production facilities and property will have an initial assessed valuation of $26.312 million, which will be depreciated over the life of the project as discussed in Section 4.10.1.1.2.

- The severance tax rate will be 3.5% and the assessed value will be one-half of the sales price.
- The New Mexico conservation tax will remain at 0.75% of 25% of taxable value of product sold.
- The New Mexico resources excise tax will remain at 0.75% of the value of the product sold.
- There will be State and Federal income taxes, but these will be based on net income and cannot be accurately predicted at this time.

Table 7.2-1 summarizes the major tax revenue streams for the CUP based on the assumptions listed above. Severance taxes and royalties will accrue to the State and will be distributed among the State and local agencies in accordance with established procedures, while the gross products and property taxes will be assessed and collected by McKinley County. The severance and gross products taxes and State royalties are based on the sales price of yellowcake and are likely to vary over the life of the project. These taxes will end when production ends. Property taxes should remain relatively constant over the project life after the initial depreciation period and will continue throughout production and well field restoration until the facilities are decommissioned and the area is reclaimed.

7.2.2 Employment

7.2.2.1 Construction Employment

As described in Section 4.10 of this ER, the CUP is expected to employ about 66 people during construction, and the duration of construction is expected to last 6 to 12 months for the facilities and infrastructure required to achieve the initial fully operational well fields in each project area. Some construction activities will occur throughout the operation phase as new well fields and associated infrastructure are built to replace the depleted well fields. Most of the construction employees are expected to come from the local labor force, since the total number of jobs is small relative to the number of unemployed workers in the local labor force and the required skill set fits well with skills and experience of the local labor force (construction of pre-engineered buildings, ponds, roads, pipelines and utility corridors and well field installation).

Salaries for the construction workers are expected to be about $70,000 per year including benefits, which is higher than median McKinley County median family income and higher than average manufacturing wages in McKinley County and the State (see Section 4.10.1 of this ER). This will be beneficial by reducing the local unemployment rate for the duration of each construction phase, and some of the workers will likely stay on through the operational phase. Assuming an average of around 66 workers during a 1-year construction period, and a per-capita wage of $70,000, the total annual payroll for construction will be about $4,620,000. This represents "new" money injected into the local economy. Payroll taxes will amount to around $400,000 per year. This level of employment is significant to the local economies. As described in Section 4.10 of this ER, there were 2,134 unemployed people in McKinley County in December 2011, representing an unemployment rate of 8.1%. In the Crownpoint Chapter, with an unemployment rate of around 26% and a labor force of around 917, these construction jobs could be a significant benefit.

7.2.2.2 Operation Employment

Approximately 75 employees will be hired for operations in each project area (see Section 4.10.1.1.2 in this ER). The level of employment will vary as each project transitions from construction through operations, restoration and decommissioning. Operations employment will average about 160 during much of the life of the CUP because project areas will be in operation simultaneously. At $70,000 per year including benefits, this represents an annual payroll of about $11.2 million. Payroll taxes will be about $1 million per year. HRI estimates that about 70% of the operations workforce will come from the local community.

7.2.2.3 Aquifer Restoration Employment

Aquifer restoration will be ongoing at each project area after each well field is depleted of economic reserves, and employment devoted to aquifer restoration will total about 10 employees at each project area. These people, and their salaries, are included in the average of 160 employees discussed in the previous section.

7.2.2.4 Decommissioning Employment

Employment during decommissioning at each project area will average about 22 persons. The duration of these activities will be 2 years or less at each project area and will commence after aquifer restoration has been completed in all well fields. For short periods and special cleanup projects there may be a need to hire additional contract employees, such as for waste disposal and surface reclamation. Salary levels would be about the same as for construction and operation employees.

