Four Corners Power Plant and
Navajo Mine energy Project
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APPENDIX C

USACE DRAFT 404B ALTERNATIVES ANALYSIS

Department of the Army

Preliminary Draft Permit Evaluation

Action ID: SPA-2012-00253-ABQ
Applicant(s): BHP Navajo Coal Company
Project Name: Pinabete Individual Permit

TABLE OF CONTENTS

1. Introduction 1
1.1 Authority 1
1.2 Permit Decision 1
2. Project Information 2
2.1 Description of Work 3
2.2 Location 3
2.3 WoUS in the Project Area 3
2.4 Scope of Analysis 4
2.5 Purpose and Need 5
2.5.1 Basic Project Purpose and Water Dependency 5
2.5.2 Overall Project Purpose and Need 5
3. Public Notification 6
3.1 Public Notice Information 6
3.1.1 Complete Application Date 6
3.1.2 Public Notice Issue Date 6
3.1.3 Public Notice Expiration Date 6
3.2 Comments/Applicant's Response/USACE Resolution 6
3.2.1 Issues Identified by the USACE 6
3.2.2 Federal Agencies 6
3.2.3 State Agencies 6
3.2.4 Tribal 6
3.2.5 Other Agencies 6
3.2.6 Public 6
3.3 Public Hearing 6
4. Alternatives Analysis 8
4.1 Determining Practicability of Alternatives 9
4.1.1 Considering Project Purpose 9
4.1.2 Availability 9
4.1.3 Practicability Factors 9

DRAFT

4.1.3.1 Cost 10
4.1.3.2 Logistics 11
4.1.3.3 Existing Technology 13
4.1.4 Considering Environmental Consequences 14
4.2 Alternatives Analysis 15
4.2.1 Applicant Preferred Alternative 18
4.2.1.1 Practicability Analysis for Proposed Project 18
4.2.1.2 Environmental Considerations 18
4.2.2 No Federal Action 18
4.2.2.1 Practicability Analysis for No Federal Action 19
4.2.3 Alternative Mine Designs 19
4.2.3.1 Alternative Mine Plan #1 20
4.2.3.1.1 Practicability Analysis for Alternative Mine Plan #1 20
4.2.3.1.2 Environmental Considerations 21
4.2.3.2 Alternative Mine Plan #2 21
4.2.3.2.1 Practicability Analysis for the Alternative Mine Plan #2 21
4.2.3.2.2 Environmental Considerations 22
4.2.4 Alternative Mining Techniques 22
4.2.4.1 Implement Highwall or Longwall Mining Techniques 22
4.2.4.1.1 Practicability Analysis for Utilizing Alternate Mining Techniques 24
4.2.4.1.2 Environmental Considerations 25
4.2.5 Alternative Mine Sites 25
4.2.5.1 Off-Site Coal Supply 25
4.2.5.1.1 Practicability Analysis for Off-site Coal Supply 26
4.2.5.1.2 Environmental Considerations 26
4.2.6 Conclusion of Alternatives Analysis 26
5. Compliance with Other Federal, State, or Local Laws 28
5.1 Section 7 of the Endangered Species Act (ESA) 28
5.2 Section 106 of the National Historic Preservation Act (NHPA) 28
5.3 Section 401 of the Clean Water Act 28
5.4 Clean Air Act 28

DRAFT

5.5 Relevant Presidential Executive Orders 28
5.5.1 Executive Order 13175—Consultation with Indian Tribes, Alaska Natives, and Native Hawaiians 28
5.5.2 Executive Order 11988—Floodplain Management 28
5.5.3 Executive Order 12898—Environmental Justice 28
5.5.4 Executive Order 13112—Invasive Species 29
5.5.5 Executive Order 13212 and 13302—Energy Supply and Availability 29
5.6 Other Authorizations 29
6. Waters of the United States 30
6.1 Jurisdictional Determination 30
6.2 Ecological Functions of Ephemeral Channels 31
6.2.1 Assessment Methodology 31
6.2.2 CRAM Results 34
6.2.3 Buffer and Landscape Context 35
6.2.4 Hydrology 36
6.2.5 Physical Structure 36
6.2.6 Biological Structure 37
6.3 Impacts to Waters of the United States 38
6.3.1 Area 4 North and Area 4 South Mining Area Impacts 39
6.3.2 Haul Roads, Light Vehicle Roads, and Burnham Road Realignment 39
6.3.2.1 Haul Roads and Light Vehicle Roads 40
6.3.2.2 Burnham Road Realignment 40
6.3.3 Transmission Line 40
6.3.4 Infrastructure 40
6.4 Reclamation 41
6.4.1 Backfilling and Grading 41
6.4.2 Replacement of Topdressing 41
6.4.3 Revegetation 42
6.4.4 Monitoring 42
6.4.5 Schedule 42
6.5 CRAM Analysis of Impacts 42

DRAFT

7. Public Interest Review and Section 404(b)(1) Guidelines Evaluation 47
7.1 Anticipated Changes to the Physical and Chemical Characteristics of the Aquatic Ecosystem 47
7.1.1 Substrate 47
7.1.1.1 Existing Conditions 47
7.1.1.2 Impacts Analysis 47
7.1.2 Suspended Particulates and Turbidity 48
7.1.2.1 Existing Conditions 48
7.1.2.2 Impacts Analysis 48
7.1.2.2.1 Construction and Operation Impacts 48
7.1.2.2.2 Applicant Proposed Measures and Regulatory Compliance Measures. 49
7.1.3 Water Quality 50
7.1.3.1 Existing Conditions 50
7.1.3.2 Impacts Analysis 50
7.1.3.2.1 Construction and Operation Impacts 50
7.1.3.2.2 Applicant Proposed Measures and Regulatory Compliance Measures. 50
7.1.4 Current Patterns and Water Circulation and Normal Water Fluctuations 51
7.1.4.1 Existing Conditions 51
7.1.4.2 Impacts Analysis 52
7.1.4.2.1 Construction and Operation Impacts 52
7.1.4.2.2 Applicant Proposed Measures and Regulatory Compliance Measures. 52
7.1.5 Mixing Zone 53
7.1.6 Flood Hazards and Floodplain Management 53
7.1.7 Erosion and Accretion Patterns 53
7.1.8 Storm, Wave, and Erosion Buffers 53
7.1.9 Aquifer Recharge 53
7.1.10 Baseflow 54
7.2 Anticipated Changes to the Biological Characteristics of the Aquatic Ecosystem 54
7.2.1 Special Aquatic Sites (Wetlands, Mud Flats, Vegetated Shallows, Riffle and Pool Complexes, Sanctuaries and Refuges) 54
7.2.2 Threatened and Endangered Species 54
7.2.3 Fish and Other Aquatic Organisms in the Food Web 55

DRAFT

7.2.4 Other Wildlife 55
7.2.4.1 Existing Conditions 55
7.2.4.2 Impacts Analysis 56
7.2.5 Biological Availability of Possible Contaminants in Dredged or Fill Material 56
7.3 Anticipated Changes to Human Use Characteristics 56
7.3.1 Water Supply and Conservation 56
7.3.2 Recreational and Commercial Fisheries 56
7.3.3 Recreation 57
7.3.4 Aesthetics 57
7.3.5 National or State Parks, Landmarks, Monuments, Wilderness Areas, Research Sites, Recreation Areas, and Similar Preserves 57
7.3.6 Historic and Cultural Values 58
7.3.7 Wild and Scenic Rivers 58
7.3.8 Consideration of Property Ownership 58
7.3.9 Safety of Impoundment Structures 58
7.3.10 Floodplain Management 58
7.3.11 Energy Conservation and Development 58
7.3.12 Navigation 58
7.3.13 Economics 58
7.3.14 Traffic/Transportation Pattern 59
7.3.15 Noise 60
7.3.16 Safety 60
7.3.17 Land Use 61
7.3.18 Food and Fiber Production 62
7.3.19 Prime and Unique Farmland 62
7.3.20 Mineral Needs 62
7.4 Other Anticipated Changes to Non-Jurisdictional Areas Determined to be within the USACE's Scope of Analysis 62
7.5 Secondary and Cumulative Impacts 62
7.6 General Evaluation 64

DRAFT

7.6.1 The relative extent of the public and private need for the proposed structure or work. 64

7.6.2 To be determined. 64

7.6.3 The extent and permanence of the beneficial and/or detrimental effects that the proposed structure or work is likely to have on the public and private uses to which the area is suited. 64

8. Contaminant Evaluation and Testing 65

9. Compensation and Other Mitigation Actions 66

10. NEPA 68

11. Permit Conditions 69

12. Determinations 70

12.1 NEPA Compliance 70

12.2 Section 404(b)(1) Guidelines 70

12.3 Public Interest 70

13. References 71

14. Decision 74

Attachment A – Vicinity Map, Alternative Maps, and Project Maps

Attachment B – Typical Construction Drawings

Attachment C – Complete CRAM Scores for Ephemeral Streams within the Project Area

Attachment D – South Pacific Division Mitigation Ratio-Setting Checklist

LIST OF TABLES

Table 1. Open House Scoping Meeting Locations and Dates 7
Table 2. Comparison of Alternatives 16
Table 3. Alternative Mine Designs and their Project Features 19
Table 4. WoUS separated by watershed 31
Table 5. Jurisdictional Stock ponds within the PJD survey area 31
Table 6. Relationship between CRAM attributes and metrics/submetrics. The four attributes are averaged to produce an overall CRAM index score. 33
Table 7. Overall CRAM index and attribute scores 34
Table 8. Surface Disturbing Components from the Proposed Action 38

DRAFT

Table 9. Potential impacts to WoUS in Area 4 North and Area 4 South from mining striplines and the 1,800-foot buffer 39
Table 10. CRAM Summary: Existing Scores and Project Impact Projections 45
Table 11. Comparison of Sediment Yield Pre-mining with Mine Operations for Pinabete Arroyo and Cottonwood Arroyo 49

LIST OF FIGURES

Figure 1. Diagrammatic cross section of the San Juan Basin showing the coal seams dipping 2 percent from west to east (Stone et al 1983) 13
Figure 2. Typical Dragline 14
Figure 3. Example of a Highwall Miner 23
Figure 4. Typical arid, ephemeral/intermittent stream cross section and its associated hydrogeomorphic floodplain units (Lichvar et al. 2009) 37

DRAFT

ACRONYMS

µmhos	micromhos per centimeter
AA	Assessment Area
APS	Arizona Public Service Company
BA	Biological Assessment
BIA	Bureau of Indian Affairs
BLM	United States Department of Interior, Bureau of Land Management
BMP	best management practice
BNCC	BHP Navajo Coal Company
Btu	British thermal units
CAA	Clean Air Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRAM	California Rapid Assessment Method
CUA	Customary Use Area
CWA	Clean Water Act
CWMW	California Wetlands Monitory Workgroup
cyd	cubic yard
dBA	hourly a-weighted sound level in decibels
Ecosphere	Ecosphere Environmental Services
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FCPP	Four Corner Power Plant
FSC	final surface configuration
GPS	Global Positioning System
IP	Individual Permit
L_{dn}	day-night average sound level
LEDPA	least environmentally damaging practical alternative
L_{max}	maximum sound level
mg/L	milligrams per liter
mi^2	square mile
MOU	Memorandum of Understanding
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NESL	Navajo Endangered Species List
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NNDFW	Navajo Nation Department of Fish and Wildlife
NNEPA	Navajo Nation Environmental Agency

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NNHP	Navajo Nation Heritage Program
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTEC	Navajo Transitional Energy Company
NWP	Nationwide Permit
OHWM	Ordinary High Water Mark
OSM	Office of Surface Mining Reclamation and Enforcement
PA	Programmatic Agreement
PJD	preliminary jurisdiction determination
PM	particulate matter
PM_{10}	particulate matter with a diameter between 2.5 and 10 micrometers
$PM_{2.5}$	particulate matter with a diameter of 2.5 micrometers or less
R2P2	Resource Recovery and Protection Plan
RFFA	reasonable foreseeable future actions
SJGS	San Juan Generating Station
SJM	San Juan Mine
SMCRA	Surface Mining Control and Reclamation Act
SPCC	Spill Prevention, Control, and Countermeasure
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
USACE	Department of the Army, Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WoUS	waters of the United States

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1. INTRODUCTION

This document is the Preliminary Draft Pinabete Individual Permit Evaluation and constitutes the Department of the Army, Corps of Engineers' (USACE) analysis supporting its assessment of environmental effects, Statement of Findings, Public Interest Review, and compliance determination under the National Environmental Policy Act (NEPA). The review was conducted in accordance with procedures described in 33 Code of Federal Regulations (CFR) 320 and 325, including Appendices B and C. This document also addresses the requirements contained in the Environmental Protection Agency's Section 404(b)(1) Guidelines published at 40 CFR 230.

The report provided here is a preliminary draft that will be completed by the USACE following the Four Corners Power Plant (FCPP) and Navajo Mine Energy Project NEPA process and consideration of public comments. The final report will constitute the USACE's permit evaluation and decision document.

1.1 Authority

( ) Section 10 of the Rivers and Harbors Act of 1899

(X) Section 404 of the Clean Water Act (CWA)

1.2 Permit Decision

To be determined.

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2. PROJECT INFORMATION

BHP Navajo Coal Company (BNCC) plans to extend its mining operations within its mining lease[1], in portions of Area 4 North and Area 4 South of the Navajo Mine (Pinabete Permit Area), in order to supply coal to FCPP for approximately 25 years beginning on or about July 2016. BNCC's Pinabete Permit is expected to require certain federal actions including:

- Approval from the Office of Surface Mining Reclamation and Enforcement (OSM) for a new Surface Mining Control and Reclamation Act (SMCRA) permit
- Approval from the U.S. Department of Interior, Bureau of Land Management (BLM) for a revised Resource Recovery and Protection Plan (R2P2) for the maximum economic recovery of coal reserves
- Approval of a CWA Section 404 Standard Individual Permit (IP) from the USACE for unavoidable impacts to jurisdictional waters of the United States (WoUS)
- Approval of a Section 402 National Pollutant Discharge Elimination System (NPDES) permit revision from United States Environmental Protection Agency (USEPA)
- Analysis of impacts of the Burnham Road relocation through portions of Area 4 North and Area 4 South by the Bureau of Indian Affairs (BIA)

The proposed permitting actions will require compliance with NEPA, Section 7 of the Endangered Species Act (ESA), Section 106 of the National Historic Preservation Act (NHPA), and related federal and tribal statutes and regulations.

On April 12, 2012, the USACE received an application from BNCC (the Applicant) for an IP for the Pinabete Permit (the Project) within portions of Area 4 North and Area 4 South of the Navajo Mine Lease (Project Area). The USACE's Project Area is coincidental with the Applicant's proposed Pinabete SMCRA permit area. The Applicant sought authorization to fill about 5.0 acres of WoUS within the Project Area. The Project Area is located entirely within the Navajo Nation Indian Reservation within San Juan County, New Mexico (see Map 1 of Attachment A).

The following analysis is provided in accordance with Section 404(b)(1) of the CWA. To avoid duplication of pertinent information, there are multiple references to sections within the OSM's FCPP and Navajo Mine Energy Project Environmental Impact Statement (EIS) that has been prepared concurrently with this 404(b)(1) analysis. While the USACE is utilizing and has referenced the OSM EIS, it has made its own independent Section 404(b)(1) assessment pursuant to its authorities. In addition, the USACE will evaluate public interest factors pursuant to 33 CFR § 320.4 prior to making its permit decision.

[1] This document refers to the permit applicant as BNCC, although the permit applicant will be Navajo Transitional Energy Company (NTEC) as of December 2013.

2.1 Description of Work

The proposed Project is to authorize under Section 404 of the CWA approximately 5.0 acres of fill in WoUS associated with BNCC's implementation of Pinabete Permit mining and reclamation activities in order to meet proposed contractual coal sales obligations to FCPP through 2041—in the event that a new coal supply agreement is reached. Additionally, the proposed Project would maintain and improve safe, reliable public road access to the Navajo Nation's Tiis Tsoh Sikaad (Burnham) Chapter area.

The proposed Project includes several primary components—mining activities, road and infrastructure construction, site reclamation, and the relocating a portion of Burnham Road (BIA Road 3005 and Navajo Road 5082). Other ancillary facilities related to the mining and reclamation activities include fencing, maintenance of roads, and distribution power lines. The proposed mining operation is a continuation of the existing Navajo Mine operations, an open pit, mine-mouth operation. Coal would be extracted utilizing surface mining techniques such as draglines or limited truck and front-end loader stripping operations. Mined coal would be transported by haul trucks from the mining areas to existing coal stockpiles and then loaded onto an existing rail transport system and delivered to FCPP. Further details regarding mining and reclamation activities are provided in Section 4 and Section 6.4.

As part of the proposed Project, approximately 2.8 miles of Burnham Road (BIA Road 3005 and Navajo Road 5082) would be realigned along the east side of the Project Area to move this public road a safe distance from active mining. BNCC would not likely need to relocate the Burnham Road until after 2022. There is no pending action for the BIA at this time; however, impacts of relocating the Burnham Road are being analyzed in this document, as they are a likely foreseeable action for BNCC.

2.2 Location

The proposed Project Area is located along tributaries of Cottonwood Arroyo, Section 2 Township 26N, Range 16W, Latitude (NAD 83) 36.511°, Longitude 108.518°, and Pinabete Arroyo, Section 14, Township 26N, Range 16W, Latitude (NAD 83) 36.483°, Longitude 108.514°, in portions of Area 4 North and Area 4 South of the Navajo Mine Lease located completely within the Navajo Nation Indian Reservation in San Juan County, New Mexico (see Map 1 of Attachment A).

2.3 WoUS in the Project Area

The WoUS in the proposed Project Area are mostly headwater (first and second order) ephemeral channels. No wetlands or other special aquatic sites, as defined in the 404(b)(1) Guidelines occur in the Project Area proposed to be impacted. Channel processes here are largely governed by the magnitude and frequency of precipitation events. In an arid environment where annual precipitation averages 5.6 inches, dry channels support flowing water typically in response to occasional high intensity or short duration (defined as 1 hour or less) precipitation

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events. Water flow has a wide range of magnitudes, but the duration is typically short because of short duration precipitation events and very high channel infiltration.

The ephemeral channels located within the Project Area range from small channels at the head of drainages (1 to 3 feet wide and 1 to 18 inches deep) to the Cottonwood and Pinabete Arroyos, larger channels (36 to 50 feet wide and 15 to 32 inches deep) upstream of the Chaco River. The small channels typically drain badland areas and only contain flow immediately after large rain events. Channels such as Cottonwood and Pinabete Arroyos receive discharges from much larger watersheds and have larger, more sustained flows.

The majority of the channels within the Project Area are C5 type channels (Rosgen 1996). C5 channels are characterized as having a sand bed with point bars as a result of high lateral bank adjustment, high to very high sediment supply, and little difference between channel bed pavement and sub-pavement materials. Without stabilizing vegetation, these channels can experience considerable lateral adjustment during a single runoff event. Sediment transport rates can be very high as a result of an unconsolidated bed but the transport distance would be relatively short due to short-duration runoff events, measured in hours. Since these channels have no real means of stabilization due to lack of bank vegetation, rock, or other natural materials, they are subject to lateral and vertical instability as a result of changes in sediment or flow regimes (Rosgen 1996).

2.4 Scope of Analysis

The proposed permit action is to expand mining within an existing mine and mine lease and relocate/ improve a public roadway on the Navajo Nation. Logistics via mining efficiency (as described in this decision document) directs the expansion footprint to be directly south of existing mining facilities and to allow infrastructure such as roads, the ore rail line, and utilities to be extended with minimal expense and impact. WoUS, in the form of ephemeral drainages, permeate the project area such that complete avoidance of Corps jurisdiction would severely limit the proponent's ability to produce supply agreement coal volumes. Because coal produced within the proposed Pinebete permit area would be transported to the processing facility at the north end of the mine permit and lease area; and because mine-associated potential impacts extend to approximately the mine lease boundary; the Corp extends it scope of analysis to the entire mine project and mine area, to include associated infrastructure improvements. Because there are no jurisdictional waters which would be regulated under Section 404 of the Clean Water Act in areas proposed to be further developed within the Four Corners Power Plant proposed lease renewal area; the Corps declines to expand its scope of analysis to include the power plant and its associated facilities.

My analysis in this document is limited to the mine lease area, road relocation/improvement and associated infrastructure of the proposed project and the primary, secondary, and cumulative impacts that the activities authorized by this permit would have on the waters within the project

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area and associated uplands. The scope of analysis includes the entire proposed Pinabete SMCRA permit area (Project Area), which encompasses approximately 5,570 acres in portions of Area 4 North and Area 4 South of the Navajo Mine Lease (see Map 1 of Attachment A).

2.5 Purpose and Need

2.5.1 Basic Project Purpose and Water Dependency

The Basic Project Purpose includes continued coal mining in an expanded footprint and public transportation safety.

2.5.2 Overall Project Purpose and Need

The Overall Project Purpose is expansion of coal mining at the Navajo Mine through 2041 to meet contractual obligations with the FCPP and provide resource-related economic development opportunities on Navajo Nation tribal trust lands, while maintaining safe and reliable public access to the Tiis Tsoh Sikaad Chapter area.

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3. PUBLIC NOTIFICATION

3.1 Public Notice Information

3.1.1 Complete Application Date

BNCC submitted a complete IP application package to the USACE on April 12, 2012.

3.1.2 Public Notice Issue Date

The USACE published a Public Notice for the proposed Project in the Federal Register on July 27, 2012.

3.1.3 Public Notice Expiration Date

The Public Notice comment period for the proposed project lasted 97 days and expired on November 1, 2012.

3.2 Comments/Applicant's Response/USACE Resolution

To be determined.

3.2.1 Issues Identified by the USACE

To be determined.

3.2.2 Federal Agencies

To be determined.

3.2.3 State Agencies

To be determined.

3.2.4 Tribal

To be determined.

3.2.5 Other Agencies

To be determined.

3.2.6 Public

To be determined.

3.3 Public Hearing

The USACE participated in six of the nine open house scoping meetings held from August 9, 2012 to August 18, 2012 in coordination with OSM for the FCPP and Navajo Mine Energy Project EIS (Cardno Entrix 2012). USACE did not attend all for funding reasons; posters and handouts with CWA permit process information were available at every meeting. Meeting locations and dates are included in Table 1.

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Table 1. Open House Scoping Meeting Locations and Dates

Venue and Location	Date
Hotevilla Village,Hotevilla, AZ	August 9, 2012
Montezuma-Cortez High School, Cortez, CO	August 10, 2012
Tiis Tsoh Sikaad (Burnham) Chapter House, Burnham, NM[1]	August 11, 2012
Nenahnezad Chapter House, Nenahnezad, NM[1]	August 13, 2012
Farmington Civic Center, Farmington, NM[1]	August 14, 2012
Shiprock High School, Shiprock, NM[1]	August 15, 2012
Durango Public Library, Durango, NM[1]	August 16, 2012
Navajo Nation Museum, Window Rock, AZ	August 17, 2012
Indian Pueblo Cultural Center, Albuquerque, NM[1]	August 18, 2012

[1] – Meetings attended by an USACE representative.

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4. ALTERNATIVES ANALYSIS

The following analysis considers a range of alternatives including a variety of on-site and off-site alternatives, and evaluates practicability under the 404(b)(1) Guidelines' factors, impacts to aquatic resources, and other environmental consequences.

The 404(b)(1) Guidelines require the Applicant to analyze alternatives that are deemed practicable. In order to be considered practicable, an alternative must be available and capable of being implemented after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

The proposed Project includes mining approximately 135 million tons of coal from Area 4 North and Area 4 South to meet proposed contractual obligations through 2041. In addition to the proposed Project and No Action alternatives, there are two alternative mine designs, three alternative mine sites, and two alternative mining technique alternatives analyzed. The No Action alternative represents the situation under which the USACE would not approve BNCC's IP application for impacts to WoUS within the Project Area.

A summary of the alternatives analysis is listed below. Detailed descriptions of the alternatives are included in Section 4.2 Alternatives Analysis.

- **Alternative 1: Proposed Project** – Pinabete Permit that includes mining in portions of Area 4 North and Area 4 South and realignment of Burnham Road (see Map 2 of Attachment A).
- **Alternative 2: No Action Alternative** – Mining activities would not take place in Areas 4 North and 4 South, and there would be no realignment of Burnham Road.
- **Alternative 3: Alternative Mine Plan # 1** – the Alternative Mine Plan #1 would mine through 5,412 acres of Areas 4 North and 4 South including a portion of Pinabete Arroyo (see Map 3 of Attachment A) (BNCC 2013).
- **Alternative 4: Alternative Mine Plan #2** – Initial version of the Pinabete mine plan to supply coal to FCPP for post-2016 operations. This mine plan would mine through 6,492 acres in separate pits for Area 4 North and Area 4 South (Map 4 of Attachment A) (BNCC 2013).
- **Alternative 5: Implementation of highwall or longwall mining methods** – This alternative considers recovering the coal at Navajo Mine using mining techniques other than surface mining.
- **Alternative 6: Obtain coal from off-site source** – Obtain coal from San Juan Mine (located 5 miles north and across the San Juan River from FCPP in Waterflow, NM), Kayenta Mine (10 miles southwest of Kayenta, AZ and approximately 160 miles from FCPP using available public roads), and El Segundo Mine (30 miles north of Milan, NM

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and approximately 180 miles from FCPP using available public roads) (see Map 5 of Attachment A).

4.1 Determining Practicability of Alternatives

4.1.1 Considering Project Purpose

The overall project purpose is expansion of coal mining at Navajo Mine through 2041 to meet proposed contractual obligations with the FCPP and provide resource related economic development opportunities on Navajo Nation Tribal Trust lands while maintaining safe and reliable public access to the Tiis Tsoh Sikaad (Burnham) Chapter area. The proposed contractual obligations with FCPP would require BNCC to supply approximately 6 million tons of coal to FCPP annually and that the coal meets quality specifications including heating value, sulfur, moisture, and ash content. BNCC would be required to maintain 1 million tons of coal inventory in pits and field stockpiles and 100,000 tons in blend piles. If BNCC fails to meet contractual obligations in spite of best efforts, BNCC could be ruled in default, which could result in substantial financial and reputational repercussions. Therefore, a practicable alternative to the proposed Project must be able to meet the contractual obligations to FCPP in terms of coal volume, coal quality specifications, and delivery timing.

4.1.2 Availability

An alternative may not be available if implementation is outside the applicant's control. For example, this may occur when necessary property or resources are owned or controlled by others, or when the alternative cannot receive timely regulatory and other approvals. In this case, coal resources not owned or controlled by BNCC may not be available to meet BNCC's obligations in a timely manner. Further, if additional regulatory approvals are required, those processes may not allow for production of coal to meet obligations beginning in or around July 2016. Accordingly, timing associated with a specific alternative has a bearing on that alternative's feasibility and availability.

Mining in Area 4 North and Area 4 South is a readily available option. The proposed Project and on-site alternatives would mine undedicated coal reserves within the Navajo Mine Lease. Alternatives to mining in Areas 4 North and 4 South would in some cases require additional regulatory permitting and/or the development of infrastructure that would preclude BNCC's ability to produce the coal volumes and quality required by its contract with FCPP. Accordingly, while it is theoretically possible to get permit boundaries adjusted or to mine in areas other than Area 4 North and Area 4 South, such alternatives may not be practicable if they are not available in the context of their ability to be acquired or permitted rapidly enough to meet the project purpose. This issue is discussed below for each alternative.

4.1.3 Practicability Factors

To be practicable, an alternative must be available and capable of being implemented after taking into consideration cost, existing technology, and logistics in light of the overall project purpose.

The practicability factors are first explained and then considered below for the proposed Project and alternatives.

4.1.3.1 Cost

The cost factor takes into account the associated capital outlay, economic viability, and reasonableness of cost increases to determine practicability. An alternative that is unreasonably expensive is not practicable.

In this case, the Applicant must comply with its obligations under the coal supply contract through 2041, including coal quality, volume, and timing specifications. Similarly, the lease agreement between BNCC and the Navajo Nation, as well as the BLM's R2P2, set requirements for the maximum economic recovery of the coal resource at Navajo Mine. Those obligations help to inform what alternatives may be economically reasonable. In addition, the geology and geography of the coal seams, overburden, and interburden, as well as mining equipment, techniques, and logistics (discussed further below) also contribute to cost considerations. Some of the constraints that these factors impose on BNCC include:

- FCPP is a "base load" plant designed to operate 24 hours per day, 7 days per week. In essence, the power plant operates at near peak load continuously to supply electricity for millions of customers in Arizona, New Mexico, and Texas. These conditions require BNCC to develop operation plans that include risk management strategies that ensure a steady, continuous coal supply for FCPP.
- FCPP was designed and constructed specifically to burn low rank, low sulfur, sub-bituminous coal. Therefore, BNCC must meet coal specifications for heating value, sulfur and ash content so it can be burned in FCPP without damaging the power plant. The quality of the coal that BNCC delivers to FCPP cannot deviate from the narrow range of contractual specifications, even though the quality of the coal can vary substantially. The heating value of coals within Navajo Mine typically ranges from 7,800 to 9,500 British thermal units (Btu) per pound. The target heating value of coal delivered to FCPP under the coal supply contract is 8,700 to 8,750 Btu per pound with a contractual minimum of 8,500 Btu per pound. Therefore, to meet contractual specifications, BNCC must blend coal from multiple locations and seams to create a coal blend that meets the target heating value. To meet FCPP contractual obligations, BNCC maintains 1 million tons of coal as working inventory in stockpiles and pits and 100,000 tons available for coal blending. The combination of the stockpiled coal and coal available for blending represents about a 1.5-month reserve supply of coal.
- The Navajo Mine Lease and applicable regulations require that BNCC maximize economic recovery criteria of the Navajo Mine coal resource. These obligations restrict operations plans that can "sterilize" coal or eliminate opportunities to recover coal. These requirements also constrain mine operations to consider maximum economic recovery, rather than least-cost recovery.

- An additional cost factor determined by the geology of Navajo Mine is the strip ratio. The strip ratio is defined as the thickness of overburden/interburden material that must be moved per unit of coal extracted. Each pit developed generally starts at a strip ratio around 4:1. This is defined, for example, as 4 tons of overburden and interburden removed to extract 1 ton of coal. This strip ratio is found on the western edge of the outcrop, but can increase to a strip ratio of 7:1 on the eastern edge of the mine lease. The higher the strip ratio, the more overburden/interburden must be removed and the higher the cost to produce each ton of coal. As strip ratios increase, pre-stripping becomes important to meet coal supply volumes. Pre-stripping utilizes a truck/loader fleet to remove overburden prior to dragline stripping, which enables the dragline to remove coal at depths not possible without pre-stripping. Pre-stripping increases the cost of removing coal compared to dragline stripping alone by 110 percent to 140 percent according to BNCC cost estimates.

4.1.3.2 Logistics

Mining logistics are defined by the mine plan and its subsidiary operations and reclamation plans that specify locations, timing, sequencing, and techniques for coal production as well as risk management strategies for meeting BNCC's obligations to FCPP and the Navajo Nation. Generally, risk management strategies at Navajo Mine are established to ensure steady coal production by managing for conditions that cause production delays. Risk management strategies include retention of contingency reserves, maintenance of coal stockpiles, and simultaneous operation in multiple pits to ensure the ability to produce sufficient volumes available to blend coal of different qualities. This enables the delivery of a steady supply of appropriate quality coal to meet contractual obligations. These strategies are, in BNCC's experience, necessary and standard business practices that take into account the specific circumstances at Navajo Mine. Conditions that may cause production delays include:

- Poor weather conditions – Flooded pits or muddy road conditions can cause production or coal transport delays.
- Highwall or spoil bank instability or failure – Highwalls and spoil banks are continually monitored for instability. If unstable conditions are detected, operations are restricted until measures can be implemented to stabilize the area. In rare instances, highwall failure could cause significant reductions in planned coal production volumes.
- Power outages – Draglines and train locomotives operate on electricity; therefore, power outages stop coal production and transportation.
- Train derailments – There have been derailments of the mine's coal transport train that have delayed coal deliveries to the FCPP.
- Unplanned dragline or equipment outages.

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Some of the operating constraints that are included in BNCC's plan to minimize the risk of coal production delays at Navajo Mine include:

- Simultaneous operations in multiple pits are needed so that, in case of pit shutdown (e.g., from a highwall failure or dragline outages), BNCC can continue to mine and deliver coal to contract specifications from other active pits. To meet coal quality and quantity production demands in a timely, commercially prudent, and economically feasible manner, the mine must maintain multiple open pits. It is important to have pits in a balance of deep and shallow strip ratio positions.
- The average production capacity of BNCC's Marion 8750 and Marion 8050 draglines working in multiple pits is approximately 40 million cubic yards per year. At an average strip ratio of approximately 6.5:1, annual coal production is approximately 6.5 million tons. Operations at higher strip ratios reduce BNCC's ability to timely and efficiently produce the necessary volume of coal. While pre-stripping can address that constraint, it does so at greatly increased costs, inefficiency, and logistical difficulties, including re-assignment of resources and equipment from other important tasks such as reclamation. Retention of contingency reserves in accessible locations is important to provide coal supply in case of an operational event or condition that may delay production.
- Ensuring sufficient pit length per dragline (at least 3,000 feet in length) is important. The space limitations at Navajo Mine make it impractical to maintain the clearance and safety conditions required for simultaneous blasting and dragline operations in a single pit shorter than 3,000 feet. Mining in a multiple seam pit requires the dragline to make six or seven passes from one end of the pit to the other end per strip (a strip is about 150 foot wide and cut the full length of the pit). Drilling and blasting occurs separately for each layer of rock between the coal seams and for each coal seam greater than 5 feet thick. Each layer of rock and coal require a drill hole about every 25 feet apart in a grid pattern over the entire strip. These conditions require drilling crews and blasting crews to constantly work in each pit outside the boom radius of the dragline. Once the coal is drilled and blasted, a truck/loader crew use front-end loaders to load the coal in haul trucks and transport the coal out of the pits to the field coal stockpiles. In addition to these activities, each dragline has a support dozer that is constantly moving material to prepare the dragline's walking surface and moving material to assist the dragline. There are also graders and water trucks working on access roads and ramps within the pits. There are other pieces of equipment working to ensure the dragline power cable is moved and maintained. If the pit length is too short, these simultaneous support activities could force an unnecessary dragline shutdown. Every effort is made to have sufficient planning and adequate pit length to ensure this does not occur. Safety concerns, operational factors, and logistical constraints described above, are essential considerations to ensure a consistent coal-delivery in the event of numerous potential anticipated or unanticipated circumstances that may cause delays in coal delivery.

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4.1.3.3 Existing Technology

The technology needed to accomplish surface coal mining must take into account the constraints at Navajo Mine, including geology and highly specialized mining equipment. These physical constraints set the technology and operating parameters for Navajo Mine. Some of these parameters include:

- Geology and pit development at Navajo Mine – There are 11 named coal seams at Navajo Mine with up to seven of these seams, in certain areas, sufficiently thick enough to be consistently minable. Mineable coal seam thickness at Navajo Mine ranges from 1.5 to 20 feet thick. Coal seams have an average 2 percent dip from west to the east. The coal dip results in the strip ratio increasing from west to east in the mine. The geology of the surrounding rock at Navajo Mine requires that overburden and interburden must be drilled and blasted for removal. Thick coal seams also require drilling and blasting for removal. Figure 1 shows a cross section of the San Juan Basin dipping two percent from the West to the East (Stone et al 1983).

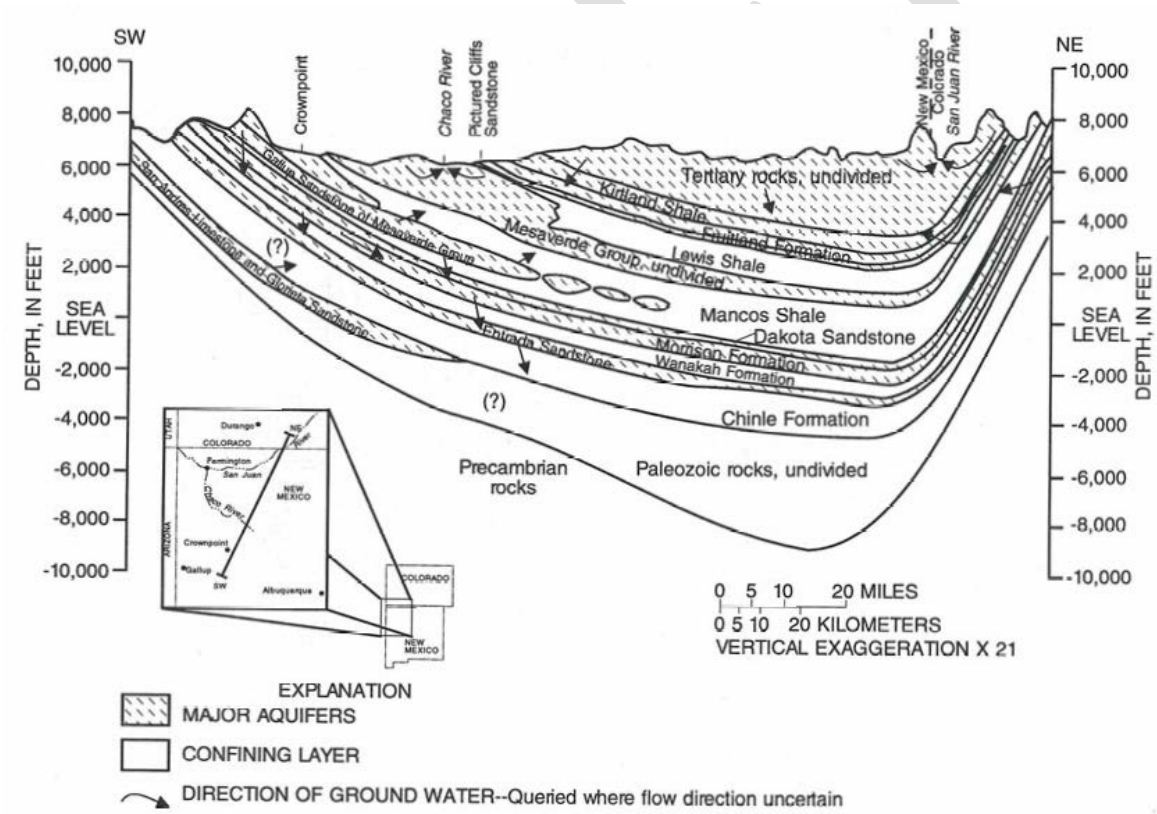

Figure 1. Diagrammatic cross section of the San Juan Basin showing the coal seams dipping 2 percent from west to east (Stone et al 1983)

- Dragline and other equipment constraints – The essential piece of equipment at the mine is the dragline that operates continuously (see Figure 2). It is idle only for planned or unplanned repairs or maintenance. Nearly all other mobile equipment at the mine is used

to ensure that the dragline operates at optimum parameters and has high availability. To meet contractual obligations, BNCC has historically maintained between two and three operating draglines at Navajo Mine. BNCC currently owns and operates three draglines: (1) Marion 8750 – with 130 cubic yard (cyd) bucket, (2) Marion 8050 – with 64 cyd bucket, and (3) Marion 7920 – with 50 cyd bucket. In the proposed Project, BNCC would retire the Marion 7920, and mine the coal reserves with its Marion 8750 and Marion 8050 draglines. Given the geologic conditions and the production demands, the operating parameters for the draglines at Navajo Mine are pit lengths of 3,000 feet with three ramps accessing each pit to provide sufficient access for drilling, blasting, and coal removal operations concurrent with dragline stripping in other parts of the mining pit.

Figure 2. Typical Dragline

4.1.4 Considering Environmental Consequences

For each available and practicable alternative, the USACE is required to assess the impacts (adverse and beneficial) on the aquatic ecosystem and the overall environment. By comparing the environmental consequences of the practicable alternatives, USACE can identify the least environmentally damaging practicable alternative (LEDPA).

BNCC conducted a similar exercise to determine the LEDPA for the pre-2016 IP and applied several of those minimization and avoidance measures when developing BNCC's Preferred Alternative. NTEC would avoid impacts to Cottonwood and Pinabete Arroyos except for a

potential future haul road and light vehicle crossing on Cottonwood Arroyo. NTEC has developed the mine plan for Areas IV North and IV South with the purpose of preserving the natural flow of Cottonwood and Pinabete Arroyos to the extent practicable. The two arroyos would not be diverted for mining purposes under the proposed Project; in addition, flow would not be retarded except for a potential road crossing on Cottonwood Arroyo. NTEC has also established a 100-foot stream buffer zone along Cottonwood and Pinabete Arroyos as required by the Pinabete Mine Plan's SMCRA permit.

A summary of the findings and analysis for the alternatives are included in Section 4.2.

4.2 Alternatives Analysis

In addition to the proposed Project, BNCC considered a number of other options to provide coal to FCPP in order to meet its contractual obligations through 2041. In this section, each alternative is screened to determine whether it is available and practicable while meeting the project purpose. Also summarized are the relative impacts to WoUS and other environmental factors as they relate to the identification of the LEDPA. Table 2 provides a summary of the analysis.

DRAFT

Table 2. Comparison of Alternatives

Alternative	Availability	Cost	Existing Technology	Logistically Possible	Meets Project Purpose	Impacts to WoUS and Other Environmental Consequences
Alternative 1: Proposed Project	Yes	Yes	Yes	Yes	Yes	About 5.0 acres of impacts to WoUS; for other factors refer to project EIS and Sections 6 and 7 of this analysis.
Alternative 2: No Action	Yes	No	Yes	No	No	None. Mining activities and Burnham Road realignment would not occur.
Alternative 3: Alternative Mine Plan #1	Yes	Capital costs (i.e., Pinabete Arroyo diversion infrastructure and equipment) would cost approximately $85 million above the proposed Project. Alternative Mine Plan #1 would result in an approximate 10% increase in operating expenses.	Yes	Yes, would require a major diversion of Pinabete Arroyo.	Yes Would result in mining through the Pinabete Arroyo and over 28 additional acres of impacts to WoUS.	33 acres of impacts to WoUS. Impacts to WoUS would increase by 28 acres compared to the Proposed Action. This alternative would require mining through the Pinabete Arroyo and diverting flows to No Name Arroyo. Surface impacts would increase by approximately 885 acres.
Alternative 4: Alternative Mine Plan #2	Yes	Capital costs (i.e., infrastructure and equipment) would be approximately $55 million above the proposed Project. Alternative Mine Plan #2 would result in an approximate 10% increase in operating expenses.	Yes	Yes	Yes Would result in an additional 1.6 acres of impacts to WoUS and include an additional 2,400 acres of disturbance.	About 6.6 acres of impacts to WoUS. Additional 1.6 acres of impacts to WoUS compared to Proposed Action. Surface impacts would be increased by approximately 2,400 acres including 10 additional miles of primary roads and 8 miles of additional power lines when compared to the Proposed Action.
Alternative 5:	No	No		No	No	Acreage of environmental impacts cannot be reasonably

DRAFT

Alternative	Availability	Cost	Existing Technology	Logistically Possible	Meets Project Purpose	Impacts to WoUS and Other Environmental Consequences
Implement Highwall or Longwall Mining Techniques	BNCC would have to revise its R2P2 and SMCRA permit for the new mining methods. Some coal reserves would not be recoverable.	Unreasonable additional costs associated with converting an existing open pit mine to an underground operation.	Yes	It would be difficult to permit and convert Navajo Mine to an underground operation by July 2016 in order to meet project purpose.		calculated for highwall mining, as the alternative would require extensive engineering and permitting. Using longwall mining, there would be minor impacts to WoUS primarily from road crossings to provide support to the underground mine. There would be areas of subsidence that could affect drainages.
Alternative 6: Offsite Coal Supply	Uncertain. Third party resources are not within BNCC's control. Timely acquisition of required quantity and quality of coal is uncertain.	No Coal production and delivery costs increase by more than 300%. Would require significant capitalization at SJM to blend and deliver coal to FCPP. Costs of acquiring from other sources are unknown.	Yes	No It is unlikely that SJM could increase production by 50%—it is more likely that SJCC would have to acquire additional lease area. New storage and blending facilities would need to be permitted. It is uncertain whether approved trucking routes would be in place soon enough to meet the project purpose and need. Navajo Nation is unlikely to approve coal delivery from a third-party mineral interest.	No	Increased coal transportation environmental impacts to air quality, public health and safety, wildlife. Reduced employment and significant reduction in royalties to the Navajo Nation. Conveyor system over San Juan River to San Juan Mine would potentially impact the endangered fish and their designated critical habitat on the San Juan River.