Table 7.2-1. Estimated Major Tax Revenues from the CUP

	Tax Revenues	
Description	**Average per Year**	**Over 20 Years Production**
Property tax on production (0.031567 times taxable value)	$1,026,000	$20,520,000
Property tax on facilities (assumes 10-yr depreciation)	$248,600	$4,972,000
State severance taxes (3.5% on taxable value of production)	$1,140,000	$22,800,000
State conservation taxes (0.75% of 25% of taxable value)	$61,000	$1,220,000
State resources excise tax (0.75% of value of product sold)	$487,500	$9,750,000
Business activities tax (assumed offset by employment)	offset	offset
Total	$2,963,100	$59,262,000

7.3 Potential Benefits of the No Action Alternative

Under the No Action Alternative, the production and property taxes identified above will not be realized by the State and local governments. The uranium ore will remain in the ground and thus could be developed at a later date, but consideration of that alternative is not within the scope of this analysis. The employment and associated personal income and payroll taxes identified in the previous section will not occur under the No Action Alternative. It is possible that other jobs will be created in the region, but that speculation is not within the scope of this report. The lands on which the CUP would be created have historically been used for rangeland agriculture. No other potential uses for this property have been identified to date, so it is considered likely that these historical uses will continue to prevail if the CUP is not constructed.

7.4 Potential External Costs of the Project

7.4.1 Housing

As explained in Section 4.10 of this ER, the available housing resources in McKinley County are expected to be adequate to support the needs of the CUP during facility construction and operation. Considering the recent economic recession with its slow recovery and the ongoing decline in housing cost and demand, and the fact that the majority of the workforce will come from the local labor force, the CUP is not expected to create a significant housing demand in the area.

7.4.2 Noise and Congestion

HRI projects an increase in the noise and congestion in the immediate area of the CUP and well field during construction of the project areas. This will include truck and equipment traffic and access to the jobsite by construction workers. These impacts will be most noticeable to residents in the immediate vicinity of the project areas and will be temporary. As described in Section 3.7 of this ER, the project vicinity is sparsely populated. Background noise around the project areas is mostly from light automobile and truck traffic and will be comparable to noise levels in a quiet residential area. The region is predominantly rural and undeveloped. Rural areas tend to be quiet, open sagebrush-grass and forested areas where natural phenomena such as wind, rain, insects, birds, and other wildlife account for most natural background sounds. Baseline noise levels for typical undeveloped desert or arid environments range from day-night sound levels of 28 dBA on calm days to 44 dBA on windy days. During construction, truck traffic on local roads will increase but will be similar in intensity to historic noise sources. During operation, little noise will emanate from the processing facilities, which will be enclosed. Noise during construction will be associated primarily with the well drilling activities and ongoing installation of utility lines and pipelines to and from the well fields. The Crownpoint project area has the most residences close to the project area. Dust from construction activities will be controlled using dust suppression techniques such as water or magnesium chloride application.

7.4.3 Local Services

HRI plans to actively recruit and train local residents for positions at the project. As stated in Section 4.10 of this ER, it is expected that the majority of construction and operating positions at the CUP will be filled with local hires. As a result of using the local workforce, the impact on local services, including schools and medical facilities, will be small.

7.4.4 Potential Aesthetic Costs

Section 3.9 of this ER describes the existing visual resources of the project areas and surrounding areas. The relatively urban character of the Crownpoint area dominates the visual/scenic values at the Crownpoint project area. There also are low-intensity industrial sites. Because of widespread overgrazing, bare soil and erosion are commonplace. The Crownpoint project area is easily visible from the town of Crownpoint and from adjacent roads (NM 371 and Navajo 9).

Unit 1 is the most natural appearing of the project areas. The area is characterized by rolling, grass-covered hills used for livestock grazing, small arroyos, and scattered pinyon pines.

Because of widespread overgrazing, bare soil and erosion are commonplace (CUP FEIS). The Unit 1 project area is visible from the town of Crownpoint and from adjacent roads (Navajo 9 and Navajo 11).

The Church Rock Sections 8 and 17 project areas are characterized by a large, shallow, grassland valley between two large sandstone bluffs. Because of widespread overgrazing, bare soil and erosion are commonplace and there is evidence of past mining for uranium (a metal building and a concrete pad associated with the old underground mine) within the project boundary (CUP FEIS). The Church Rock Sections 8 and 17 project areas are visible from NM 556, which passes through the project areas.