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4.2.1 Applicant Preferred Alternative

The proposed Project, the applicant preferred alternative, would utilize two of BNCC's draglines working within multiple permitted pits or a single pit of sufficient length for multiple activities. For a detailed description of the preferred alternative, see Sections 2.3 and 6.3 and Map 2 of Attachment A. This plan is in accordance with current and historic operations at Navajo Mine and enables reasonable operational flexibility, maintenance of sufficient stockpiles, and contingency reserve and coal blending opportunities while minimizing operational risks. This alternative meets the project purpose and need to deliver contracted coal quantities to FCPP through 2041.

4.2.1.1 Practicability Analysis for Proposed Project

The proposed Project could be implemented at a reasonable cost. The proposed mine plan includes reasonable capital costs for new infrastructure, contingency reserves, and stockpiles. The proposed mine plan also enables mining within an acceptable strip ratio and variability in pit depth. Logistically, all conditions that could cause production delays and operational risks are managed or mitigated under this alternative by having multiple draglines operating in different pits or a single pit of sufficient length for multiple activities. Therefore, the proposed Project is a practicable alternative.

4.2.1.2 Environmental Considerations

As a practicable alternative, USACE must consider the environmental consequences of the proposed Project. These consequences are analyzed and reported in detail in Sections 6 and 7 of this report. A summary is included here. Impacts to WoUS under this alternative would be approximately 5.0 acres over the 25 years of the proposed Project. The proposed impacts are broken down by impact type in Section 6.3. Impacts to other environmental factors (e.g., biological, sensitive species, water, air, etc.) are detailed in Section 7 of this analysis and additional information is available in the EIS.

4.2.2 No Federal Action

33CFR 325 Appendix B (9)(b) directs the Corps to determine the no action alternative to be the alternative "which results in no construction requiring a Corps permit." For the proposed permit action, the scope of analysis has been determined to include the entire mine project and associated mining infrastructure. WoUS permeate the proposed mine expansion area to the extent that avoidance of all Corps jurisdictional features would prohibit the mine from mining within the proposed project area in a manner that meets other federal and tribal requirements. The No Action alternative is thus that mining activities would not take place in Areas 4 North and South, and there would be no realignment of Burnham Road.

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4.2.2.1 Practicability Analysis for No Federal Action

The No Action alternative, as described, would result in the mine continuing mining activities within the area covered under their existing 404 permit (issued March 2012) until the coal runs out (estimated July 2016). Reclamation of existing mined areas would then take place and be monitored for a period of 15-30 years, after release of which the Navajo Nation may return the land to a grazing use, as provided by SMCRA reclamation requirements and existing lease agreements. The No Action alternative would not meet the purpose and need for the proposed project.

4.2.3 Alternative Mine Designs

Alternatives to the proposed Project include two mine plans with different footprints and mine strip configurations (BNCC 2013). The mining methods for the two alternative mine plans would be similar to the methods utilized for the proposed Project (Maps 3 and 4 in Attachment A). The two alternative mine plans are both contained within Area 4 North and Area 4 South, as is the proposed Project. Table 3 compares various components of these two alternate designs with the proposed Project.

Table 3. Alternative Mine Designs and their Project Features

Project Features	Mine Design Alternative[1]		
	Proposed Pinabete Mine Plan (Proposed Project)	Alternative Mine Plan #1	Alternative Mine Plan #2
SMCRA Permit (acres)	5,569	5,412	10,094
Conceptual Mining Disturbance Footprint (acres)	4,104	4,998	6,492
Proposed Relocation of the Burnham Road (N-5082) (miles)	3	6	6
Approximate Impact to WoUS (acres)	5.0	33.0	6.6
Length of Primary Roads (miles)	5	13	15
Length of Ancillary Roads (miles)	16	14	15

DRAFT

Length of Power lines (miles)	8	16	16
Haul Distance to Lowe Stockpile (Area 3) (miles)	5	8	8

[1] – BNCC 2013

4.2.3.1 Alternative Mine Plan #1

Alternative Mine Plan #1 was originally proposed as a 50-year mining project within Area 4 South and Area 5 of the Navajo Mine Lease Area (BIA 2007). The Alternative Mine Plan #1 is described in detail in Appendix D of the Desert Rock Energy Project Draft EIS (BIA 2007). The mine plan was adjusted to only include mining within Area 4 South (see Map 3 in Attachment A) and would be adjusted to meet the proposed purpose and need of FCPP and the Navajo Mine Energy Project.

Under this alternative, BNCC would seek approval from OSM for a new 5,412-acre SMCRA permit that includes a mining disturbance of approximately 4,998 acres (Table 3). BNCC would operate two draglines and the coal would be transported to a field coal stockpile on the western permit boundary, prior to being transported 8.4 miles to the Lowe Stockpile in Area 3 via primary haul roads.

4.2.3.1.1 Practicability Analysis for Alternative Mine Plan #1

A major component of Alternative Mine Plan #1 is the diversion of the Pinabete Arroyo into No Name Arroyo. According to BNCC cost estimates, the Pinabete Diversion would have to be completed early in the mining sequence and require an approximately $30 million (in 2005 dollars) additional infrastructure expense. The infrastructure costs of Alternative Mine Plan #1 (i.e., Pinabete Diversion, haul roads, power lines, ancillary roads, support facilities) would likely cost BNCC an additional $70 million dollars over the proposed Project. The longer haul roads would likely require the purchase of an additional five coal haulers ($15 million) to maintain sufficient production rates. BNCC would utilize the existing Area 3 Industrial Facilities, so no new industrial facilities would be constructed. Under Alternative Mine Plan #1, additional labor would likely be required for coal haulage, maintenance of haul roads, and maintenance of the additional equipment. BNCC would likely experience an approximate 10 percent increase in operating expenses due to the longer haul roads and labor.

Alternative Mine Plan #1 would require additional revisions to pending permitting actions including, but not limited to: the OSM SMCRA Pinabete Permit application, BLM R2P2 revision, and USEPA NPDES revision application. It is unlikely that these required permitting revisions would be completed by the start of the proposed fuel sales agreement in July 2016.

4.2.3.1.2 Environmental Considerations

Impacts to WoUS under this alternative would be about 33 acres and would include mining through the majority of Pinabete Arroyo within Area 4 South. The Pinabete Arroyo would be diverted upstream of the mining area into the smaller No Name Arroyo. This temporary diversion would require approximately 3 to 4 million cyds in excavation and extensive engineering and design. The diversion would remain in place for the duration of proposed mining. Compared to the proposed Project, Alternative Mine Plan #1 would impact 28 additional acres of WoUS—an additional 800 acres would be included in the disturbance footprint compared to the proposed Project. The California Rapid Assessment Method (CRAM) analysis included two sites on Pinabete Arroyo that scored higher in habitat value than the headwater ephemeral streams including the presence of tamarisk and willow (*Salix exigua*) patches that provide potential migratory stopover habitat for the federally listed southwestern willow flycatcher (see Section 6.2).

4.2.3.2 Alternative Mine Plan #2

Alternative Mine Plan #2 was the original version of a mine plan to supply coal to FCPP for Post-2016 operations. Under Alternative Mine Plan #2, BNCC would seek approval from OSM for a new 10,094-acre SMCRA permit area and proposed mining disturbance in approximately 6,492 acres (see Table 3). Mining would be located in both Area 4 North and Area 4 South (see Map 4 of Attachment A). BNCC would continue to develop the Area 4 North striplines to the south into the new permit area. The Area 4 South pit would be located southwest of the Pinabete Arroyo and would require a new boxcut to develop this pit. It is a possibility that BNCC would use all three draglines (two draglines in Area 4 North and one in Area 4 South) until the boxcuts in the Area 4 South pit were completed. Once the boxcuts were complete, only two draglines would be needed, one in each pit (BNCC 2013).

Coal from the Area 4 North pit would likely be hauled directly to the Lowe Stockpile in Area 3 for a distance of 3.7 miles. Similar to Alternative Mine Plan #1, Alternative Mine Plan #2 contains a field coal stockpile in Area 4 South (see Map 4 of Attachment A). Coal from the Area 4 South pit would likely be hauled to the stockpile prior to be being hauled the 8.4 miles to the Lowe Stockpile.

4.2.3.2.1 Practicability Analysis for the Alternative Mine Plan #2

The additional infrastructure (e.g., haul roads, power lines, support facilities, etc.) associated with Alternative Mine Plan #2 would be similar to Alternative Mine Plan #1, but would not require construction of the Pinabete Diversion. According to BNCC cost estimates, the infrastructure costs, i.e. haul roads, powerlines, support facilities, of Alternative Mine Plan #2 would likely be an additional $40 million dollars over the proposed Project. The longer haul roads would likely require the purchase of an additional five coal haulers ($15 million) to maintain sufficient production rates. BNCC would utilize the existing Area 3 Industrial

Facilities, so no new industrial facilities would be constructed. Under Alternative Mine Plan #2, additional labor would likely be required for coal haulage, maintenance of haul roads, and maintenance of the additional equipment. BNCC would likely experience an approximate 10 percent increase in operating expenses due to the longer haul roads and potential additional labor.

Alternative Mine Plan #2 would require additional revisions to pending permitting actions including, but not limited to: the OSM SMCRA Pinabete Permit application, BLM R2P2 revision, and USEPA NPDES revision application. It is unlikely that these required permitting revisions would be completed by the start of the proposed fuel sales agreement in July 2016.

4.2.3.2.2 Environmental Considerations

Alternative Mine Plan #2 would impact 6.6 acres of WoUS, which is 1.6 acres greater than the proposed Project. In addition, the alternative would include up to approximately 1,300 acres of additional surface disturbance (see Table 3). Potential impacts to federally listed species would be the same as under proposed Project.

4.2.4 Alternative Mining Techniques

4.2.4.1 Implement Highwall or Longwall Mining Techniques

This alternative considers recovering the coal at Navajo Mine using mining techniques other than surface mining with draglines. Highwall mining techniques use highwall continuous miners or augers to extract the coal by penetrating into the horizontal coal seams exposed by the highwalls or vertical walls in an existing pit (see Figure 3). Longwall mining is a type of underground mining. It is accomplished by mining along a coal seam and using hydraulic roof supports above the longwall operation to avoid immediate collapse. Coal recovery with these alternate methods is substantially lower than the 90 percent recovery achieved with the current dragline operation at Navajo Mine. Highwall or longwall mining would not meet the maximum economic recovery requirements of the Navajo Mine Lease and BLM’s R2P2 mandates. Furthermore, the lower coal recovery rate for these alternate mining methods would also reduce the likelihood that remaining coal reserves at Navajo Mine would be sufficient to meet obligations for supply to FCPP.

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Figure 3. Example of a Highwall Miner

Implementation of either alternative mining technique at BNCC would require many plan revisions and regulatory approvals including:

- Addendum to the current Ground Control Plan
- Revision to the proposed Pinabete SMCRA Permit and mine plan and
- Revision to the current Navajo Mine SMCRA permit
- Revision to BLM's R2P2 for Navajo Mine
- BIA approval to utilize these mining methods at BNCC and potential changes to mine lease and trust agreements to adjust maximum economic recovery terms for Navajo Mine
- Revision to the staffing at Navajo Mine with mine workers skilled in underground or highwall mining.

Auger mining and longwall mining would shift Navajo Mine from a surface to underground mine and would involve a shift in strategies. Detailed geotechnical evaluations and altered mine planning would be required to deal with the change in mining strategies and the surface subsidence that occurs with auger or longwall mining. Since Navajo Mine was designed and operated as a surface strip mine for the past 50 years, conversion to these alternate mining

methods would require significant investment in re-design, equipment, and employee training. According to BNCC cost estimates, the capital cost for equipment alone (i.e., longwall, continuous miners, vent shaft, conveyors) is estimated to be about $300 million. This estimate is based on BHP Billiton New Mexico Coal's (BNCC's parent company) experience with development and operation of the San Juan Mine.

4.2.4.1.1 Practicability Analysis for Utilizing Alternate Mining Techniques

Highwall mining at Navajo Mine would be completed in conjunction with continued strip mining operations because strip mining creates the vertical faces required for auger access. Highwall mining would recover approximately 40 to 50 percent of the coal reserve as compared to the approximate 80 to 90 percent recovery of the same coal reserve by a surface dragline operation. BNCC would be required to subcontract this mining operation to a third-party because it does not own the equipment or employ workers trained for this mining method. This would substantially increase operating costs. In 2001, a contractor was employed at San Juan Mine to conduct highwall operations prior to startup of the underground operations. The estimated cost was about $5.00 per ton of coal produced at the pit, which is substantially more expensive than current operations.

In addition to the plan revisions and regulatory approvals listed above, longwall mining would require a new mine plan for underground operation. Converting to an underground mining operation would also affect the existing workforce. Workers that did not want to transfer to the underground operation would need to be terminated or transferred and a new underground workforce would have to be recruited and trained. As with highwall mining, longwall mining would recover approximately 40 to 50 percent of the coal reserve as compared to the approximate 80 to 90 percent recovery of the same coal reserve by a surface dragline operation. A longwall operation would only recover a portion of the largest seam and would not be able to recover the other seven or eight seams. Unlike a dragline or truck/loader mining operation, a longwall operation can only mine one seam. In addition, longwall mining would sterilize substantial surface recoverable coal reserves due to subsidence and the inability to economically or physically recover the thinner coal seams. This reduced resource recovery could be in violation of maximum economic recovery requirements of the mine lease agreement and BLM's R2P2 regulations (43 CFR 3484.1). Further, it is unlikely that either the highwall or the longwall options would produce sufficient quantities of coal to timely meet contractual obligations. Finally, converting from a surface strip mine to a modern underground longwall mine would require significant recapitalization and business plan revision by BNCC. BNCC would need to agree to undertake new business and safety risks associated with these mining methods. Therefore, neither highwall nor longwall mining methods are considered practicable to meet coal delivery obligations through 2041 due to timing, cost, quantity, and logistical obstacles.

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4.2.4.1.2 Environmental Considerations

Using longwall mining, there would be minor impacts to WoUS primarily from road crossings to provide support to the underground mine. There would be areas of subsidence that could affect drainages. Impacts from highwall mining are difficult to predict because significant effort would be required to develop a feasible mine plan and footprint. The socioeconomic impact is difficult to predict; while BNCC would have significantly higher operational costs, only a select few local contractors would benefit.

4.2.5 Alternative Mine Sites

Alternative mine sites were also considered when developing the LEDPA. Three separate mines were identified within the larger Four Corners Region as potential suppliers of coal to FCPP (San Juan Mine, Kayenta Mine, and El Segundo Mine) (see Map 5 of Attachment A).

4.2.5.1 Off-Site Coal Supply

Another approach is to meet coal obligations with FCPP from an off-site source such as San Juan Mine located 5 miles north and across the San Juan River from FCPP. Coal from the San Juan Mine is similar to that at Navajo Mine and therefore could likely be burned at the FCPP; whereas other regional mines are unlikely to have similar coal quality for use at FCPP. Using San Juan Mine as a coal source would require that sufficient quantities of coal be provided from the San Juan Mine. Presently, San Juan Mine has an annual production capacity of 8 to 9 million tons. At this rate, the coal reserves at the mine are estimated to be sufficient until 2022. San Juan Mine would have to supply FCPP with approximately 6 million tons of coal annually to meet the contractual obligations to FCPP through 2041. To supply this quantity of coal, San Juan Mine would have to increase its production capacity by 66 percent. Furthermore, new coal loading facilities would have to be installed at San Juan Mine and FCPP as well as new stockpile, mixing, and storage facilities. Because of cost and permitting restrictions, the most likely delivery method would be to truck the coal from San Juan Mine to FCPP, which is approximately 15 miles by available public roads. This would require that BNCC obtain state and local approvals and permits to operate coal trucks along a proposed public road delivery route. The number of truck trips needed to provide FCPP with approximately 6 million tons of coal from San Juan Mine annually is estimated to be almost 822 trips daily.

The concept of a conveyor option has previously been considered by BNCC to deliver coal from Navajo Mine to the San Juan Generating Station (SJGS) and a similar option could be used to deliver coal from San Juan Mine to Four Corners Power Plant. The conveyor delivery alternative however was rejected due to high costs and potential impacts to endangered fish and designated critical habitat in and along the San Juan River. In addition, San Juan Mine would have to obtain additional equipment and revise their mine plan to meet the additional demands.

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Other potential sources of off-site coal include the Kayenta Mine (10 miles southwest of Kayenta, Arizona and approximately 160 miles from FCPP using available public roads) and El Segundo Mine (30 miles north of Milan, New Mexico and approximately 180 miles from FCPP using available public roads). As with transporting coal from San Juan Mine (SJM) to FCPP, the most likely delivery method would be to truck the coal requiring BNCC to obtain state and local approvals to operate coal trucks along a public road and would require the same 822 trips daily.

A related consideration is that the EPA has suggested that mining coal for export be discussed and evaluated in the alternatives analysis, citing press reports that it is being considered by the Navajo Nation. Coal export would require a change to the mine plan to support export, with an associated NEPA review owing to public controversy. Infrastructure upgrades (roads, rail) would likely also require NEPA review. OSMRE has determined that this alternative is speculative at this point, and were the option considered by NTEC, there would be associated NEPA reviews required that would address the consequences of the plan.

4.2.5.1.1 Practicability Analysis for Off-site Coal Supply

Using an off-site coal mine would require that FCPP negotiate a lease modification with the Navajo Nation to allow delivery of coal from a source other than Navajo Mine. Furthermore, San Juan Mine would have to negotiate a modification with its contract with SJGS to allow for sale of coal to a third-party. In addition, transport costs would increase the cost of coal supplied to FCPP. The logistics of transporting coal by truck to FCPP from an off-site source would greatly increase the likelihood of coal supply disruptions at FCPP, and require additional stockpiles and coal quality monitoring. Similar obstacles would occur for transporting coal from either Kayenta or El Segundo Mine with additional difficulties of obtaining contracts with other coal companies and approximately 12 times the travel distance. It is also unclear as to what, if any, other federal, tribal, or state approvals would be required. Utilizing an off-site coal mine is not practicable because of substantial additional costs and logistical obstacles.

4.2.5.1.2 Environmental Considerations

Increased environmental impacts associated with off-site coal delivery to FCPP would occur under this alternative. The 822 daily truck trips between FCPP and SJM, Kayenta Mine, or El Segundo Mine would increase adverse impacts on air quality, vehicle traffic, transportation infrastructure wear, public health and safety, and wildlife.

4.2.6 Conclusion of Alternatives Analysis

In light of the Project purpose, no alternatives to the proposed Project are practicable—primarily due to the logistical obstacles, operational risks, additional costs, and permitting time required to implement the various alternatives. Additionally, alternatives other than the proposed Project have either greater impacts to WoUS and/or to other elements of the environment. The two alternative mine designs would have substantially larger footprints and impact at least 1.6 additional acres of WoUS for the Alternative Mine Plan #2 and up to 28 additional acres for

DRAFT

Alternative Mine Plan #1 (see Table 3). The alternative mining techniques and utilizing off-site coal mines represent extreme emergency scenarios that are not commercially reasonable under normal operating circumstances at Navajo Mine. Under the No Federal Action Alternative, no additional mining would occur beyond what is currently permitted through July 2016, and Burnham Road would not be realigned.

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5. Compliance with Other Federal, State, or Local Laws

5.1 Section 7 of the Endangered Species Act (ESA)

Consultation is ongoing with USFWS in coordination with OSM. The USACE is a consulting party to the Section 7 process.

5.2 Section 106 of the National Historic Preservation Act (NHPA)

Consultation is ongoing with the Navajo Nation in coordination with OSM. The USACE is a consulting party to the Section 106 process.

5.3 Section 401 of the Clean Water Act

An initial 401 permit application has been submitted to the Navajo Nation Environmental Protection Agency (NNEPA).

5.4 Clean Air Act

The Clean Air Act (CAA) (42 U.S.C. 7401 et seq.) and USEPA-established CAA implementing regulations (40 CFR 50-99), establish a comprehensive framework for the evaluation and regulation of both air quality and air quality impacts via national ambient air quality standards (NAAQS). NAAQS set the maximum allowable concentration of pollutants in ambient air. The overall approach of the CAA is based on the linkage between emission sources of air pollutants and the ambient concentrations of those pollutants.

Consultation is ongoing with the USEPA in coordination with OSM; the USACE is a consulting party to the CAA process.

5.5 Relevant Presidential Executive Orders

5.5.1 Executive Order 13175—Consultation with Indian Tribes, Alaska Natives, and Native Hawaiians

Consultation is ongoing with the Navajo Nation in coordination with OSM. The USACE is a consulting party to the Section 106 process.

5.5.2 Executive Order 11988—Floodplain Management

There would be minimal effect to floodplains and floodplain management associated with the proposed Project; surface impoundments required by OSM would retain stormwater within the mine areas.

5.5.3 Executive Order 12898—Environmental Justice

In general, the Proposed Action would result in limited environmental and health effects, not above generally accepted norms or appreciably exceeding those experienced by other

DRAFT

populations, on the local community due to the limited magnitude and geographic range of expected impacts and extensive mitigation and protective measures incorporated in project operations.

5.5.4 Executive Order 13112—Invasive Species

With surface disturbance, the potential for the spread or introduction of noxious weeds increases. Vehicles, people, wind, and water may transport seeds and deposit them in disturbed soils, or existing seeds may be encouraged to germinate in disturbed soils. Noxious weeds that spread can degrade habitat quality and decrease productivity of native forage. As with fugitive dust, the effects of noxious weeds can extend beyond the immediate area of disturbance. BNCC's Noxious Weed Management Plan employs multiple measures to minimize the introduction and spread of noxious weeds within Navajo Mine. These measures include the purchase of certified native seed and grass-hay mulch from credible sources.

5.5.5 Executive Order 13212 and 13302—Energy Supply and Availability

The review was expedited and/or other actions were taken to the extent permitted by law and regulation to accelerate completion of this energy-related project while maintaining safety, public health, and environmental protections.

5.6 Other Authorizations

Not applicable.

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6. WATERS OF THE UNITED STATES

6.1 Jurisdictional Determination

The field mapping for the Area 4 North and Area 4 South preliminary jurisdictional determination (PJD) survey area was conducted on July 18 and August 1-3, 2011 by wetlands ecologists from Ecosphere Environmental Services (Ecosphere) and received independent concurrence from USACE on November 27, 2011 (see Map 6 of Attachment A). Methodologies used during these surveys are outlined in A Field Guide to the Identification of the Ordinary High Water (OHWM) in the Arid West Region of the Western United States (ERDC/CRREL TR-08-12, August 2008) and approved for use by the USACE Albuquerque District. Where proposed mining activities would potentially impact "bluelines" [as obtained from the U.S. Geological Survey (USGS) High-Resolution National Hydrography Dataset (NHD); USGS 2008], a field determination was made on whether the drainage feature supported a defined bed-and-bank feature based on scour and deposition processes.