The visual resources of all four project areas are in Class IV VRM areas, which means activities such as houses and other buildings attract attention and are a dominant feature of the landscape in terms of scale. The primary viewers of the project will be the Navajo residents living on or near the project areas. The surface structures proposed for the CUP include pre-engineered steel buildings housing the processing facilities, office/lab facilities and a warehouse; chemical storage vessels; wellhead covers; several small metering houses, retention ponds; and electrical distribution lines. The project will use existing and new roads to access each well field. Because of the relatively flat to rolling topography in the areas selected for placement of facilities, construction of roads, buildings and drill pads will require relatively minor amounts of earthwork.

Project development will alter the physical setting and visual quality of portions of the landscape, which will affect the overall landscape to some degree, as viewed from sensitive viewing areas. The proposed facilities will introduce new elements into the landscape and will alter the existing form, line, color, and texture that characterize the existing landscape. The project will primarily affect rangelands. In foreground-middleground views, the processing facilities, metering houses, wellhead covers, and water retention ponds will be the most obvious features of development. Access roads will be visible as light-tan exposed soils in geometrically-shaped areas with straight, linear edges that provide some textural and color contrasts with the surrounding rangeland. The processing facilities, metering houses, and wellhead covers will be painted to resemble the colors of the surrounding soil and vegetation cover. These facilities will be visible from local county roads, but will be subordinate to the rural landscape. During construction of the well fields, the most visible structures from any distance away will be the masts on the drill rigs, although these may or may not be visible from a distance depending upon whether the rig or the viewer is in an area of high or low relief. The electric distribution line poles will be an estimated 20 feet tall and will be located throughout the project areas to provide power to metering house and deep disposal wells. The distribution lines are similar in appearance to those typical of the rural landscape, but will occur at a higher density than on adjacent lands. The lines will be obvious to viewers at the viewing areas, but will not change the rural character of the existing landscape.

Following completion of each well, the mud pits will be backfilled and the land around the well will be graded to blend with surrounding topography and seeded to approved species. Wellhead covers will be low-profile and of neutral colors and will be difficult to discern in the landscape from any sensitive viewing area. Generally, color contrasts are most likely to be visible in the foreground-middleground distance zone; however, the wellhead covers will be an earthtone color that will harmonize with the surrounding vegetation and soil colors. Therefore, contrast of line, form, texture, and color will be low. The facilities will not be noticeable to the casual observer. Wellhead covers will be visually subordinate to the landscape in foreground-middleground distance zone. Any adverse changes in aesthetics at the proposed project area, such as increased noise, will be minimal due to the remoteness of the area, the nature of ISR operations, improved technologies, and required reclamation.

7.4.5 Land Access Restrictions

Lessees and allottees of land located within the controlled areas (well fields, processing facilities, and retention ponds) will lose access and free use of these areas during construction, operation, aquifer restoration, and decommissioning, as described in Section 4.1 of this ER. The areas impacted are all used for agricultural purposes. HRI will offset these land use restrictions by compensation through the relevant tribal (for tribal lands) or Federal agency (BIA for allottee lands).

Interference with other uses of the proposed project area will be limited due to the lack of development in the area and the reclamation requirements. For example, due to limited development of groundwater in the area to date, impacts to other water users outside the project areas will be minimal. To ensure that future users of the project areas are aware of the presence of abandoned wells, a deed notice of the well field locations will be required.

7.4.6 Most Affected Population

The expected impacts from the CUP will represent a totally new land use within what is currently a basically rural area. This represents a change for the few residents of the area, and the impacts of change, like those of noise, are based in part on the perception and attitude of the individual being affected. For the most part, the financial impact from operation of the CUP will be positive for McKinley County and the residents who will be directly or indirectly employed by the operation. With this project HRI could provide much-needed and well-compensated employment opportunities for the local population. HRI would adopt a policy of purchasing goods and services locally to the extent possible, in order to maximize the positive economic impact on a county facing economic challenges. Production tax collections and particularly the increase in local property taxes paid on the facilities and the production of uranium would have a significant economic impact on local government-provided services. Offsetting these positive impacts to the local population are increases in noise, congestion, and aesthetic impacts for residents in and adjacent to the CUP. Lessees or allottees with property in the project areas will have financial arrangements with HRI and will benefit economically from the presence of the CUP. Lessees, allottees, and landowners outside of the project areas will receive no direct financial benefits from the project.