If scour and deposition features were present, an assessment was made to determine which geomorphic features present were representative of an OHWM. Primary OHWM features used were the top elevation of lateral and point bars, changes in particle size, and the presence/absence of vegetation. Along with OHWM width, average OHWM depth was measured. Average depth was based on the difference between the OHWM elevation and the average elevation of the channel bed surface. A Global Positioning System (GPS) point and photograph were taken where each OHWM measurement was made. Measurements were made at intervals along each "blueline" that would allow a reasonable approximation of the surface area and volume of WoUS potentially impacted by BNCC mining activities. Of the 104 "blueline" crossings measured and recorded in the field, 25 were areas with no defined bed-and-bank. In these instances, the beginning of the defined channel (bed-and-bank) were identified in the field and located with a GPS unit (Ecosphere 2012a).

The survey area included in this PJD report includes sections previously analyzed for Section 404 NWP 21 renewals and IP application for Areas 3 and 4 North within the Cottonwood drainage. Fieldwork to support Section 404 permitting for mining activities in Areas 3 and 4 North was completed in 2008 and 2009 using the same methodology outlined above (Ecosphere 2012a).

Overall, Ecosphere delineated about 16.2 miles and about 29.0 acres of WoUS and about 2.05 acres of stock ponds within the Project Area (see Map 6 of Attachment A) (Ecosphere 2012a). This includes about 6.3 miles and about 7.9 acres of WoUS (all in the Cottonwood drainage) previously identified in the 2009 PJD submitted to the USACE in association with BNCC's 2009 and 2011 NWP 21 renewals (SPA-2008-520-DUR and SPA-2011-00122-ABQ, respectively), and 2011 Pre-2016 Area 3 and Area 4 North Mining IP (SPA-2011-00122-ABQ), and 2012

DRAFT

Pinabete IP application (SPA-2012-00253-ABQ). The USACE verified the PJD determinations on November 27, 2011. Table 4 includes a summary of all WoUS by watershed. Table 5 includes the jurisdictional stock ponds.

Table 4. WoUS separated by watershed

Drainage	Length of WoUS (Miles)	Area of WoUS (Acres)
Cottonwood Arroyo	7.6	10.4
Pinabete Arroyo	8.6	18.6
Total	16.2	29.0

Table 5. Jurisdictional Stock ponds within the PJD survey area

Drainage	Name	Area (Acres)	Cowardin Classification[1]
Pinabete Arroyo	Pinabete Pond	0.58	PUS[2]
Pinabete Arroyo	Area 4N/4S Pond	0.34	PUS
Pinabete Arroyo	Stevenson's Well Pond	1.13	PUS
	Total	2.05	

[1] – Cowardin et al 1979.
[2] – PUS – palustrine unconsolidated shore.

6.2 Ecological Functions of Ephemeral Channels

6.2.1 Assessment Methodology

CRAM was used to evaluate the background condition of the arid ephemeral streams and channels within Area 4 North and Area 4 South (described in this section), to estimate the effects of post-project direct and indirect impacts (described in Section 6.5), and to evaluate the adequacy of the proposed mitigation (described in Section 9) (CWMW 2012). USACE encourages the use of rapid assessment methods as a core tool to evaluate aquatic resource condition. CRAM was originally intended to provide a rapid and repeatable assessment method that can be used routinely for wetland monitoring and assessment throughout the State of California; however, the constructs of CRAM can be applied to a wide range of arid, ephemeral streams similar to those found throughout the arid southwestern United States (SCCWRP 2010). For example, CRAM was used for several large solar and transmission projects located in southern California under the direction of the Los Angeles District of the USACE including the Solar Two project (SPL-2008-01244-MLM) and for the Pre-2016 Area 3 and Area 4 North mining IP (SPA-2011-00122-ABQ).

DRAFT

Other rapid assessment methods were investigated prior to utilizing CRAM for this project. The New Mexico Environment Department's Surface Water Quality Bureau is currently developing the New Mexico Rapid Assessment Method; however, the method was not ready for public use when the CRAM fieldwork was conducted. It was also determined that CRAM offered a better alternative than a strictly qualitative assessment of the ephemeral channels. CRAM correlated well with a qualitative assessment of the channels observed during fieldwork (section 6.2.7).

The CRAM methodology currently recognizes six major hydrological types, four of which have subtypes (CWMW 2012). Arid, ephemeral and intermittent streams fall into the Riverine type. For the purposes of CRAM, condition is defined as the state of an assessment area's physical and biological structure, the hydrology, and its buffer and landscape context relative to the best achievable states for the same type of hydrologic resource. Condition is evaluated based on observations made at the time of the assessment. Assessment results can then be used to infer the ability to provide various functions, services, values, and beneficial uses to which a hydrologic resource is most suited (CWMW 2012), although these are not measured directly by CRAM. CRAM also identifies key anthropogenic stressors that may be affecting the hydrologic resource's condition.

CRAM assesses four overarching attributes of stream condition: (1) buffer and landscape context, (2) hydrology, (3) physical structure, and (4) biotic structure. Within each of these attributes are a number of metrics that assess more specific aspects of stream condition (Table 6). In addition to producing a condition score, CRAM also includes a stressor checklist to help explain the scores and to identify possible management actions to improve condition. A description of these attributes and their corresponding metrics is provided below.

To conduct a CRAM assessment, each of the metrics is evaluated for an Assessment Area (AA) in the field to yield a numeric score for an assessed wetland based either on narrative or on schematic descriptions of condition or on thresholds across continuous values. Choosing the best-fit description for each metric generates a letter grade for each attribute. Metric and attribute scoring in CRAM was developed such that the incremental increase in condition associated with moving from one category to the next higher category is the same across metrics and attributes; that is, an increase from category D to category C is proportionally the same as an increase from category B to category A. These letter grades are converted to numeric scores by assigning the following values: A=12, B=9, C=6, D=3. Metric scores under each attribute are aggregated in CRAM to yield scores at the level of attributes, and attribute scores are aggregated to yield a single overall index score, via simple arithmetic formulas. Attribute and index scores are expressed as percent possible, ranging from 25 (lowest possible) to a maximum of 100.

DRAFT

Table 6. Relationship between CRAM attributes and metrics/submetrics. The four attributes are averaged to produce an overall CRAM index score.

Attribute	Metric
Buffer and Landscape Context	Landscape Connectivity
	Buffer:
	Percent of AA with Buffer
	Average Buffer Width
	Buffer Condition
Hydrology	Water Source
	Hydroperiod
	Hydrologic Connectivity
Physical Structure	Structural Patch Richness
	Topographic Complexity
Biological Structure	Plant Community:
	Number of Plant Layers Presents
	Number of Co-dominants
	Percent Invasive Species
	Horizontal Interspersion and Zonation
	Vertical Biotic Structure

CRAM is a useful initial diagnostic tool to determine general aquatic resource health and produces condition scores that are comparable and repeatable. An overall CRAM index score provides a way to summarize the conditional health of a wetland or riparian area, relative to its maximum achievable condition. However, using the current CRAM Riverine Module, the maximum overall CRAM index scores may not be achievable for arid ephemeral systems because the CRAM Riverine module was originally designed for coastal Riverine systems that typically have greater plant diversity and cover and greater ecological complexity (CWMW 2012).

The results of the CRAM analysis from this project and previous projects on Navajo Mine and in southern California indicate that the CRAM Riverine module can be applied to arid, ephemeral streams but some of the metrics may need to be recalibrated for this environment. The Buffer and Landscape Context appeared adequate as currently constructed while the Hydrology Attribute performed reasonably well, but some of the current metrics may need to be revised. Metrics within the Biological and Physical Attributes were problematic when applied to the

DRAFT

ephemeral streams on site due to the lack of physical and biological complexity in ephemeral channels. When compared to CRAM scores for perennial, coastal streams, scores for the Project Area were consistently lower for the Physical and Biological Attributes since these attributes of the CRAM Riverine module were designed to detect complexity within a system (CWMW 2012). Nevertheless, the current CRAM Riverine Module still provides a useful method for relative comparison of condition and health of these arid ephemeral systems, and can be used to establish a pre-Project baseline for evaluation of Project impacts, to determine mitigation suitability, and aid in future mitigation monitoring.

6.2.2 CRAM Results

Twenty-four AAs within the study site were assessed with CRAM (see Map 7 of Attachment A). These sites were each within the stream lengths that would be impacted by the various components of the proposed Project (i.e., mining disturbance, Burnham Road crossings, and haul road crossings) or would be located within 250 meters of the disturbance footprint. All sites were classified as unconfined riverine systems (i.e., the width of the valley across which the system can migrate without encountering a hillside, terrace, or other feature that is likely to prevent further migration is at least twice the average bankfull width of the channel). Three sites were along the Cottonwood Arroyo (AAs 16, 23, and 24) and two sites were along Pinabete Arroyo (AAs 24 and 25).

CRAM index scores for the 24 sites ranged from 52 to 72 with the highest score at AA #16 along Cottonwood Arroyo and the lowest score at AA #15; the average score was 59 (see Table 7 and Map 7 of Attachment A). Attachment C contains the full CRAM scores for all 24 sites.

Table 7. Overall CRAM index and attribute scores

CRAM Index and Attribute Scores	Headwater Systems	Cottonwood and Pinabete Arroyos	Overall
Overall Index Score	56	68	59
Buffer and Landscape Context	93	93	93
Hydrology	70	87	73
Physical Structure	32	43	34
Biotic Structure	35	49	38

The drainages within the Project Area fall into two distinct categories. The smaller, headwater stream systems had distinctly different channel widths, morphologies, and biological communities than the larger stream channels of Cottonwood and Pinabete Arroyos. Overall, 19 of the 24 sites captured the headwater stream systems. These sites were primarily west of

Cottonwood Arroyo in Area 4 North and north of Pinabete Arroyo in Area 4 South (see Map 7 of Attachment A).

These sites scored lower than the sites along Cottonwood and Pinabete Arroyos with overall scores 12 points lower (Table 7). The primary differences were in the hydrology, physical structure, and biotic structures attribute scores. Several of these headwater streams were severely incised, which lowers the hydrology attribute score. The streams received less flow during fewer events during the year, so the physical structure of the streams lacked the complexity of Cottonwood and Pinabete Arroyos leading to a lower physical structure score. In general, the headwater stream systems had simpler vegetation communities with less species diversity and lower overall plant cover as the lower biotic structure attribute scores depict.

The sites along Cottonwood and Pinabete Arroyos (AAs 16, 23, 24, 25, and 26) had wider channels with more complexity within the channel and true riparian habitats along their floodplain terraces including small patches of tamarisk (*Tamarisk* sp.), saltgrass (*Distichlis spicata*), and rubber rabbitbrush (*Ericameria nauseosa*). In addition, the vegetation communities had greater overall cover than the headwater stream systems.

6.2.3 Buffer and Landscape Context

This attribute of CRAM addresses general landscape aspects of the riparian vegetation and buffer of a site. CRAM defines buffer as the "area adjoining the assessment area that is in a natural or semi-natural state and currently not dedicated to anthropogenic uses" (CWMW 2012). The metrics scored with the Riverine Module are generally applicable to sites within the Project Area. Although the existing riparian vegetation on the study site may differ in complexity, structure, and species composition from more mesic riparian systems, the connectivity of the riparian corridor and buffer of arid, ephemeral streams still provide important structural habitat for a variety of wildlife species, play an important role in the dispersal of both animals and plants, and can also shade and stabilize fluvial environments, providing habitat for wildlife (Naiman et al. 1993, Patten 1998).

For the CRAM riverine module, this attribute is scored with two metrics: (1) the continuity of the riparian corridor over a prescribed distance upstream and downstream of the assessment area, and (2) the amount, size, and condition of the buffer on both sides of the AA. Overall, this was the highest scoring CRAM attribute; all sites scored a 93 for this attribute. There was no development within 500 meters of any of the AAs. Since Area 4 North and Area 4 South have infestations of invasive species (Russian thistle [*Salsola tragus*] and halogeton [*Halogeton glomeratus*] being the most prevalent), every AA received a "B" for Buffer Condition. The remainder of the metrics scored as "A's."

6.2.4 Hydrology

For the CRAM riverine module, this attribute is scored with three metrics: (1) Water Source (direct fresh water sources to the channel during the dry season), (2) Channel Stability (the degree of channel aggradation or degradation), and (3) Hydrologic Connectivity (assessed based on the degree of channel entrenchment, calculated as the flood-prone width divided by the bank full width; Leopold et al. 1966, Rosgen 1996, Montgomery and MacDonald 2002). Final scores for the Hydrology attribute ranged from 50-92 (average score = 73) (see Table 7). Metrics of the Hydrology attribute in CRAM assess the sources, quantities, and movements of water, plus the quantities, transport, and fates of water-borne materials, particularly sediment as bed load and suspended load (CWMW 2012).

Overall, channel stability within the Project Area can be characterized as generally being in equilibrium with minor signs of aggradation and degradation, which is expected for normally functioning arid, ephemeral streams. Signs of excessive degradation were observed at several sites where incised channels were encountered (AAs 1, 3, 6, 10, 11, 15, 18, and 22). Several of these sites are located in badland formations where the unstable soils are prone to erosion. These sites scored “C’s” for Channel Stability whereas the remainder of the AAs scored “B’s” for this metric.

Hydrologic Connectivity is assessed based on the degree of channel entrenchment, or the inability of flows in a channel to exceed the channel banks (Rosgen 1996). The majority of headwaters sites within the Project Area scored a “C” or “D” for this metric. The sites along the Cottonwood and Pinabete Arroyos scored “B’s” or “A’s” for this metric.

6.2.5 Physical Structure

The metrics used to score the Physical Structure Attribute (physical patch types and topographic complexity) of the CRAM riverine module generally scored very low for the ephemeral streams assessed in the Project Area. Overall, this attribute did not apply well as designed for the arid, ephemeral streams found in the Project Area. For CRAM, this attribute is scored with two metrics: (1) Patch Richness (the number of different obvious types of physical surfaces or features that may provide habitat for aquatic, wetland, or riparian species) and (2) Topographic Complexity (the spatial arrangement and interspersion of patch types). Final scores for the Physical Structure attribute ranged from 25 to 50 (average score = 34) (see Table 7). Overall, this was the lowest scoring CRAM attribute.

For the physical patch type richness metric, most sites scored low due to the few patch types observed in the field; no site scored higher than a “D” except AAs 16 and 23 along Cottonwood Arroyo which scored “C’s.” The low scores are somewhat misleading because some of the patch types listed in the current Riverine module, such as algal mats and submerged vegetation would not occur within an arid system.

DRAFT

To receive a high score for the Topographic Complexity CRAM metric, the presence of two elevational changes (e.g., “benches” or breaks in channel slope) is required. In perennial streams, benching is facilitated by variations in flow and sediment regimes. Because ephemeral streams in arid environments experience extreme and rapid variations in flood regime, the formation of benches is not a process that is expected to occur. Revised cross-section diagrams for arid stream systems would assist in interpretation of the topographic complexity metric, and potentially generate more variable scores for this metric. For example, in Figure 4, these cross-section diagrams could depict representations of in-channel features (e.g., low flow channel, active floodplain, and adjacent terraces) rather than elevation changes associated exclusively with the edge of the assessment area as was seen within the Project Area.

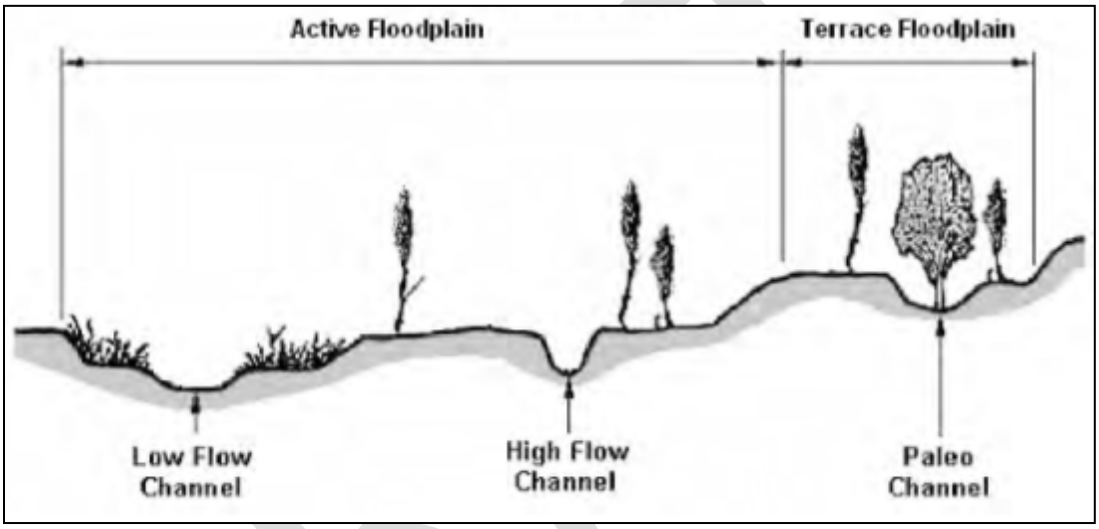

Figure 4. Typical arid, ephemeral/intermittent stream cross section and its associated hydrogeomorphic floodplain units (Lichvar et al. 2009)

6.2.6 Biological Structure

The metrics used to score the Biological Structure Attribute of CRAM generally scored very low for the ephemeral streams in the Project Area. The streams here are typical of arid, ephemeral streams in that they are relatively simple systems with few plant species, low plant cover, and low complexity across the landscape.

Metrics comprising this attribute focus on aspects of the vascular vegetation, which contribute to a wetland’s material structure and architecture. The Biological Structure attribute is scored with three metrics: (1) Plant Community (number of vegetation layers, dominant plant species richness, and the number of invasive co-dominant species), (2) Horizontal Interspersion and Zonation (the number of distinct plant zones and the amount of edge between them), and (3) Vertical Biotic Structure (the degree of overlap among plant layers). Final condition scores for

the Biotic Structure attribute ranged from 31-53 (average score = 38) (see Table 7). Overall, this was the second lowest scoring CRAM attribute.

Using CRAM's scoring criteria, there was an ecological condition difference between the Biological Structure attribute scores for the headwater systems (Biological Structure score of 35) and Cottonwood and Pinabete Arroyos (Biological Structure score of 49). This was evident in the field with the majority of headwater sites having simpler vegetation communities with an average of only two plant layers and little variety within the landscape. The headwater systems also lacked riparian vegetation (tamarisk, willows, and saltgrass) that were observed along Cottonwood and Pinabete Arroyos.

6.2.7 Overall Scores

The Pinabete Permit Area includes a variety of ephemeral systems and CRAM adequately captured that variety within the final scores for the sites. Overall, CRAM scores for the headwater systems were 12 points lower than for Cottonwood and Pinabete Arroyos (Table 7) with large differences in the Hydrology, Physical Structure, and Biological Structure Attribute scores. These differences were also observed in the field with less biological diversity in the headwater systems, greater channel incisement due to badland formations, and an overall lack of complexity in the system.

6.3 Impacts to Waters of the United States

Surface disturbance from the Proposed Project would result from the following mine activities: strip mining, the construction and use of haul and light vehicle roads, realigning Burnham Road, the construction and maintenance of a transmission line, and building infrastructure to support mining activities. The total amount of surface disturbance within the proposed Pinabete Permit Area would be about 4,104 acres (see Table 8 and Map 8 of Attachment A) and about 5.0 acres of WoUS would be impacted by the proposed mine activities.

Table 8. Surface Disturbing Components from the Proposed Action

Type of Activity	Total Area Affected (acres)	Proposed Impacts to WoUS (acres)	Type of Disturbance
Area 4 North and Area 4 South Mining Activities	3,356	2.98	Permanent
Haul Roads, Light Vehicle Roads, and the Burnham Road Realignment	414	0.92 (3)	Permanent
Transmission Line[1]	56	0	None
Infrastructure (Sediment and Drainage Control Ponds, Soil and Coal Stockpiles)[2]	278	1.1 (3)	Permanent
Total	4,104	5.0	Permanent

1 – The power line crosses 4 jurisdictional channels, but no poles would be placed within the OHWM and no access roads would cross the channels.

2 – No buildings would be located within jurisdictional streams. Retention ponds or stockpiles could be located within jurisdictional channels.

3 – Estimated acreage of impacts to WoUS resulting from construction of haul roads, light vehicle roads, and sediment ponds.

6.3.1 Area 4 North and Area 4 South Mining Area Impacts

Proposed mining activities in portions of Area 4 North and Area 4 South would impact approximately 2.98 acres of WoUS (see Table 9 and Map 8 of Attachment A). The mining disturbance has been separated into 5-year increments and the acreage incudes both the pit stripline disturbance and mining buffer (maximum distance of 1,800 feet). The mining area buffer is needed to safely salvage topdressing resources and place haul roads, access roads, and mining support facilities in advance of active mining strips. WoUS within the Area 4 North and Area 4 South mining areas would effectively be removed until reclamation occurs (see Section 6.4). The approximately 2.98 acres of WoUS includes ephemeral, headwater stream systems with narrow channels and no riparian vegetation. Mining disturbance would also impact three ephemeral stockponds—the Area 4 North/4 South Pond, the Pinabete Pond, and Stevenson Pond. In an effort to minimize impacts to WoUS, BNCC is not proposing to conduct mining activities within the Cottonwood Arroyo or Pinabete Arroyo.

Table 9. Potential impacts to WoUS in Area 4 North and Area 4 South from mining striplines and the 1,800-foot buffer

Five-year mining stripline increments[1]	Total acres of land disturbance	Acres of impacts to WoUS
2016 to 2021	1,033	0.65
2021 to 2026	1,081	0.37
2026 to 2031	453	0.14
2031 to 2036	501	0.55
2036 to 2041	288	1.27
Total	**3,356**	**2.98**

[1] – Includes 1,800-foot buffer for overburden placement/removal and support facilities.

6.3.2 Haul Roads, Light Vehicle Roads, and Burnham Road Realignment

Haul roads, light vehicle roads, and the Burnham Road realignment will be designed to industry standards, to control and prevent erosion and siltation, and to minimize the impacts to the normal water flow within the channels within the Project Area. The haul roads, light vehicle roads, and Burnham Road Realignment will impact approximately 0.92 acre of WoUS (see Table 8). These impacts would result from the installation of culvert crossings. All culvert crossings would be adequately sized to safely pass a 10-year, 6-hour precipitation event.