7.4.7 Health and Environmental Costs

HRI proposes the CUP will provide the societal benefits described in Section 7.2 while knowing that health and environmental costs will be minimized by ISR operations. The health and environmental costs that were evaluated include:

- disturbance of soil and vegetation,

- disturbance to wildlife and wildlife habitat,
- disturbance to hydrogeology,
- use of groundwater,
- depletion of uranium resources,
- production of waste,
- potential exposure to radioactive material, and
- impacts on aesthetics.

Soil, vegetation, hydrology, existing land uses, wildlife, and wildlife habitat will be temporarily disturbed during the project. These resources were characterized during studies of the baseline conditions at the project areas, which are summarized in various parts of Chapter 3 of this ER. Potential impacts to these resources are described in Chapter 4 of this ER. The resources will be reclaimed to support the approved post-project land uses, which will be the same as the pre-project land uses, in accordance with applicable standards and regulations. Within the Crownpoint project area, land uses include rangeland, transportation, industrial and residential. The Unit 1 area is comprised of rangeland (grassland and shrubland) with several single family dwellings and minor roads. The majority of the Church Rock Sections 8 and 17 project areas is rangeland with small areas of industrial, residential and evergreen forest. Existing disturbance within the Church Rock Section 17 project area, includes the remnants of the OCRM (mine shafts, tailings ponds, and one building) and various unpaved roads.

Reclamation activities are described in more detail in Chapter 2 of this report. Because ISR operations are conducted in a series of well fields, which are installed, produced, and reclaimed sequentially, only portions of the project areas will be disturbed at a given time. Inherent to the license renewal, the uranium will be depleted. The uranium mineral will provide a source of fuel for producing electric power. Currently, the nation and the public are strongly supporting alternative sources of energy, including nuclear energy, to reduce dependence on foreign petroleum supplies and to reduce carbon emissions. The CUP will remove uranium, in a safe and controlled manner, from the geological formation in which it naturally occurs. By doing so, the radioactivity of the host rock associated with uranium will be reduced. This will help safeguard the health of humans and the environment that might otherwise be exposed to these ores in the future.

Groundwater will serve as the tool to recover uranium. Groundwater will be pumped from the production wells in the production zone; oxidized by the addition of fortified groundwater, reintroduced to the production zone through the injection wells; recovered from the production wells; treated at the processing facilities for removal of uranium; and circulated through this system again and again. Ultimately, the majority of the water will be treated to remove dissolved constituents and returned to the exempted aquifer containing the production zone. A fraction of the groundwater will be disposed as waste.

Various types of wastes will be produced from the CUP. These wastes may be categorized as AEA-regulated wastes and non-AEA-regulated wastes. Materials will be decontaminated or treated to reduce the volume of waste. AEA-regulated waste will be removed from the proposed project areas and disposed at an NRC-licensed facility or will be disposed in a UIC Class I well or retention ponds, depending on the type of waste, in accordance with current NRC regulations and license conditions. All other wastes also will be disposed according to applicable local, state, and federal regulations.

Potential exposures to radioactive materials were estimated using results from radiation surveys and the MILDOS-AREA model. Estimated public exposure to radioactive materials as a result of the CUP is negligible due to the remote location of the project areas, the nature of ISR operations, and the ore processing technologies. Occupational exposure will be maintained ALARA by providing the proper training, guidance, monitoring, engineering and administrative controls, and PPE to safely handle, store, decontaminate, and/or dispose waste materials.

7.5 Potential Internal Costs of the Project

Internal costs impact HRI and cover the construction, operation, aquifer restoration and decommissioning phases of the CUP. The primary internal costs will include:

- capital costs associated with obtaining claims and regulatory approvals, including permits, and environmental studies;
- capital costs of facility construction;
- operation and maintenance costs;
- costs of aquifer restoration;
- costs of facility decommissioning, including radiological decontamination; and
- costs of surface reclamation.

Internal costs are not typically made public for competitive reasons and are not subject to regulation, so they are not estimated in this ER. The estimated decommissioning costs for the CUP will be included in the annual financial assurance update submitted to NMED and the NRC for approval prior to construction activities. Each year, the cost estimate will be reviewed by the regulatory authorities based on total remaining aquifer restoration and decommissioning work, and adjustments will be made as necessary. Reclamation costs for the purpose of establishing the amount of the restoration and decommissioning performance bond will be made public once is has been approved by the regulators.

7.6 Cost-Benefit Summary

The benefit-cost summary for a fuel-cycle facility such as the CUP involves comparing the societal benefit of a reliable uranium supply, which will be used to provide energy, against possible local environmental costs, for some of which there may be no directly related compensation. For this project, there are basically three of these potentially uncompensated environmental costs:

- groundwater impact;
- radiological impact; and
- disturbance of the land.

The groundwater impact is considered to be temporary in nature, as aquifer restoration activities will restore the groundwater to pre-construction use suitability. As required by LC 10.28 of SUA-1580, HRI must demonstrate the feasibility of aquifer restoration at the Church Rock Section 8 project area before the project can move forward with full-scale production.

The potential radiological impacts of the project will be small, with all AEA-regulated wastes being disposed of off-site at licensed disposal facilities. Radiological impacts to air and water are also expected to be small. The disturbance of land for an ISR facility is quite small, both in terms of total area disturbed and magnitude of topographic changes, especially when compared with conventional mining techniques. All of the disturbed land will be reclaimed after the project is decommissioned and will become available and suitable for pre-construction uses.

In addition to the specific, tangible benefits described in this report, the CUP will also provide more diverse benefits. Regional recreation may be enhanced following the reclamation of the disturbed area, because of improved access and the reclamation of the disturbed area to support wildlife and livestock grazing.

The CUP will support a domestic source of energy and environment-friendly practices. The uranium production will assist to supply a reliable, economical, domestic source of uranium while applying current technologies to minimize disturbance. The project will also help offset the deficit in annual domestic uranium production and help meet increasing energy demands. Uranium production varies as a function of market conditions, which are affected by political and economic factors. After two decades of falling worldwide production of uranium prior to 2003, production has generally risen and is projected to continue to rise through at least 2035. An increasing portion of uranium, now 45%, is produced by ISR (WNA 2010d). The U.S. produced about 3% of the world's uranium in 2010. Today's reactor fuel requirements are met from primary supply (direct mine output - 78% in 2010) and secondary sources: commercial stockpiles, nuclear weapons stockpiles, recycled plutonium and uranium from reprocessing used fuel, and some from reenrichment of depleted uranium tails (left over from original enrichment). The CUP, once in full-scale production, will add up to 1.5 million kg [3 million lb] of yellowcake per year to the market, although the economic figures in this report are based on an average annual production of 0.5 million kg [1 million lb] per year in order to avoid overstating potential economic benefits.

7.7 Summary

In considering the energy value of the yellowcake produced to U.S. energy needs, the economic benefit to McKinley County, the minimal radiological impacts, minimal disturbance of land, and technical feasibility of mitigating all other impacts, it is believed that the overall benefit cost balance for the proposed CUP is favorable, and that renewing the license for the CUP is the appropriate regulatory action. There will be few, if any, public costs (local, county, and state) associated with the project for the following reasons. HRI will provide safety training for all their employees at company expense, and will train local emergency response agencies with methods to deal with any potential emergencies that are specific to ISR operations. HRI will utilize local labor to the extent possible, so impacts to schools, healthcare facilities, and other public facilities will not be adversely impacted. The major benefits will be the increased tax base for State and local governments and the opportunity for local people to obtain relatively high-paying employment for a substantial length of time.

8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

Chapter 1 of this ER explains the purpose and need for the Proposed Action, which is to renew HRI's current combined source and 11e.(2) byproduct material license (SUA-1580). Chapter 2 describes the Proposed Action and the No Action Alternative. As stated in Section 2.1 of this ER, the No Action Alternative was the only alternative evaluated as part of this ER, since the NRC evaluated the Alternatives presented in CUP FEIS including alternative sites for ISR operations, alternative sites for yellowcake drying and packaging, and alternative liquid waste disposal methods. Since the project has already been evaluated and approved by the NRC, per the CUP FEIS and SUA-1580, this ER compares the information presented in the CUP FEIS to current conditions. The affected (baseline) environment for the Proposed Action is described in Chapter 3, potential environmental impacts are described in Chapter 4, mitigation measures are described in Chapter 5, the monitoring program is described in Chapter 6, and Chapter 7 presents the a discussion of the benefits and costs of the project. This following presents a brief summary of the environmental consequences of the Proposed Action.