6.3.2.1 Haul Roads and Light Vehicle Roads

Haul roads would be constructed along the east and west perimeters of the active mining areas for Area 4 North and Area 4 South (see Map 8 of Attachment A). There would be one designated light vehicle road that would parallel the east haul road along the eastern border of the permit area. The east and west perimeter haul roads combined with the adjacent light vehicle roads include crossings of WoUS are calculated to impact approximately 0.89 acre of WoUS (see Table 8 and Map 8 of Attachment A). The one ephemeral stream crossing proposed for the west haul road is contained within the 1,800-foot buffer for the mining strips. To provide for operational flexibility as mining proceeds and to access vegetation reference areas and potential future infrastructure such as topdressing stockpiles, staging areas, etc., BNCC anticipates a future haul road and light vehicle road crossing of the South Fork of the Cottonwood Arroyo. BNCC has developed a typical design for the crossing in accordance with current mine design standards and SMCRA requirements. The typical design for the road crossing is provided included as Attachment B. The typical design includes information regarding construction watershed acreage above the culvert crossing, the culvert diameter, and the culvert length (Attachment B).

6.3.2.2 Burnham Road Realignment

The Burnham Road realignment crosses one ephemeral channel (see Map 8 of Attachment A). The crossing would require a culvert due to the amount of traffic and the need to keep the road open during large precipitation events. Total impacts to WoUS from the Burnham Road Realignment are calculated to be 0.03 acre.

6.3.3 Transmission Line

In order to support the proposed mining activities in portions of Area 4 North and Area 4 South, BNCC would need to construct a transmission line along the perimeter of BNCC's Navajo Mine Lease and the Pinabete SMCRA permit area (Project Area). The transmission line would cross four jurisdictional WoUS (see Map 8 of Attachment A); however, no poles would be placed in the ephemeral streams and no access roads would cross the jurisdictional WoUS. This is consistent with current BNCC power line construction practices.

6.3.4 Infrastructure

Various structures are necessary to support mining activities. These include sediment and drainage control ponds, topdressing and coal stockpiles, and various buildings. No buildings would be constructed within WoUS. Sixteen sediment and drainage control ponds are proposed within the Project Area (see Map 8 of Attachment A). Of the 16, only three would be located outside of disturbance buffers for roads or the mining strips (see Map 8 of Attachment A). A typical pond design and dimensions and capacities for each of the 16 ponds are included in Attachment B. It is not expected that the total WoUS impact acreage of the 16 proposed ponds would be greater than 0.2 acre based on the average size of other ponds that were constructed in Area 3 and the northern portion of Area 4 North. To provide for operational flexibility and to

DRAFT

facilitate infrastructure as mining proceeds, BNCC anticipates a total of approximately 1.1 acres of impact to WoUS resulting from mine plan infrastructure (see Table 8).

6.4 Reclamation

BNCC is required to reclaim all areas disturbed during strip mining operations as contemporaneously as practicable with mining operations (30 CFR §816.100). SMCRA requires diverse, effective, and permanent vegetative plant communities native to the BNCC permit area to be established on all regraded and other disturbed lands (30 CFR 816.111). A reclamation plan has been developed for the mine in compliance with the requirements of the SMCRA permit (BNCC 2012). Reclamation consists of the following activities:

- Backfilling and grading
- Replacement of topdressing
- Revegetation
- Reclamation monitoring
- Post-mining land use with the same as or higher and better use than pre-mining uses. In this case, the drainage density would be restored to the pre-mine density.

6.4.1 Backfilling and Grading

Spoil materials are regraded with dozers, front-end loaders, haul trucks, or draglines to an approved final surface configuration (FSC) topography. Backfilling and grading activities are conducted as contemporaneously as practicable.

Regrading generally consists of both primary and secondary regrading activities. Primary regrading utilizes track dozers to level off the spoil ridges. Some areas and ramps might not have sufficient backfill material readily available for track dozers to adequately regrade the area. In these instances, supplemental equipment may be used to facilitate primary regrading activities. This equipment includes, but is not limited to, scrapers, draglines, and end-dump haul trucks and front-end loaders. Secondary regrading may, if needed, follow primary grading for additional contouring of the land surface to accommodate topdressing replacement.

Once the area has been regraded to the FSC topography, the regraded spoil is systematically sampled for root-zone suitability. Areas not meeting the OSM approved root-zone criteria are mitigated as required with up to four feet of suitable root-zone material.

6.4.2 Replacement of Topdressing

Areas disturbed by mining or mining related activities (e.g., ramps, primary haul roads, and support facilities) would have topdressing material replaced for the purpose of reclamation. Areas of minimal surface disturbance (e.g., ancillary roads, power line disturbances, drill sites)

would not receive additional topdressing material. Heavily compacted regraded surfaces would be ripped to alleviate compaction. Topdressing may be replaced year-round with equipment (i.e., scrapers or haul trucks) best suited for the conditions of the reclamation area. Topdressing material would be hauled from either topdressing stockpiles or hauled directly from a topdressing salvage site and replaced on the reclamation plot at an average prescribed depth.

6.4.3 Revegetation

Revegetation activities are initiated on those areas that have been regraded and topdressed during the first normal growing season after regrading and topdressing. Revegetation activities run from March through October and include seedbed preparation, seeding, mulching, and irrigation. The seedbed is mechanically prepared using traditional agricultural practices to reduce soil compaction, promote water infiltration, control wind and water erosion, and improve seed to soil contact for early seed development. The prepared seedbed is seeded with approved native cool and warm season seed mixes consisting of native forbs, grasses, and shrubs appropriate for the region. Mulch is applied and crimped into all reseeded areas to control erosion, slow evaporation at the surface, promote infiltration, decrease wind velocity at the soil surface, and provide an organic base to promote nutrient cycling.

BNCC utilizes irrigation to help promote the establishment of a sustainable revegetation cover. Irrigation is applied over two growing seasons, as needed, from May to mid-October. The first growing season is intended to help promote the successful germination and establishment of the seed mixes. The second growing season irrigation is generally a one-time application scheduled for April or May intended to support root development. During years of high winter or spring precipitation, the second year irrigation is reduced or is unnecessary.

6.4.4 Monitoring

Once the area has been regraded, topdressed, and revegetated, BNCC is required to monitor its progress for a minimum of 10 years to ensure that a diverse, effective, and sustaining vegetative cover capable of supporting the prescribed post-mining land-use is established.

6.4.5 Schedule

According to BNCC's Pinabete mine plan, reclamation would begin approximately 10 years after mining in the Project Area begins in 2016 and would continue as contemporaneously as practicable. An area would be feasible for reclamation once it is a sufficient distance away from the active mining areas and of sufficient size to allow for the safe operation of reclamation equipment.

6.5 CRAM Analysis of Impacts

The direct and indirect effects during construction and operation of the Areas 4 North and 4 South mining areas, as previously discussed, have the potential to adversely affect the ephemeral

channels found within the Project Area. CRAM was used to assess the existing functionality of these channels and assign numerical scores based on the analysis of various functional attributes. The results regarding existing conditions are discussed in Section 6.2. By dividing the four attributes of the CRAM methodology into their respective metrics, it is possible to describe—according to CRAM's numerical scoring system—the estimated direct and indirect effects of the proposed Project on those same functional attributes of the ephemeral channels, including buffer condition, structural patch richness, and number of plant layers. Some of the projections are quantitative, but because certain attributes of the established CRAM Riverine module (Physical and Biological) do not adapt well to the arid region ephemeral channels, some of the projections are qualitative.

The purpose of this analysis is to supplement the assessment of impacts to aquatic resources and aid in determining adequate mitigation to replace the functionality of those resources lost due to the Project. In particular, the CRAM analysis assists in the determination of the ability of proposed mitigation plans to compensate for the areal extent of and functions provided by the channels that would be affected by mining in Areas 4 North and 4 South. More detailed impacts analysis for the physical, chemical, and biological properties of the ephemeral channels are included in Section 7.

The ephemeral channels within the active mining areas of Area 4 North and Area 4 South would be completely mined through during the extraction of coal resources. The CRAM scores for these channel lengths would revert to "0" for all attributes until the channels are reclaimed (Attachment C). This applies to all channel lengths except for those associated with Cottonwood and Pinabete Arroyos (AAs 16, 23, 24, 25, and 25) (see Map 7 of Attachment A).

The Buffer and Landscape Connectivity Attribute scores would be impacted for those channels not mined through but in proximity to mining (i.e., Cottonwood and Pinabete Arroyos). The buffer metric is composed of three submetrics: (1) percentage of the AA perimeter that has a buffer; (2) the average buffer width; and (3) the condition or quality of the buffer. Portions of Cottonwood and Pinabete Arroyos are within 200 meters of the proposed Project area. Each site still has a buffer around the entire site; however, the buffer width does not extend the full 200 meters where it encounters the mining area. The Buffer Width sub-metric was reduced to a "C" from an "A" for AAs 16, 23, and 24 and to a "B" for AA 25. AA 26 was on average greater than 200 meters from the proposed Project Area. This reduced the average Buffer and Connectivity Attribute Scores from 93 to 89 for these four sites and reduced the overall scores from 68 to 67.

In summary, it is estimated that four sites within the mining strips would reduce to "0" for headwater channel systems (see Table 10) due to mining. The average CRAM score for these sites was 56, so there would be a reduction of 56 points. In addition, there would be an approximately 1 percent reduction in CRAM scores (functional loss) for sections of Cottonwood and Pinabete Arroyos within 200 meters of the proposed Project Area due to reductions in the

Buffer Width sub-metric. See Table 10 for CRAM Summary Scores and Attachment C for CRAM data spreadsheets with existing and projected scores for streams within and adjacent to the proposed project area. BNCC proposes to compensate for the temporal loss of functionality due to the Project's impacts by improving the functions and services along a section of the San Juan River within the Navajo Nation Reservation. See Section 9 for details regarding the mitigation sites and plans. As part of BNCC's reclamation, the WoUS removed during mining would be restored to their original functions and values as soon as possible after mining operations have ceased in an area.

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1 **Table 10. CRAM Summary: Existing Scores and Project Impact Projections**

CRAM Projection	Headwater Systems				Cottonwood and Pinabete Arroyos				Overall			
	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction
Buffer and Landscape Connectivity	22.4	0.0	22.4	-100%	22.4	21.3	1.1	-100%	22.4	4.1	18.3	-82%
Landscape Connectivity	12.0	0.0	12.0	-100%	12.0	12.0	0.0	0%	12.0	2.1	9.9	-82%
Buffer Metrics	10.4	0.0	10.4	-100%	10.4	9.3	1.1	-11%	10.4	2.0	8.4	-81%
% of AA with Buffer	12.0	0.0	12.0	-100%	12.0	12.0	0.0	0%	12.0	2.5	9.5	-79%
Average Buffer Width	12.0	0.0	12.0	-100%	12.0	7.8	4.2	-35%	12.0	1.9	10.1	-84%
Buffer Condition	9.0	0.0	9.0	-100%	9.0	9.0	0.0	0%	9.0	1.9	7.1	-79%
Raw Score	22.4	0.0	22.4	-100%	22.4	21.3	1.1	-5%	22.4	4.1	18.3	-82%
Final Score	93.4	0.0	93.4	-100%	93.4	88.6	4.8	-5%	93.4	17.2	76.2	-82%
Hydrology	25.1	0.0	25.1	-100%	31.2	31.2	0.0	0%	26.4	6.3	20.1	-76%
Water Source	11.4	0.0	11.4	-100%	12.0	12.0	0.0	0%	11.5	2.4	9.1	-79%
Hydroperiod/Channel Stability	7.7	0.0	7.7	-100%	9.6	9.6	0.0	0%	8.1	2.0	6.1	-75%
Hydrologic Connectivity	6.0	0.0	6.0	-100%	9.6	9.6	0.0	0%	6.8	1.9	4.9	-72%
Raw Score	25.1	0.0	25.1	-100%	31.2	31.2	0.0	0%	26.4	6.3	20.1	-76%
Final Score	69.8	0.0	69.8	-100%	86.7	86.7	0.0	0%	73.3	17.4	55.9	-76%
Physical Structure	7.6	0.0	7.6	-100%	10.2	10.2	0.0	0%	8.1	2.1	6.0	-74%
Structural Patch Richness	3.0	0.0	3.0	-100%	4.2	4.2	0.0	0%	3.3	0.9	2.4	-73%
Topographic Complexity	4.6	0.0	4.6	-100%	6.0	6.0	0.0	0%	4.9	1.3	3.6	-74%
Raw Score	7.6	0.0	7.6	-100%	10.2	10.2	0.0	0%	8.1	2.1	6.0	-74%
Final Score	31.6	0.0	31.6	-100%	42.5	42.5	0.0	0%	33.9	8.9	25.0	-74%
Biotic Structure	12.5	0.0	12.5	-100%	17.8	17.8	0.0	0%	13.6	3.7	10.0	-73%
PC: No. of plant layers	6.3	0.0	6.3	-100%	8.4	8.4	0.0	0%	6.8	1.6	5.1	-76%
PC: No. of codominants	3.0	0.0	3.0	-100%	3.6	3.6	0.0	0%	3.1	0.8	2.4	-76%
PC: Percent Invasion	9.3	0.0	9.3	-100%	9.0	9.0	0.0	0%	9.3	1.9	7.4	-80%
Plant Community Metrics	6.2	0.0	6.2	-100%	7.0	7.0	0.0	0%	6.4	1.4	5.0	-78%
Interspersion	3.0	0.0	3.0	-100%	5.4	5.4	0.0	0%	3.5	1.1	2.4	-68%

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CRAM Projection	Headwater Systems				Cottonwood and Pinabete Arroyos				Overall			
	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction	Original Average Scores	Projected Average Scores	Impact delta	Percent Reduction
Vertical Biotic Structure	3.3	0.0	3.3	-100%	5.4	5.4	0.0	0%	3.8	1.1	2.6	-70%
Raw Score	12.5	0.0	12.5	-100%	17.8	17.8	0.0	0%	13.6	3.7	10.0	-73%
Final Score	34.9	0.0	34.9	-100%	49.5	49.5	0.0	0%	37.9	10.2	27.7	-73%
Overall AA Score	56.3	0.0	56.3	-100%	68.0	67.0	0.9	-1%	58.8	13.5	45.3	-77%

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7. Public Interest Review and Section 404(b)(1) Guidelines Evaluation

7.1 Anticipated Changes to the Physical and Chemical Characteristics of the Aquatic Ecosystem

7.1.1 Substrate

7.1.1.1 Existing Conditions

Soils within the Project Area have been surveyed by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) as part of the Soil Survey of San Juan County, New Mexico – Eastern Part (NRCS 1980) and Soil Survey of Shiprock Area, Parts of San Juan County, New Mexico and Apache County, Arizona (NRCS 2004). As part of the survey, soils were classified utilizing the USDA Soil Taxonomy System (NRCS 1999).

Mining specific soil surveys have also been completed within the Navajo Mine. Soil surveys were completed in 1985, 1988, 1998, and 2007. The surveys generally follow the taxonomic system utilized by the NRCS. The mining-specific soil surveys were focused on identification of the soils map units and salvageable topdressing material within the various soil survey areas. Topdressing refers to all unconsolidated material capable of supporting plant growth in the upper 60 inches of the native in-situ soil profile. The survey procedures and survey results are documented in the SMCRA mine permit (BNCC 2012).

The permit area occurs within the Colorado Plateau physiographic province that has a wide diversity of topography, geologic materials, soils, and vegetation. Many of the soils in the survey area are formed from alluvium and eolian sediments derived from shale and sandstone. Some soils are formed in place and are considered residual. Most of the soils in the survey area have been forming only since the late-Pleistocene and during the Holocene Era. It is very common to find buried soils that date back to the Pleistocene Era (BNCC 2012).

7.1.1.2 Impacts Analysis

The proposed mining activities would include removal of soil material, overburden, and interburden geologic material within the proposed mining area. This would include the headwater systems of Area 4 North and Area 4 South as depicted in Map 8 of Attachment A. These activities would mix and homogenize surface soils and topdressing (soil materials) within the areas that would be mined. The mixing would occur as a result of topdressing salvage, topdressing stockpiling, and subsequent topdressing replacement activities within reclaimed areas. Soil impacts would occur over a medium-term period (5 to 10 years after a mining strip is impacted). The proposed mining activities would occur through 2041. Reclamation would be contemporaneous with mining activities but it is expected that final reclamation of the Project Area would continue for approximately 10 years after mining has been completed. Impacts to soils would be of low severity because the soils are not suitable for agricultural use and potential for erosion would be mitigated by reclamation.

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Alluvial soils of the Cottonwood Arroyo and Pinabete Arroyos would not be mined through by the proposed Project; however, there may be one haul road crossing over the South Fork of Cottonwood Arroyo (see Map 8 of Attachment A) in the future. Minimal excavations within the South Fork of the Cottonwood channel may be needed to install the culverts within the channel.

All soil material handling activities would be completed per OSM requirements and in compliance with the proposed Pinabete SMCRA permit, which prescribe regulatory compliance measures to preserve the integrity of soils. These measures include removal of soils that would be utilized for topdressing ahead of mining activities to prevent contamination, stockpiling topdressing not used immediately for reclamation, and the use of berms surrounding soil stockpiles and seeding and mulching to reduce erosion. Additionally, sediment and drainage control best management practices (BMPs) would be implemented as described in the Sediment Control Plan of the Pinabete SMCRA permit (BNCC 2012) and Storm Water Pollution Prevention Plan (SWPPP) for disturbed areas. Any surface spills of petroleum hydrocarbons or other regulated substances would be handled per the Navajo Mine Spill Prevention, Control, and Countermeasure (SPCC) Plan.

7.1.2 Suspended Particulates and Turbidity

7.1.2.1 Existing Conditions

Since Project Area channels have flowing water only in response to rainfall or snowmelt events, and channel bed and bank features are generally comprised of unconsolidated sand or finer textured particles, the runoff generally contains very high-suspended sediment, total dissolved solids (TDS), and other dissolved constituents acquired from these soils. Total sediment concentrations average 70,733 milligrams per liter (mg/L) for Cottonwood Arroyo and range from 10,200 to 521,000 mg/L for Pinabete Arroyo with a median value of 79,200 mg/L (BNCC 2012), which are similar to the regional values described below.

Sediment concentrations were monitored downstream of the proposed Project Area at the Chaco River near the San Juan River from October 1969 through September 1989. Suspended sediment concentrations vary with discharge, but are typically in the range from 300 to 5,000 mg/L—except during storm runoff events when concentrations can range from 50,000 to 171,000 mg/L. Observed suspended sediment loads were as high as 629,000 tons/day (USGS 2007a).

7.1.2.2 Impacts Analysis

7.1.2.2.1 Construction and Operation Impacts

While some sediment runoff is expected from surface disturbance, BNCC would route all disturbed area runoff to sediment ponds and approved NPDES outfall locations or implement alternative sediment control BMPs as described in the pending Pinabete SMCRA permit (BNCC 2012). The sediment ponds and alternative BMPs will stay in use through the bond release period or until it is demonstrated that runoff from the disturbed areas would not contribute quantities of suspended solids greater than those generated pre-mining in accordance with Section 402 of the

CWA. Sediment yields from the mine area are expected to be lower during mining and reclamation as all disturbed area runoff would be retained in sediment ponds or other retention BMPs as shown in Table 11 (BNCC 2012).

Table 11. Comparison of Sediment Yield Pre-mining with Mine Operations for Pinabete Arroyo and Cottonwood Arroyo

Watershed Location	2 year-6 hour event (0.85 inch)	10 year-6 hour event (1.28 inches)	25 year-6 hour event (1.56 inches)	100 year-6 hour event (2.04 inches)
	Sediment yield (tons)	Sediment yield (tons)	Sediment yield (tons)	Sediment yield (tons)
Pinabete Arroyo, pre-mine	2,821	9,886	16,325	25,646
Pinabete Arroyo, during mining operations	2,249	7,973	13,380	24,777
Cottonwood Arroyo, pre-mine	10,744	27,242	40,586	67,180
Cottonwood Arroyo, during mining operations	10,473	26,966	40,310	66,822

7.1.2.2.2 Applicant Proposed Measures and Regulatory Compliance Measures

BNCC proposes to implement BMPs to avoid and minimize water quality impacts during mining by controlling runoff and sedimentation into nearby channels, including minimization of disturbance footprints, establishment of stream buffer zones, employment of upstream diversions or highwall impoundments, the use of sediment ponds, perimeter berms or containment features, and re-seeding of areas prepared for reclamation as soon as practical. BNCC would comply with SMCRA requirements, USEPA's NPDES permit under Section 402 of the CWA, and Navajo Nation's Section 401 Water Quality Certification under Section 401 of the CWA to control the discharge of sediment within the active mining sectors of Areas 4 North and 4 South.

BNCC would also prepare and implement BMPs and a SWPPP that incorporates measures outlined in the Sediment Control Plan (BNCC 2012), and would comply with USEPA's Multi-Sector General Permit (MSGP) under Section 402 of the CWA to control water and sediment discharge during the Burnham Road realignment construction. Culverts would be designed as described in Section 6.3.2.

Within the mine areas, reclamation would incrementally re-establish topography with positive drainage towards the Chaco River. Sediment yields in runoff from the reclaimed areas are

DRAFT

expected to decline below the pre-mine conditions due to improved post-mine vegetation cover due to reclamation efforts

Under the SMCRA regulations, BNCC is required to reclaim all areas and employ BMPs to prevent additional contribution of suspended sediments to stream flow outside of the Project Area. To meet NPDES Section 434 Western Alkaline Drainage outfall standards, BNCC must demonstrate that the area's entire outfall watershed area is reclaimed and suspended sediments are not greater than pre-mine conditions.

7.1.3 Water Quality

7.1.3.1 Existing Conditions

Surface water sampling was conducted by BNCC from 1997-1999 for Cottonwood Arroyo and is considered representative of current conditions (BNCC 2011). The moderately saline sodium sulfate waters are alkaline with a moderate hardness. The average conductivity on Cottonwood Arroyo has ranged from 861 to 1,728 micromhos per centimeter (µmhos/cm) on Cottonwood Arroyo. The average selenium concentration ranges from 0.003 to 0.006 mg/L and exceeds the NNEPA standard for aquatic wildlife habitat of 0.002 mg/L (NNEPA 2007). Selenium levels in samples acquired upstream of the Navajo Mine Lease are often elevated above the samples downstream of the mine (BNCC 2011).