Due to the benign nature of uranium ISR methods and the lack of unique environmental resources in the area, the potential environmental impacts of the CUP will be minor. In addition, due to the phased nature of ISR, the environmental impacts will be short-term. The only irreversible and irretrievable commitment of resources for the project construction, operation, aquifer restoration, and decommissioning will be the chemicals used in the uranium recovery process (none of which is scarce), the fuel required to operate equipment and transport employees to and from the project areas, and the power consumed by the process (to run the equipment). The power that will be generated by the uranium produced will far exceed the power required in the ISR process. After the short-term use of project areas to recover uranium from the groundwater, the project areas will be restored to preconstruction condition. Overall, the potential environmental consequences will be small in magnitude. The potential environmental consequences of the CUP are summarized in Table 8-1.

Table 8-1. Summary of Environmental Consequences

Potential Impact	Alternative	Potential Environmental Consequence
Potential Land Surface Impacts	Proposed Action	Surface disturbance on 478 acres, or approximately 19% of the CUP. Disturbance will range from short-term for construction of wells and pipelines that will be reclaimed after construction to long-term for roads, buildings, and retention ponds that will remain until final D&D. All disturbance will be reclaimed to the suitable preconstruction uses after NRC approved aquifer restoration and D&D.
	No Action	None
Potential Land Use Impacts	Proposed Action	Controlled area up to 177.2 ha.
	No Action	None
Potential Transportation Impacts	Proposed Action	Traffic will increase on local roads, peaking during construction and operation. Small risks of spills associated with chemicals transported to the project area and material shipments, including loaded resin and 11e.(2) byproduct material, transported from the project areas. Roads in the project areas may be turned over to lessees/allottees following D&D.
	No Action	None
Potential Geology and Soils Impacts	Proposed Action	The CUP will not significantly impact geology. Topsoil will be removed for construction of facilities. Removed topsoil will be stockpiled and reseeded to protect from erosion. During decommissioning the topsoil will be replaced and reseeded to support the preconstruction use of livestock grazing.
	No Action	None
Potential Surface Water Impacts	Proposed Action	Small risk of increased sediment load to ephemeral arroyos due to surface disturbance. Small risk of degradation in water quality due to spills and leak. Small potential for impacting surface water if surface discharge or land applications are used as disposal options (both will be permitted and approved by EPA and NRC).
	No Action	None
Potential Groundwater Impacts	Proposed Action	Small risk of contaminating adjacent aquifers (horizontal or vertical excursions). The small net withdrawal of groundwater (process bleed) from the production zone to maintain a hydraulic gradient will represent consumptive use. Groundwater consumed will be replaced by natural recharge over time.
	No Action	None
Potential Ecological Impacts	Proposed Action	No critical game habitats or T&E species will be impacted. Small, temporary loss of habitat for some species will occur throughout the project.
	No Action	None
Potential Air Quality Impacts	Proposed Action	Fugitive dust and combustion emissions will be slightly increased throughout the life of the project. Fugitive dust will result from increased traffic. The majority of combustion emissions will results from construction equipment and increased heavy trucks traffic.
	No Action	None

Table 8-1. Summary of Environmental Consequences (Continued)