Surface water data were collected and analyzed for different parameters during 3 years of water monitoring (1998, 2007, and 2008) from two sites on Pinabete Arroyo (Upper Pinabete upstream of the mine and Lower Pinabete downstream of the mine). Similar to Cottonwood Arroyo, Pinabete Arroyo contains sodium sulfate waters with a hardness ranging from 29 to 413 mg/L as calcium carbonate (BNCC 2012). The average selenium concentration ranges from <0.001 to 0.007 mg/L, with some of the concentrations in excess of the NNEPA standard for aquatic wildlife habitat of 0.002 mg/L (NNEPA 2007).

7.1.3.2 Impacts Analysis

7.1.3.2.1 Construction and Operation Impacts

It is anticipated that increases of TDS, sulfate, and manganese concentrations in runoff from disturbed areas would occur during mining. The TDS and sulfate concentrations may result from dissolution of weathered geologic materials on the surface (spoils). However, surface runoff from disturbed areas would be retained in the mine pit, sediment ponds, or other retention BMPs; therefore, potential changes in surface water quality are expected to be negligible in Pinabete Arroyo, Cottonwood Arroyo, and Chaco River during mining and reclamation operations (BNCC 2012).

7.1.3.2.2 Applicant Proposed Measures and Regulatory Compliance Measures

BNCC would control release of contaminants by implementing BMPs, controlling runoff and flow into and through the mine area, and complying with its SMCRA, NPDES permits, and other

CWA requirements. BNCC has developed a series of retention ponds engineered to ensure that no contaminated water leaves the active mine area (see Map 8 of Attachment A). BNCC would not refuel any vehicles within 100 feet of ephemeral channels nor would equipment be stored within the ephemeral channels. This would reduce the potential of spills that would impact the ephemeral channel system within the Project Area. BNCC maintains and implements a SPCC plan that identifies areas of risk, specifies appropriate controls for bulk storage areas, identifies control strategies for managing a spill, should it occur, and lists procedures for safely disposing of any contaminated materials.

7.1.4 Current Patterns and Water Circulation and Normal Water Fluctuations

7.1.4.1 Existing Conditions

The channels that occur within the Project Area are ephemeral in nature; they carry flows for short durations in response to precipitation events and snowmelt. BNCC's Pinabete SMCRA permit application identifies the Pinabete Arroyo and Cottonwood Arroyo as intermittent drainages based on their watersheds being larger than 1 square mile as required by SMCRA (30 CFR § 701.5). However, these channels demonstrate ephemeral flow regimes. No perennial streams are present within the Project Area. The closest perennial drainage occurs along the lower reaches of Chaco River and the San Juan River—approximately 15 miles downstream of the Project Area. The lower reaches of Chinde Wash within Area 2 of Navajo Mine contain flow during the growing season due to irrigation return flow from Navajo Agricultural Products Industry agricultural fields upstream of the Navajo Mine. The Cottonwood Arroyo drains a watershed of about 80 square miles, traverses the Navajo Mine Lease Area between Area 3 and Area 4 North, and joins the Chaco River about 3 miles downstream of Navajo Mine Lease Area. Pinabete Arroyo drains a watershed of about 60 square miles and flows southeast to northwest through Area 4 South and joins the Chaco River approximately 2.5 miles downstream of Navajo Mine Lease Area.

About 48 percent of the Cottonwood Arroyo's watershed is occupied by badlands, which accounts for the high discharge and flow intensities observed in this arroyo. Peak flows in the Cottonwood Arroyo from a 10-year, 6-hour event at the upstream Navajo Mine Lease boundary are predicted to be about 2,871 cubic feet per second (cfs) (BNCC 2012). Suspended sediment concentrations are high during storm runoff events and the sandy channel bed and bank materials are reworked by the larger flood events.

Pinabete Arroyo is braided in many locations within the Project Area that reflects the highly variable discharge rates, high bed load, limited vegetation, and high width to depth ratio. Peak flows in the Pinabete Arroyo from a 10-year, 6-hour event at the upstream lease boundary are predicted to be about 1,124 cfs (BNCC 2012).

Downstream and to the west of the Navajo Mine Lease area, the Pinabete Arroyo and Cottonwood Arroyo drain into Chaco River which then flows into the San Juan River

DRAFT

approximately 30 river miles downstream of the confluence with Cottonwood Arroyo. The USGS monitored streamflow in the Chaco River close to the San Juan River from November 1975 through September 1994. The USGS (2007b) found that base flows sampled from 1959 to 1994 ranged from 0 to 30 cfs and annual peak flows ranged from 1,170 to 6,410 cfs, and that the 2-year discharge was approximately 3,750 cfs.

7.1.4.2 Impacts Analysis

7.1.4.2.1 Construction and Operation Impacts

With the proposed mining in Area 4 North and Area 4 South, there would be direct impacts of slightly reduced flows from storm events on tributaries to the Chaco River, including tributaries to Cottonwood and Pinabete Arroyos. In addition, there would be decreases in storm-related flows to Cottonwood and Pinabete Arroyos due to the construction of highwall impoundments and sediment ponds. BNCC modeled surface water flows in Pinabete and Cottonwood Arroyos using SEDCAD software for pre-mine and expected post-reclamation conditions. The results show little difference in flow quantities between pre-mine conditions and expected post-reclamation conditions (see Table 11).

BNCC utilizes highwall impoundments to intercept upgradient flow above the active pits and sediment ponds to intercept downgradient flows before they leave the Project Area. These highwall impoundments and sediment ponds, coupled with mining of the ephemeral drainages within the Project Area, may decrease storm-related flows in Chaco River to the west. BNCC has designed the sediment ponds within the Project Area to capture the surface flows from a 10-year, 24-hour, or 100-year, 6-hour (total containment) storm event. Storm events exceeding the ponds design will be allowed to discharge according to BNCC's NPDES permit. There have been ten discharge events between 1977 and 2012. Water retained within the highwall impoundments or sediment ponds may be used for dust suppression or pumped to other sediment ponds in order to maintain sufficient storage in the ponds for storm runoff.

7.1.4.2.2 Applicant Proposed Measures and Regulatory Compliance Measures

All areas impacted under the proposed action would ultimately be reclaimed to approximate original contours and pre-mine drainage density. BNCC plans to reclaim the disturbed portions of the Project Area using geomorphic principles to re-create landforms, drainage densities and drainage patterns to ensure positive drainage and to minimize impacts to the hydrologic balance within and adjacent to the Project Area. Small area depressions (less than 1 acre/foot capacity) may be opportunistically established within the reclaimed areas to promote topographic diversity, act as seasonal surface water collection sites, and create micro-habitats for post-reclamation wildlife and vegetation communities. BNCC plans to reclaim all of the sediment ponds and drainage control structures utilized during mining operations. However, the Navajo Nation may request that some or all of the ponds remain, to provide water for post-mine uses, which could affect flow patterns for that channel (BNCC 2012). The culverts installed on

Burnham Road would be permanent features, but have been engineered to not alter downstream water flow or circulation (Attachment B)

7.1.5 Mixing Zone

Not Applicable. Project does not involve the discharge of dredged material.

7.1.6 Flood Hazards and Floodplain Management

There would be minimal effect to floodplains and floodplain management associated with the proposed activity; surface impoundments required by OSM retain stormwater within the mine disturbance areas.

7.1.7 Erosion and Accretion Patterns

Under baseline conditions, sediment in the Pinabete Arroyo and Cottonwood Arroyo is derived from a variety of natural sources including erosion of soils on the hillsides, roads and disturbed areas, and bed or banks of the stream channels. The primary source of sediment is likely surface erosion from the contributing watershed.

BNCC would route all disturbed area runoff to sediment ponds or implement alternative sediment controls, as described in the Sediment Control Plan in the Pinabete Mine Plan SMCRA Permit (BNCC 2012). Sediment ponds and BMPs for sediment control will stay in use through the bond release period or until demonstrations show that runoff from the disturbed areas will not contribute quantities of suspended solids greater than those generated pre-mining. A SWPPP would be maintained during the construction and operational phases of mining and reclamation. BMPs would be employed to minimize erosion and the migration of sediment during mining and reclamation activities.

7.1.8 Storm, Wave, and Erosion Buffers

As there are no large water bodies adjacent to or within the proposed action area, there are no impacts to storm and wave buffers.

BNCC has established stream buffer zones around the Pinabete Arroyo and Cottonwood Arroyo as required by SMCRA (30 CFR §816.57). Unless authorized by OSM, BNCC may not conduct mining activities that would disturb the surface of the land within 100 feet of a perennial or intermittent stream. Authorized activities within the stream buffer zone may not cause, or contribute to, a violation of BNCC's CWA Section 401 Water Quality Certifications as required by SMCRA [30 CFR 816.57(a)].

7.1.9 Aquifer Recharge

Alluvial fill deposits occur in the valley bottoms of Cottonwood and Pinabete Arroyos within the permit area. Portions of the alluvium of Cottonwood and Pinabete Arroyos are saturated and will yield water to wells, as evidenced by the dug wells completed in the alluvium of both arroyos.

DRAFT

The groundwater is not sufficient for sustained base flow in either of these drainages (BNCC 2012).

Drawdown of water levels in the Fruitland Formation adjacent to proposed mining operations could result in the drawdown of groundwater in the alluvium of the South Fork of Cottonwood Arroyo. This would occur at some locations. There are two livestock wells downgradient of the permit area that could be impacted by reductions in alluvial groundwater flow; however, neither is currently used for livestock watering. Pinabete Arroyo alluvium is perched above unsaturated bedrock and is not hydraulically connected with the Fruitland Formation; therefore, no impacts to the Pinabete alluvium are expected by mining operations (BNCC 2012).

7.1.10 Baseflow

Groundwater discharge rates within Navajo Mine are low and insufficient to sustain base flow at any streams near the permit area including Cottonwood and Pinabete Arroyos (BNCC 2012). One potential groundwater discharge location along Pinabete Arroyo was identified with enhanced vegetation growth and salt deposits, but there were no signs of surface flow (BNCC 2012). Flow is exclusively a result of large precipitation events.

7.2 Anticipated Changes to the Biological Characteristics of the Aquatic Ecosystem

7.2.1 Special Aquatic Sites (Wetlands, Mud Flats, Vegetated Shallows, Riffle and Pool Complexes, Sanctuaries and Refuges)

The Project Area does not contain any special aquatic sites. The jurisdictional WoUS found within the Project Area are largely unvegetated ephemeral channels. Vegetation that does occur sparsely in channels is largely dominated by upland plant species with isolated patches of riparian habitat, including tamarisk.

While no fill in wetlands is proposed, the proposed mitigation plan is expected to result in improved wetland health and habitat adjacent to the San Juan River (see Section 9).

7.2.2 Threatened and Endangered Species

According to the USFWS, there are 12 federally listed threatened, endangered, proposed threatened, or candidate plant and animal species with potential to occur in San Juan County, New Mexico. USFWS listed species were obtained from the USFWS Southwest Region Endangered Species List. Federally listed species for San Juan County, New Mexico, their habitat associations, and a description of the potential for each to occur in the action area is provided in the Biological Assessment (BA) that is included with the Four Corners Power Plant and Navajo Mine Energy Project EIS.

There is no suitable habitat for any federally listed species to reside or breed within the Navajo Mine lease or permit areas, including within the areas proposed for mining in Areas 4 North and

4 South. It is possible that the endangered southwestern willow flycatcher travel through the area; however, the potential is low due to the lack of suitable landing and resting habitat.

For purposes of analysis of impacts to threatened and endangered species, where the Action Area as defined in the BA, and includes both direct and indirect impacts, extends to include a short reach of the San Juan River, known and potential habitat for several federally listed species occur associated with habitats along and within the river system. In addition to breeding and migratory stopover habitat for the southwestern willow flycatcher, there is habitat and known occurrences of yellow-billed cuckoo, roundtail chub, and known occurrence and critical habitat for the Colorado pikeminnow and razorback sucker. The San Juan River is approximately 16 miles away from proposed mining in Areas 4 North and 4 South and approximately 3.3 miles from infrastructure and transportation related disturbances in Areas I and II. As such, the BA prepared for the project evaluates the potential impacts to these species.

7.2.3 Fish and Other Aquatic Organisms in the Food Web

The Project Area does not support any fish, crustaceans, mollusks, or other aquatic species. The aquatic organisms within the San Juan River would not be impacted since there would not be a measurable change in water quality or quantity reaching the San Juan River from the Proposed Project.

7.2.4 Other Wildlife

7.2.4.1 Existing Conditions

A number of medium and small-sized mammals have been documented within the greater area and are common throughout the Navajo Mine lease area and Four Corners Region. Medium-sized species include coyote (*Canis latrans*), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), and kit fox (*Vulpes macrotis)* (BNCC 2009; Ecosphere 2008). Desert cottontail (*Sylvilagus audubonii*) and black-tailed jackrabbit (*Lepus californicus*), as well as their scat and tracks, are commonly observed in most habitats throughout the analysis area. Gunnison's prairie dog (*Cynomys gunnisoni*) towns have been mapped in the proposed Pinabete Permit Area and the species is known to occur throughout the greater area (Ecosphere 2012b). Common squirrel species within the analysis area include white-tailed antelope squirrel (*Ammospermophilus leucurus*), ground squirrel (*Spermophilus* sp.), and rock squirrel (*Spermophilus variegatus*).

Small mammal species documented in the analysis area include Ord's kangaroo rat (*Dipodomys ordii*) and banner-tailed kangaroo rat (*Dipodomys spectabilis*), silky pocket mouse (*Perognathus flavus*), Apache pocket mouse (*Perognathus apache*), deer mouse (*Peromyscus maniculatus*), western harvest mouse (*Reithrodontomys megalotis*), woodrat (*Neotoma* spp.), northern grasshopper mouse (*Onychomys leucogaster*), and the Botta's pocket gopher (*Thomomys bottae*) (BNCC 2009; Ecosphere 2004). Small mammal densities are historically low in the area (BNCC

2009) and concentrated in Arroyo Shrub habitat (Ecosphere 2004) due likely to greater availability of food and shelter relative to other habitat types.

Reptiles common to the analysis area include western whiptail (*Cnemidophorus tigris*), gopher snake (*Pituophis melanoleucus*), bull snake (*Pituophis melanoleucus* sub. *sayi*), prairie rattlesnake (*Crotalus viridis*), short-horned lizard (*Phrynosoma douglassii*), side-blotched lizard (*Uta stansburiana*), lesser earless lizard (*Holbrookia maculata*), and collared lizard (*Crotaphytus collaris*).

7.2.4.2 Impacts Analysis

Impacts to wildlife as a result of mining are explained in detail in the Four Corners Power Plant and Navajo Mine Energy Project EIS. In general, loss and fragmentation of wildlife habitats are inevitable consequences of surface disturbance when vegetation is removed as proposed for the Project Area. Therefore, direct impacts to wildlife primarily include the loss and fragmentation of wildlife habitats that include small mammals and generalists such as coyote, black-tailed jackrabbit, desert cottontail, and lizards (Ecosphere 2004, 2008).

Direct impacts from habitat loss and alteration would be confined to the active mine site and are expected to be low to moderate in the short term because comparable habitat types surround the Project Area. Impacts would be low in the long term after successful reclamation of the mined area. Further, impacts would likely be limited to specialist species that are less able to adapt to changes in their environment, examples include sensitive species such as those described in the Four Corners Power Plant and Navajo Mine Energy Project EIS.

7.2.5 Biological Availability of Possible Contaminants in Dredged or Fill Material

No known contaminants would be placed as fill material within WoUS within the permit area. The ephemeral waterways proposed for impact would be removed in the mining process and restored during reclamation.

7.3 Anticipated Changes to Human Use Characteristics

7.3.1 Water Supply and Conservation

No municipal or private water supplies exist in the Project Area. There are three stock watering ponds within the Project Area on tributaries to Pinabete Arroyo (see Map 6 of Attachment A) that capture surface flows. These stock ponds are not used for irrigation, consumption by humans, or purposes other than livestock watering. BNCC may replace these stock water impoundments after mining is complete in coordination with OSM and the affected land uses (BNCC 2012).

7.3.2 Recreational and Commercial Fisheries

No recreational or commercial fisheries exist in the Project Area, and no impacts to fisheries are expected.

7.3.3 Recreation

No water-related recreation activities occur in the Project Area, and no impacts to recreation are expected.

7.3.4 Aesthetics

Existing visual conditions in the Project Area and the potential visual impact area include views of existing BNCC coal mining operations. Open, undulating, low shrubland-dominated arid landscapes lie east, west, south, and north of the proposed Project Area with distant views of the La Plata, Chuska and Lukachukai, and Carrizo mountain ranges to the northeast, west, and northwest of the site, respectively. Views in the area include panoramic landscapes or views with a limited number of obstructions within a 360-degree field of vision. Foreground and middleground views throughout most of the Project Area include the reddish-brown dragline and black coal stockpiles and light brown to gray overburden piles of existing coal mining operations, and light brown or gray-green shadscale or greasewood-dominated scrublands to the east, west, south, and north of the active mining areas. No large trees are generally visible in this landscape, although some patches of tamarisk and coyote willow are found along Cottonwood and Pinabete Arroyos. The Hogback geologic feature lies northwest of the Project Area and is both a major geographic landmark as well as a cultural landmark to the Navajo people.

Activities that would result in direct impacts to visual resources would include the continuation of permitted mining activities in Area 4 North, the proposed expansion of mining activities into Area 4 South, and the realignment of Burnham Road to the east and south of existing mining activities. Indirect effects, such as construction dust, haze, and night lighting would continue through the life of the proposed mining and were accounted for in the visual impacts analysis. Implementation of dust suppression measures would reduce, but not completely eliminate, potential short-term effects to visual resources in the Project Area. In general, areas located within 1 mile of the Proposed Action activities would experience moderate visual changes that are not considered significant. Views that are more distant would experience a lower degree of visual change.

Visual change associated with mining would be short term. Once mining operations are completed in Areas 4 North and 4 South, reclamation in these areas would be implemented and the landscape would return to visual conditions similar to pre-mined lands. The visual change associated with the realignment of Burnham Road would be long term.

7.3.5 National or State Parks, Landmarks, Monuments, Wilderness Areas, Research Sites, Recreation Areas, and Similar Preserves

There are no parks, national or historic monuments, national seashores, wilderness areas, research sites, or similar preserves in or near the Project Area, and no impacts to such sites are expected. The nearest sites are Mesa Verde National Park which is 38 miles north of Navajo Mine and Chaco Canyon National Historical Park with is 40 miles southwest of Navajo Mine.

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7.3.6 Historic and Cultural Values

Historic and cultural properties impacted by the Project will be addressed through Section 106 of the National Historic Preservation Act. The Section 106 consultation process ensures that Federal agencies identify historic properties affected by their proposed action(s); assess the Project effects upon historic properties, and seek ways to avoid, minimize, or mitigate any adverse effects. Although OSM has been determined to be the lead federal agency responsible for ensuring Section 106 compliance, the USACE will participate in the consultation process and will be a Signatory to the Programmatic Agreement (PA). The PA is a legally binding document that spells out how the involved parties meet their statutory obligations to fulfill the requirements of Section 106.

7.3.7 Wild and Scenic Rivers

There are no wild and scenic rivers within the proposed Project Area or the surrounding area.

7.3.8 Consideration of Property Ownership

The mine area is leased from the Navajo Nation; land use is discussed in Section 7.3.17. The proposed mining activities would reduce livestock grazing and BNCC has entered into agreements with affected grazing allottees to compensate them for their losses.

7.3.9 Safety of Impoundment Structures

Impoundment structure design and oversight is part of the OSM SMCRA (30 CFR 816.49) and U.S. Department of Labor – Mine Health and Safety Administration (30 CFR 77.216) permitting process. The designs are included within the SMCRA permit application.

7.3.10 Floodplain Management

The potential impacts to downstream floodplain management from the Project Area would be minimal; stormwater in the mined areas is retained on-site or will be discharged according to the proposed NPDES permit.

7.3.11 Energy Conservation and Development

To be determined.

7.3.12 Navigation

There are no perennial water sources within the Project Area; the proposed Project would not impact navigation.

7.3.13 Economics

A recent economic impact analysis of the Four Corners Power Plant and Navajo Mine by the L. William Seidman Research Institute/Arizona State University staff estimated the direct, indirect, and induced impact of the power plant and mine operations under pre and post-2016 scenarios as well as with mine permit transfer to Navajo Nation (ASU 2013). The pre-2016 scenario assumes

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business-as-usual with current coal and power production levels. Under this scenario the total economic impact of Navajo Mine is estimated in terms of employment of 2,110 jobs, labor income of $131.5 million, and contribution to New Mexico's Gross State Product (or total output) of $254 million. The post-2016 scenario assuming operations with only Units 4 and 5 at Four Corners Generating Station and associated coal production reduced by 40 percent would have estimated economic impact of 1,310 jobs, labor income of $85.8 million, and contribution to New Mexico's Gross State Product (or total output) of $173.6 million. The estimated economic impact of the mine permit transfer would make an additional $17.9 million currently paid in federal and state taxes available to the Navajo Nation. The estimated economic impact of this additional revenue to the Navajo Nation is 285 jobs, labor income of $10.6 million, and $16.5 million in total output. The net economic impact of the post-2016 scenario assuming reduced coal production from Navajo Mine and the mine permit transfer to NTEC is estimated to be a reduction in employment of 515 jobs compared to business-as-usual, a reduction in labor income of $35 million, and a reduction in total output of $64 million compared to pre-2016 business as usual.

7.3.14 Traffic/Transportation Pattern

Currently, materials and employees access the Navajo Mine from US Highway 64, NM, Highway 371, or US Highway 491, via an infrastructure of San Juan County and/or BIA roads. US Highway 64 is the primary transportation route running east to west between Farmington and Shiprock. The New Mexico Department of Transportation classifies NM Highway 371 as a rural minor arterial route for travel between Farmington and Interstate 40 at Thoreau. US Highway 491 links Interstate 40 at Gallup with US Highway 191 at Monticello, Utah.

Numerous other two-track roads intersect the mining lease in Areas 4 North and 4 South. These two-track roads are single lane, low traffic volume roads typically used by the local residents to access grazing areas or water sources. While these roads are used by the public, they are not maintained with public funds nor have they been designated as public roads by the Navajo Nation or other applicable road authorities. BNCC may elect to keep some of these two-track roads open during mining and reclamation activities to access environmental monitoring stations.

Direct impacts associated with mining operations in Areas 4 North and 4 South would require removing, restricting, and/or relocating unimproved two-track roads used for Customary Use Area (CUA) access and livestock grazing. Restriction or modification of existing access routes specifically used for CUA management would result in minor to moderate short-term impacts for the life of the operation.