Potential Impact	Alternative	Potential Environmental Consequence
Potential Noise Impacts	Proposed Action	Noise levels will increase above ambient levels due construction equipment and vehicles. The residences within and surrounding each project are could experience short-term noise above the 55-dBA "annoyance" threshold.
	No Action	None
Potential Historical and Cultural Impacts	Proposed Action	Risks will be small since cultural resources in the HRI's 5-year disturbance plan have been inventoried and fenced. Additional impacts could occur if previously undiscovered cultural resources are identified during construction activities. This will be mitigated by HRI employing a full-time archaeologist to oversee all land disturbing activities. A stop-work provision will be provided if any previously unidentified cultural resources are discovered.
	No Action	No new cultural resources will be discovered and identified that may assist archaeologists in gaining knowledge about ancient cultures.
Potential Visual/Scenic Resources Impacts	Proposed Action	Impacts will occur from new structures and construction equipment in previously undeveloped areas. Continuous and intermittent lighting systems at the project areas could cause an impact, but will be mitigated.
	No Action	None
Potential Socioeconomic Impacts	Proposed Action	Local communities could be positively impacted by the addition of jobs created by the CUP. McKinley County, the State of New Mexico, and the Navajo Nation will be beneficially impacted as a result of taxes on the CUP.
	No Action	None
Potential Environmental Justice Impacts	Proposed Action	Sight risk of impacts to the environmental justice community although the risk will be mitigated by employing NRC staff recommendations.
	No Action	None
Potential Nonradiological Health Impacts	Proposed Action	Slight risk of public exposure to non-radiological hazards, including chemicals. Spills and leaks will be mitigated using BMPs.
	No Action	None
Potential Radiological Health Impacts	Proposed Action	MILDOS-AREA modeling shows no impacts to the public resulting from the CUP.
	No Action	None
Potential Waste Management Impacts	Proposed Action	Slight risk of exposure to public associated with transporting wastes to approved disposal sites.
	No Action	None

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11.0 GLOSSARY

11e.(2) byproduct material: The tailings or wastes produced by extracting or concentrating uranium or thorium from any ore processed primarily for its source material content.

Arroyo: An intermittently dry creek.

Brine: A concentrated solution containing dissolved minerals generated from the production or restoration reverse osmosis units.

Brine concentrator: A process that deionizes a waste stream into deionized water and a solids 11e.(2) byproduct material.

CUP FEIS: Final Environmental Impact Statement to Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico, NUREG-1508.

Channel: Man-made landform to divert water.

Decommissioning: The process of closing down a facility followed by reducing residual radioactivity.

Elution: The process of extracting (or eluting) one material from another by washing with a solvent (eluant) to remove adsorbed material from an adsorbent such as an ion exchange resin.

Excursion: Exceedance of upper control limits for two or more excursion indicators or a single upper control limit excursion indicator exceeded by 20% in a monitor well.

Injection well: A well through which fortified groundwater is introduced into the production zone.

Ion exchange: A chemical process used to recover uranium from solution by the exchange of dissolved uranium ions between the recovered uranium solution and a solid such as a synthetic polymer resin.

ISR GEIS: Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities, NUREG-1910

Lined retention pond: A retention ponds with a leak detection system used to temporarily store either product water, brine, or other waste water, including liquid from process drains, contaminated reagants, resin transfer wash water, filter backwash water, plant wash down water, and decontamination water.

Loaded resin: Resin from the ion exchange columns loaded with uranium complexes.

Monitor well: A well constructed or utilized to measure water levels and/or to obtain water quality samples or other physical data that will be used to control the operation or to indicate a potential circumstance that could affect the environment.

Metering house: A building containing manifolds, pumps, flow control valves, and sample points for controlling and monitoring fortified groundwater flowing to injection wells and recovery solutions from production wells within a well field.

Process bleed: A solution drawn to adjust production or to restore groundwater by removing more fluids from the production zone than are injected, causing fresh groundwater to flow into the production area.

Product water: Nearly pure water generated from the production and restoration reverse osmosis units and brine concentrators.

Production area: A collection of well fields.

Production well: A well through which a recovery fluid is produced from the production zone.

Production zone: The uranium-bearing portion of a geologic formation or part of a formation that is the target of ISR uranium recovery using underground injection of fortified groundwater.

Reverse osmosis: A reversal of the natural osmotic process. By confining a concentrated solution against a semi permeable membrane and applying a reverse pressure on the concentrate greater than the naturally occurring osmotic pressure, water will move across the membrane (product water), and out of the original concentrate, resulting in an even more concentrated solution (brine).

Satellite facility: A remotely located facility for initial processing of uranium recovery solutions.

Trunk line: A buried pipeline conveying fortified groundwater from the processing facilities to the distribution lines or recovery solution from a distribution line to the processing facilities.

Well field: The area of an ISR operation that encompasses the array of injection, production, and monitoring wells and interconnected piping employed in the ISR recovery process.