Realignment of Burnham Road would modify the existing transportation infrastructure. The proposed realignment would improve road surface conditions and safety from the existing condition. There would be no need to stop traffic during blasting operations at Navajo Mine after the realignment, which will improve both transportation network safety and traffic flow.

DRAFT

Realignment of the Burnham Road would have minor to moderate beneficial effects upon traffic volumes associated with use of this road.

7.3.15 Noise

HDR Engineering Inc. (HDR) conducted two field visits (February 2011 and January 2012) to document noise levels of multiple activities throughout the BNCC mining lease. These activities include coal extraction, stripping activities (prestrip, overburden, and interburben), blasting (coal and over/interburden), reclamation activities, haulage activities (trucks and rail haulage), facilities noise levels, and ambient noise levels (HDR 2012). HDR also recorded ambient noise levels at the BNCC coal plant that includes background noise levels of FCPP. Ambient noise levels were measured both with the active mining areas and undisturbed portions (Areas 4 South and 5) of the BNCC mining lease. Peak noise levels ranged between 36 and 113 dBA (hourly A-weighted sound level in decibels) L_{max} (maximum sound level) depending upon level of activity and noise source (HDR 2012).

Although there are no regulatory limits for noise impacts from the project, the USEPA guidelines established under the Noise Control Act of 1972 can be used to assess the acceptability of project-related noise. The USEPA guideline uses the 24-hour noise metric and sets a noise level of 55 dBA L_{dn} (day-night average sound level) as the acceptable limit for outdoor use areas. Because there are no other enforceable noise standards that apply to the project, the USEPA acceptable noise level will be used as the criteria for evaluating noise impacts from the project.

Noise levels and noise impacts from the proposed Project are directly related to the number and types of heavy equipment being used for the specific activity. The highest noise levels from mining activity would be associated with coal removal with vegetation and topdressing removal second highest. Noise levels from mining activities would be below the impact threshold of 55 dBA L_{dn} at the nearest receivers. Substantial impacts are not expected from noise or ground-borne vibrations from blasting operations due to controls on blasting operations and that blasting does not occur at night.

7.3.16 Safety

The consequences of the alternatives on health and safety focus on public exposure to air emissions from Navajo Mine operations. Other potential health and safety risks to workers are not expected to be substantial since extensive health and safety programs are designed to minimize worker risk and are implemented and enforced at Navajo Mine. A recent health survey in San Juan County, New Mexico found that residents have a higher incidence of chronic lower respiratory disease including asthma, than the remainder of New Mexico and the United States (SJC 2010). Increased medical visits for asthma symptoms have been attributed to elevated levels of ozone in the area (NMDH 2007). However, there is no direct link between increased ambient particulate matter (PM) levels and increased reports of asthma symptoms or asthma incidence. The impact assessment criteria for public health are based on whether the levels of

PM and ozone precursor emissions from Navajo Mine would cause exceedances of NAAQS in San Juan County, New Mexico because the NAAQS are set by USEPA to ambient concentration levels that are to be protective to human health. The analysis also considers localized effects.

The proposed Project would result in the same levels of ozone precursor emissions. Ambient air modeling found that these emissions would not cause a measurable change in ambient particulate matter with a diameter between 2.5 and 10 micormeters (PM_{10}) or particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$) concentrations in San Juan County, New Mexico. San Juan County is currently in "attainment" status and ambient air quality does not regularly exceed the NAAQS. Therefore, there would be no substantial adverse public health consequences for the proposed Project.

7.3.17 Land Use

The land use resource assessment area considers land use within the proposed mining areas and related features and 1-mile area surrounding proposed mining and Burnham Road realignment. Assessment of potential effects on land use resources, including effects on CUAs and grazing uses, surface access, and water sources, is based on criteria defined by SMCRA's land use provisions (30 CFR 761.11(a)).

Under SMCRA regulations, BNCC is required to develop adequate resource protection measures to eliminate, minimize, and/or mitigate land use effects. The proposed Project wholly incorporates these SMCRA-based requirements. Likewise, the success, timing, and release of mine-land reclamation areas are administered by OSM in facilitation of and compliance with federal SMCRA requirements (30 CFR 800.40), and are also coordinated with the Navajo Nation and BIA prior to release of lands.

In the short term, the proposed Project would directly reduce the livestock grazing area for local permittees, reduce wildlife habitat, and restrict public access on two-track roads in the land uses resource assessment area. BNCC has entered into agreements with holders of impacted grazing permits and CUAs within the land use resource assessment area to compensate them for the value of disrupted grazing production and relocation or replacement of improvements to their grazing area. These agreements comply with 16 Navajo Tribal Code, which requires compensation for all surface use. Agreements have been reviewed by the Navajo Land Administration and BIA to ensure fair and equitable compensation. To minimize impacts to grazing permittees, as a result of modification of surface use due to mining, BNCC would continue to provide water (in tanks) for livestock use in areas around the Navajo Mine.

In the long term, the surface and vegetation affected by the proposed Project would be reclaimed and returned to a condition similar to or better than its original status. Post-mine land use would be designated for livestock grazing and wildlife habitat, and would again be open to grazing and other tribal surface uses. The construction of impoundments incorporated into the post-mining landscape would support livestock grazing and wildlife habitat.

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7.3.18 Food and Fiber Production

As described in Section 7.3.17, the proposed Project would directly reduce livestock grazing for local permittees during mining operations in Areas 4 North and 4 South. BNCC has agreements in place to compensate impacted grazing allottees during mining operations and has committed to focusing reclamation activities on restoring rangeland for livestock grazing. No agricultural fields are located within the permit area.

7.3.19 Prime and Unique Farmland

No prime and unique farmland occurs within or immediately adjacent to the Project Area. The Navajo Mine Lease receives approximately 5.6 inches of rain annually. The area within the Project Area has not been historically used as crop land, and there are no soil mapping units that can be classified as prime farmland by the USDA – NRCS (7 CFR 657.5).

7.3.20 Mineral Needs

The Navajo Mine lease and BLM's R2P2 provisions require that BNCC achieve maximum economic recovery criteria of the Navajo coal resource. This minimizes or eliminates operations plans that can "sterilize" coal or eliminate opportunities to recover coal in any part of the Navajo Mine. These requirements constrain mine operations to consider maximum economic recovery—rather than least-cost recovery. However, these requirements also take into account the need to retain contingency reserves to ensure a steady supply of sufficient quantities and quality of coal. No other mineral resources are located within the permit area.

7.4 Other Anticipated Changes to Non-Jurisdictional Areas Determined to be within the USACE's Scope of Analysis

Not applicable.

7.5 Secondary and Cumulative Impacts

Although a particular alteration of a wetland may constitute a minor change, the cumulative effect of numerous piecemeal changes can result in a major impairment of wetland resources. Thus, the particular wetland site for which an application is made must be evaluated with the recognition that it may be part of a complete and interrelated wetland area. 33 CFR §320.4(b)(3). Accordingly, a cumulative impact/effects analysis is required. Under 40 CFR §1508.7, a cumulative impact is defined as "…the impact on the environment which 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 taking place over a period of time." Under 40 CFR §230.11(g), cumulative effects on the aquatic ecosystem are defined as:

> …the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material. Although the

> impact of a particular discharge may constitute a minor change in itself, the cumulative effect of numerous such piecemeal changes can result in a major impairment of the water resources and interfere with the productivity and water quality of existing aquatic ecosystems. Cumulative effects attributable to the discharge of dredged or fill material in waters of the United States should be predicted to the extent reasonable and practical. The permitting authority shall collect information and solicit information from other sources about the cumulative impacts on the aquatic ecosystem. This information shall be documented and considered during the decision-making process concerning the evaluation of individual permit applications, the issuance of a General permit, and monitoring and enforcement of existing permits."

For the purposes of this cumulative effects analysis, effects to the aquatic ecosystem from past, currently proposed, and actions determined to occur within the reasonably foreseeable future (RFFAs) are considered.

Resources in the overall project and cumulative effects analysis area include primarily ephemeral stream systems. These are characterized by either no vegetation or upland vegetation, and convey flowing water only in response to rain events. They have limited function including water and sediment conveyance, pollutant attenuation, and minor wildlife corridor activity. Some, including Cottonwood Arroyo and Pinabete Arroyo, verge on intermittent, due both to their larger size and inflows from NAPI (for Cottonwood Arroyo), and have been observed to contain persistent invasive riparian species such as tamarisk and native riparian species including willow and saltgrass as observed during the 2011 WoUS delineation and 2013 CRAM field effort.

Previous area activities include mining and reclamation through Areas I, II, and III, and include pre-Clean Water Act mining impacts. Mining was initiated in 1957. The total current mine lease area is 33,600 acres. To date, approximately 13,000 acres have been mined, of which approximately 8,000 acres have been reclaimed. Areas not yet reclaimed include infrastructure currently in use that would be reclaimed when all mining activities cease and recently mined areas. SMCRA permit requirements for previously mined areas include surface hydrology creation to ensure post-mine surface water discharge equivalent to the pre-mine discharge and provide for post-mine grazing land use.

The currently proposed action would result in 5.0 acres of impact to WoUS. The relevant SMCRA permit requires post-mining reclamation of unavoidable long-term temporal fills to the surface water resources. This will be accomplished by recreating surface hydrology to pre-mining conditions. Additionally, the applicant proposes mitigation that would increase riparian function along a site on the San Juan River, create a wetland adjacent to the San Juan River, and utilize geomorphic reclamation techniques to reclaim ephemeral streams in Area 3 of Navajo Mine to offset the long-term temporal loss preceding reclamation.

RFFAs with potential discharges of dredged and/or fill material to aquatic resources include mining in Areas 4 North, 4 South, and 5. The Pinabete Mine Plan only includes the northern portion of Area 4 South and none of Area 5. Due to lease agreements and BLM regulations/requirements to maximize economic recovery, the remainder of Area 4 South and Area 5 are included as RFFAs within the area. Estimated aquatic resources in the remaining portion of Area 4 South includes approximately 17 stream miles of predominately ephemeral streams. Area 5 contains approximately 20 stream miles of predominately ephemeral streams. Potential impacts due to dredged and/or fill activities may not occur in all resources as a result of RFFAs. Any potential impacts via long-term temporal loss due to RFFAs would likely be offset by mitigation under CWA Section 404 requirements in addition to post-mining reclamation to recreate surface water features commensurate with those mined as required under SMCRA.

Other potential activities in the reasonably foreseeable future include transmission line construction and/or alteration of existing lines and the return to pre-mine grazing land use. These activities would not likely result in permanent discharge of dredged and/or fill into aquatic resources and so are not included in the cumulative effects analysis.

Through a combination of mitigation for unavoidable long-term temporal loss and restoration of surface water hydrology during post-mining reclamation, no cumulative effects to aquatic resources within the overall project area are expected.

7.6 General Evaluation

7.6.1 The relative extent of the public and private need for the proposed structure or work.

To be determined.

7.6.2 To be determined.

7.6.3 The extent and permanence of the beneficial and/or detrimental effects that the proposed structure or work is likely to have on the public and private uses to which the area is suited.

The proposed Project will have permanent impacts to WoUS as a result of the mining, transportation infrastructure, and support facilities. The proposed Project is expected to have minimal detrimental effects on public and private uses of the area, since those uses are currently limited. The beneficial effects associated with utilization of the property would be experienced during the full extent of the project life.

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8. CONTAMINANT EVALUATION AND TESTING

Evaluation of the information indicates that the proposed discharge material meets testing exclusion criteria; based on the above information in Sections 7.1.1, 7.1.2, and 7.1.3, the material is not a carrier of contaminants.

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9. Compensation and Other Mitigation Actions

Under SMCRA and CWA requirements, BNCC is committed to avoiding and minimizing impacts to water resources. In particular, BMPs and other surface water controls would be implemented to avoid and minimize erosion, sedimentation, and pollution of waters. In addition, as discussed below, BNCC would avoid impacts to Cottonwood and Pinabete Arroyos except for a potential future haul road and light vehicle crossing on Cottonwood Arroyo. BNCC would also reclaim the mine area to restore prominent drainage features and the hydrologic balance. Compensatory mitigation would be implemented to offset temporal loss of functionality from impacted WoUS.

BNCC has developed the mine plan for Areas 4 North and 4 South with the purpose of preserving the natural flow of Cottonwood and Pinabete Arroyos to the extent practicable. The two arroyos would not be diverted for mining purposes under the proposed Project; in addition, flow would not be retarded except for a potential road crossing on Cottonwood Arroyo. BNCC has established a 100-foot stream buffer zone along Cottonwood and Pinabete Arroyos.

BNCC has committed through its proposed SMCRA permit application to restore Areas 4 North and 4 South to their approximate original contours. The reclamation of mine disturbance to the approximate original contours serves to minimize the disturbance to hydrologic balance and restore prominent drainage features within the Project Area to their approximate pre-mining conditions. The reclamation is guaranteed by reclamation bond determined upon the amount of mining disturbance within the Project Area. The reclamation bond value will fluctuate over time within the Project Area—increasing as new disturbance is added and potentially decreasing as performance standards are met and as OSM approves the release of bond as described in 30 CFR 800. Reclamation would begin approximately 10 years after mining begins in 2016 and would continue as contemporaneously as practicable. As reclamation progresses throughout the regraded areas, BNCC will re-establish drainages according to the approved final surface configuration design.

Consistent with USACE guidance including the Final Compensatory Mitigation Rule (April 10, 2008), Regulatory Guidance Letter No. 02-2 (Dec. 24, 2002), and the Memorandum of Agreement Between the Environmental Protection Agency and the Department of the Army Concerning the Determination of Mitigation Under the Final Compensatory Mitigation Rule, the mitigation requirements in this plan are designed to compensate for the loss of jurisdictional areas in the Project Area so as to ensure no net loss of functions and services of WoUS as a result of the permitted activity. The primary mechanisms for mitigating the loss of jurisdictional areas are re-establishment and creation.

To offset the temporal loss of functionality impacts of WoUS during active mining, BNCC has proposed the re-establishment of native riparian habitat and the creation of wetland habitat. Because BNCC's impacts to WoUS occur incrementally per year of operation, the USACE is working with the applicant to prepare a phased approach when addressing mitigation requirements. Among the mitigation measures proposed, BNCC has proposed creating wetland

habitat in a section of the San Juan River, removing exotics (tamarisk, knapweed [*Centaurea* sp.], and Russian olive), planting riparian species along the banks of the river, and reclaiming the ephemeral streams within Area 3 of Navajo Mine covered under the 2011 Pre-2016 Area 3 and Area 4 North Mining IP (SPA-2011-00122-ABQ) using geomorphic reclamation principals.

BNCC plans to complete its mitigation requirements in two phases that correlate to the two coal supply agreements anticipated with APS. Phase 1 would involve mitigation either at a site located within the Navajo Nation just south of Highway 64 and the Hogback or another site located along the San Juan River within the Nenahnezad Chapter of the Navajo Nation. Mitigation at either site would include the removal of tamarisk, knapweed, and Russian olive along the banks of the San Juan River, planting native riparian shrubs and trees, and creating a wetland area connected to the San Juan River. During Phase 2, BNCC would reclaim the remainder of the Area 3 mining disturbance with a hybrid geomorphic reclamation approach based on the fluvial geomorphic principles in hydrologic restorations (Dunne and Leopold 1978; Rosgen 1996).

Note: The USACE South Pacific Division Mitigation Ratio Setting Checklist Procedure will be utilized to determine a final compensatory mitigation ratio for unavoidable impacts should a permit decision be reached.

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10. NEPA

This document includes an environmental review of the proposed Project and satisfies the requirements of NEPA. USACE is utilizing and has referenced the Four Corners Power Plant and Navajo Mine Energy Project EIS as part of the NEPA review.

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11. PERMIT CONDITIONS

To be determined.

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12. DETERMINATIONS

To be determined.

12.1 NEPA Compliance

To be determined.

12.2 Section 404(b)(1) Guidelines

To be determined.

12.3 Public Interest

To be determined.

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14. DECISION

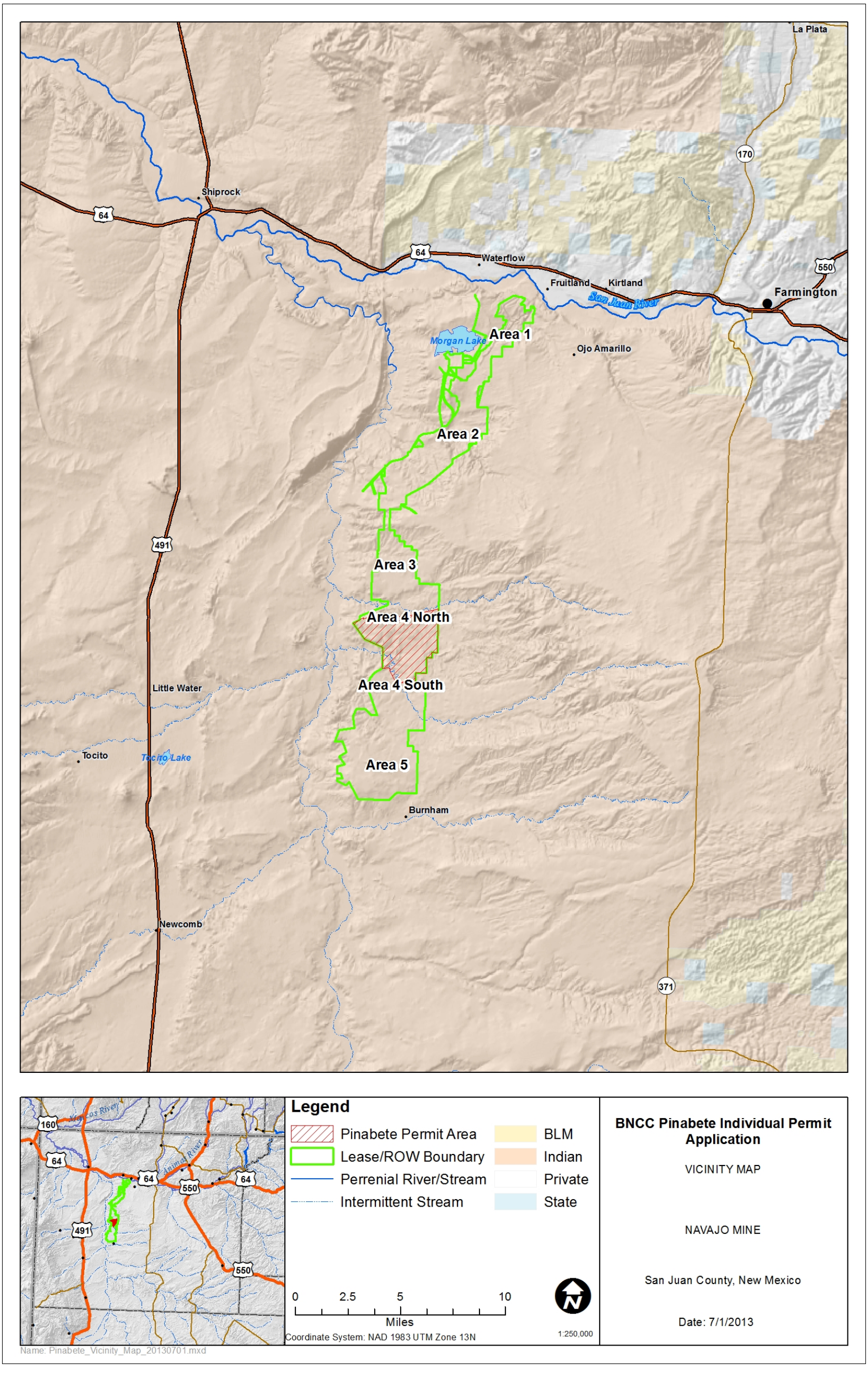
To be determined.

DRAFT

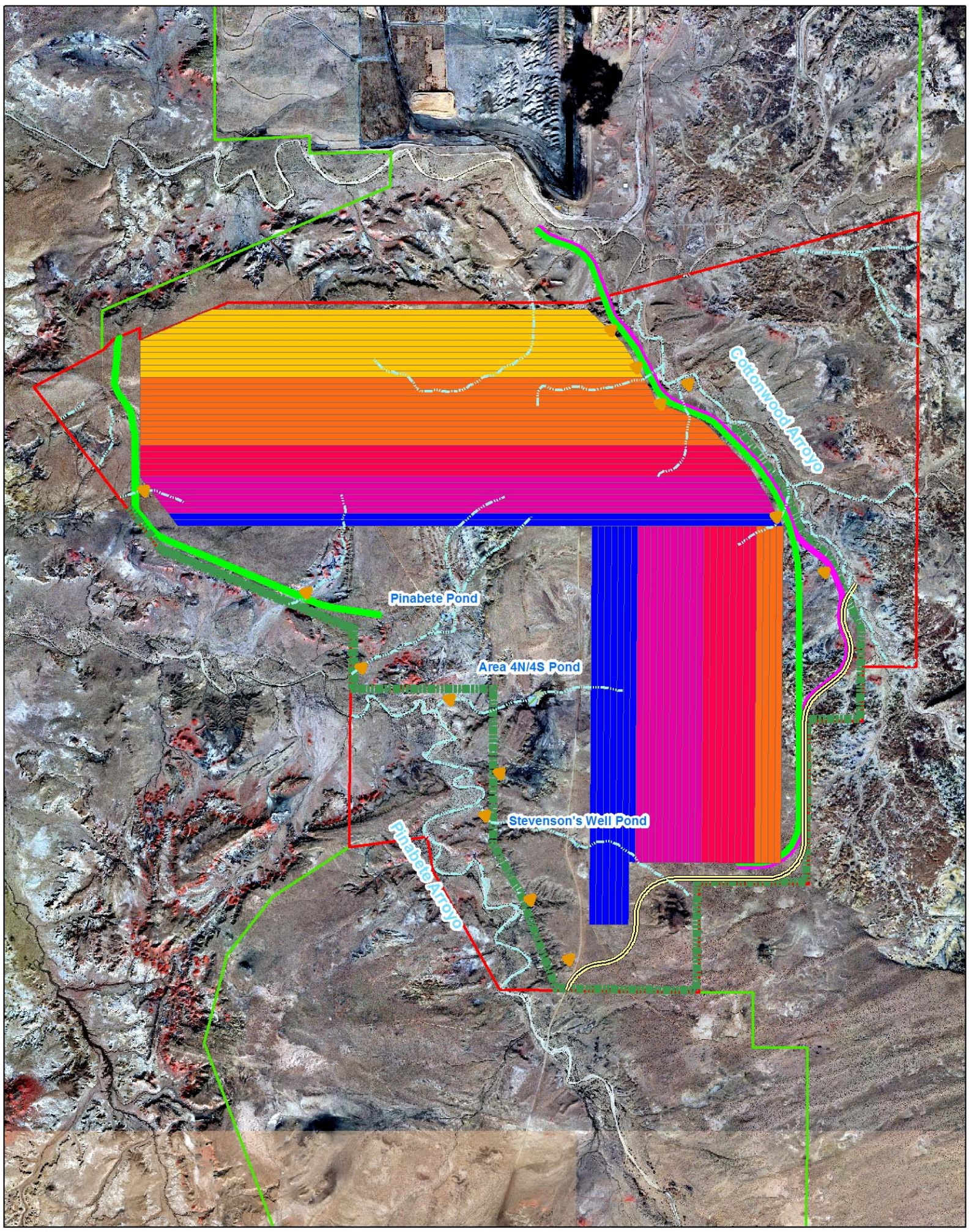
Attachment A – Vicinity Map, Alternative Maps, and Project Maps

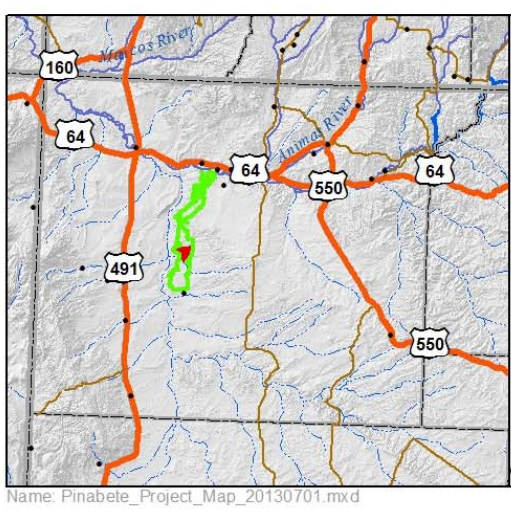
Map 1. Location of Navajo Mine and the proposed Project Area
Map 2. Pinabete Mine Plan for Portions of Area 4 North and Area 4 South
Map 3. Alternative Mine Plan #1 General Arrangement
Map 4. Alternative Mine Plan #2 General Arrangement
Map 5. Alternative Coal Mine Locations in Relation to Four Corners Power Plant
Map 6. Preliminary jurisdictional determination for the Pinabete Permit area
Map 7. Location of CRAM Assessment Areas within the overall Project Area
Map 8. Impacts to Waters of the U.S. in Area 4 North and Area 4 South from the Pinabete Permit Area

Map 1. Location of Navajo Mine and the proposed Project Area



Map 2. Pinabete Mine Plan for Portions of Area 4 North and Area 4 South





Legend

- Proposed Ponds
- Jurisdictional Streams
- Stock Ponds
- Burnham Road Realignment
- Haul Roads
- Light Vehicle Road
- Powerline
- West Haul Road
- Pinabete Mine Plan Permit Area
- BNCC Mining Lease and Rights of Ways

Relative Stripline Completion Years

Five Year Stripline Increments

- 2016 - 2021
- 2021 - 2026
- 2026 - 2031
- 2031 - 2036
- 2036 - 2041

0 0.275 0.55 1.1

Miles

Coordinate System: NAD 1983 UTM Zone 13N

1:27,948

BNCC Pinabete Individual Permit Application

Proposed Pinabete Mine Plan
Areas 4 North and 4 South

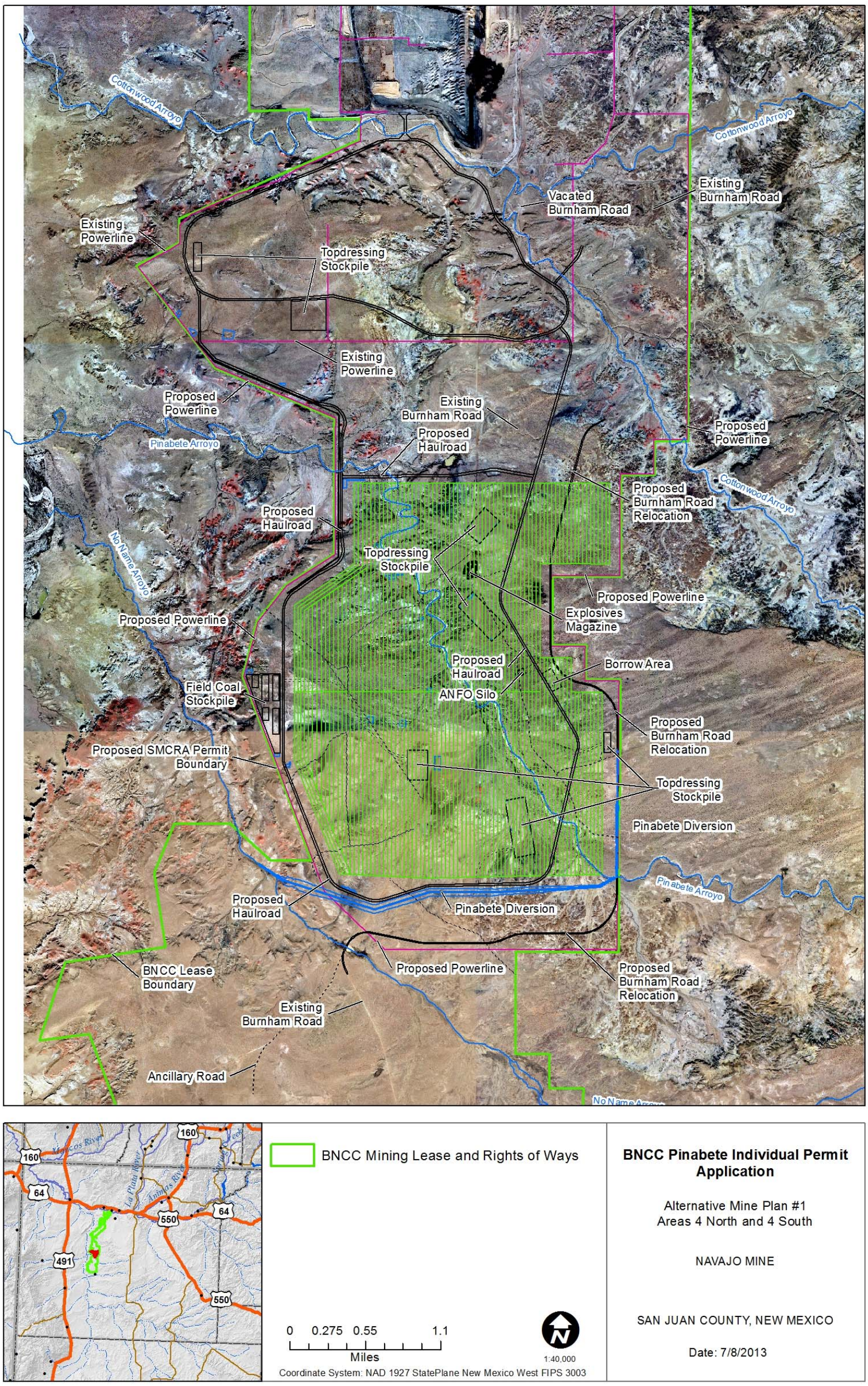
NAVAJO MINE

San Juan County, New Mexico

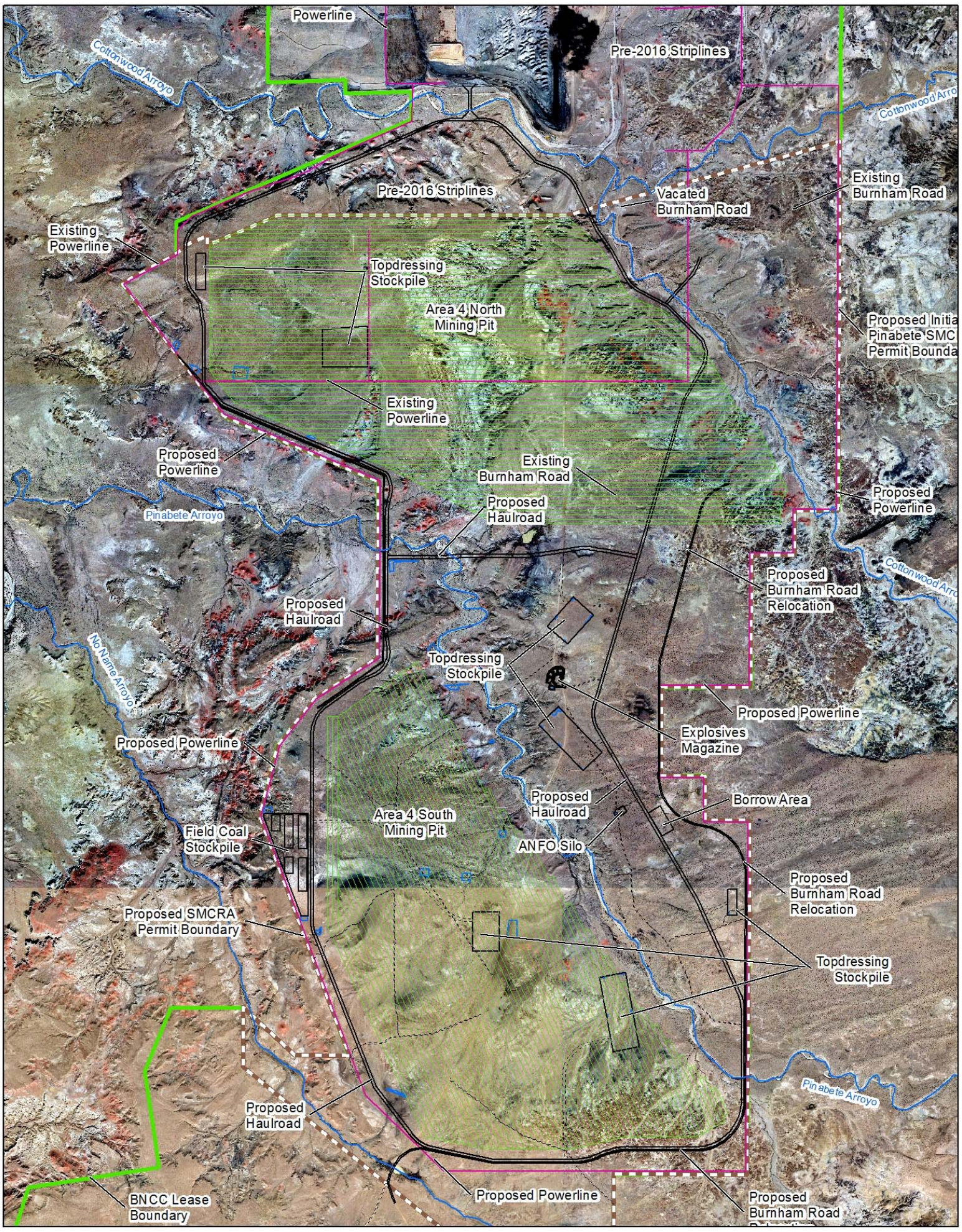
Date: 7/8/2013

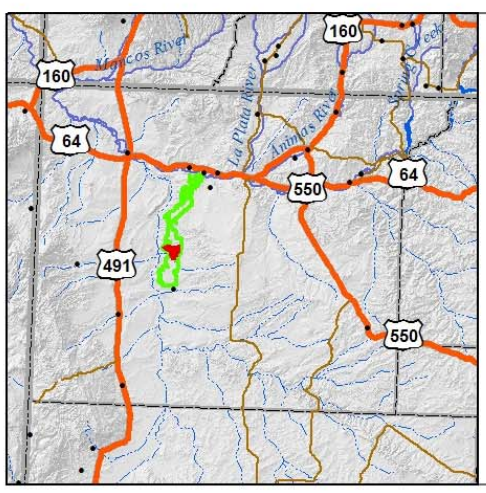
Name: Pinabete_Project_Map_20130701.mxd

Map 3. Alternative Mine Plan #1 General Arrangement



Map 4. Alternative Mine Plan #2 General Arrangement





BNCC Mining Lease and Rights of Ways

0 0.25 0.5 1
Miles

1:35,000

Coordinate System: NAD 1927 StatePlane New Mexico West FIPS 3003

BNCC Pinabete Individual Permit Application

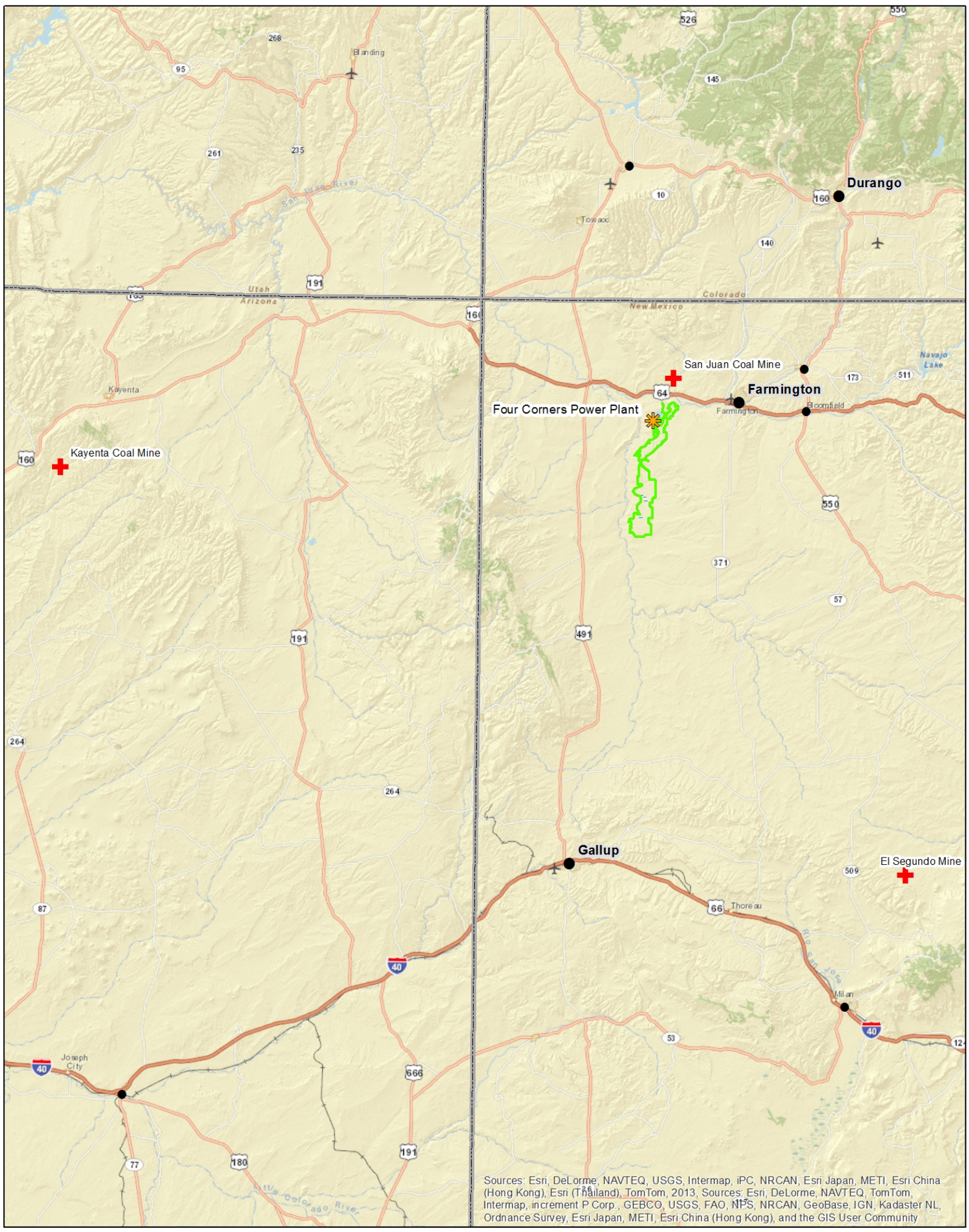
Alternative Mine Plan #2
Areas 4 North and 4 South

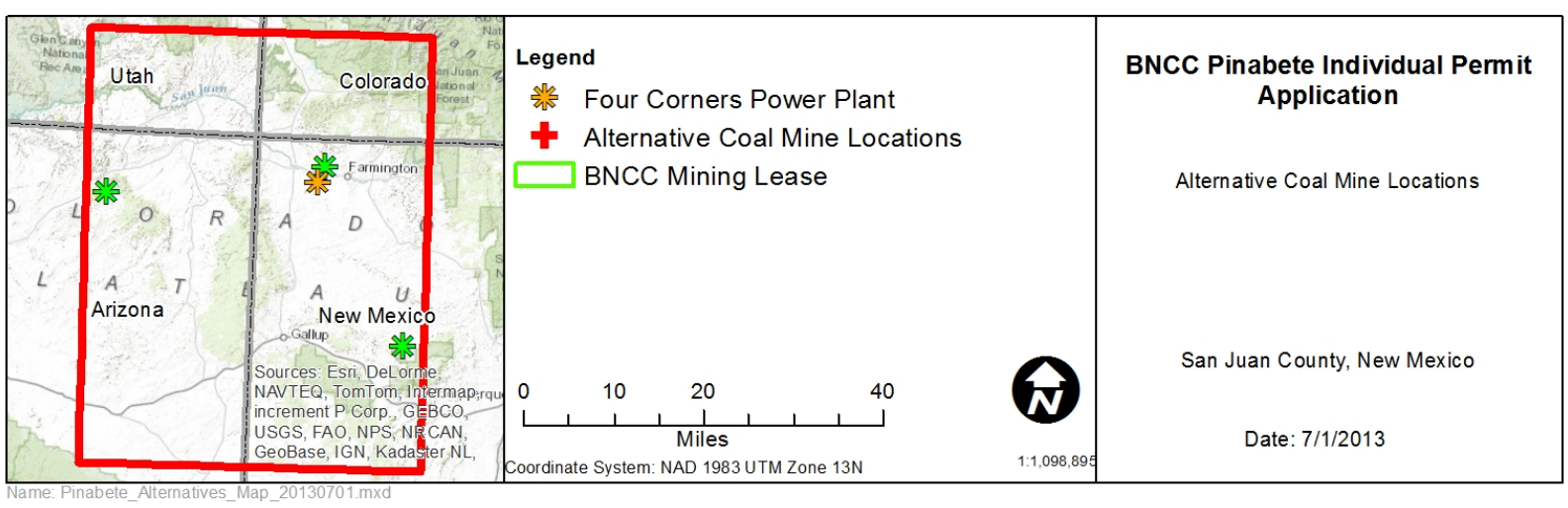
NAVAJO MINE

SAN JUAN COUNTY, NEW MEXICO

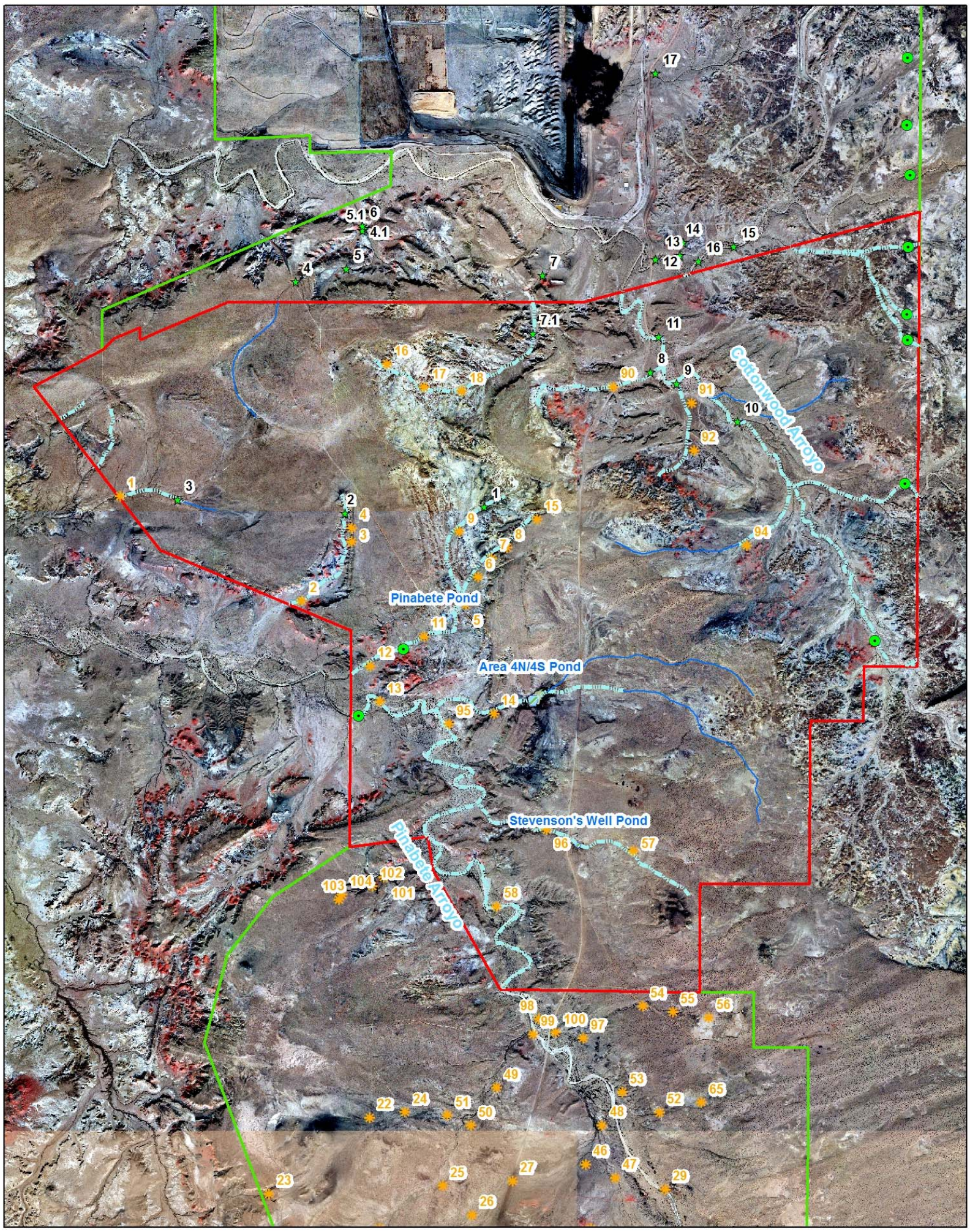
Date: 7/8/2013

Map 5. Alternative Coal Mine Locations in Relation to Four Corners Power Plant

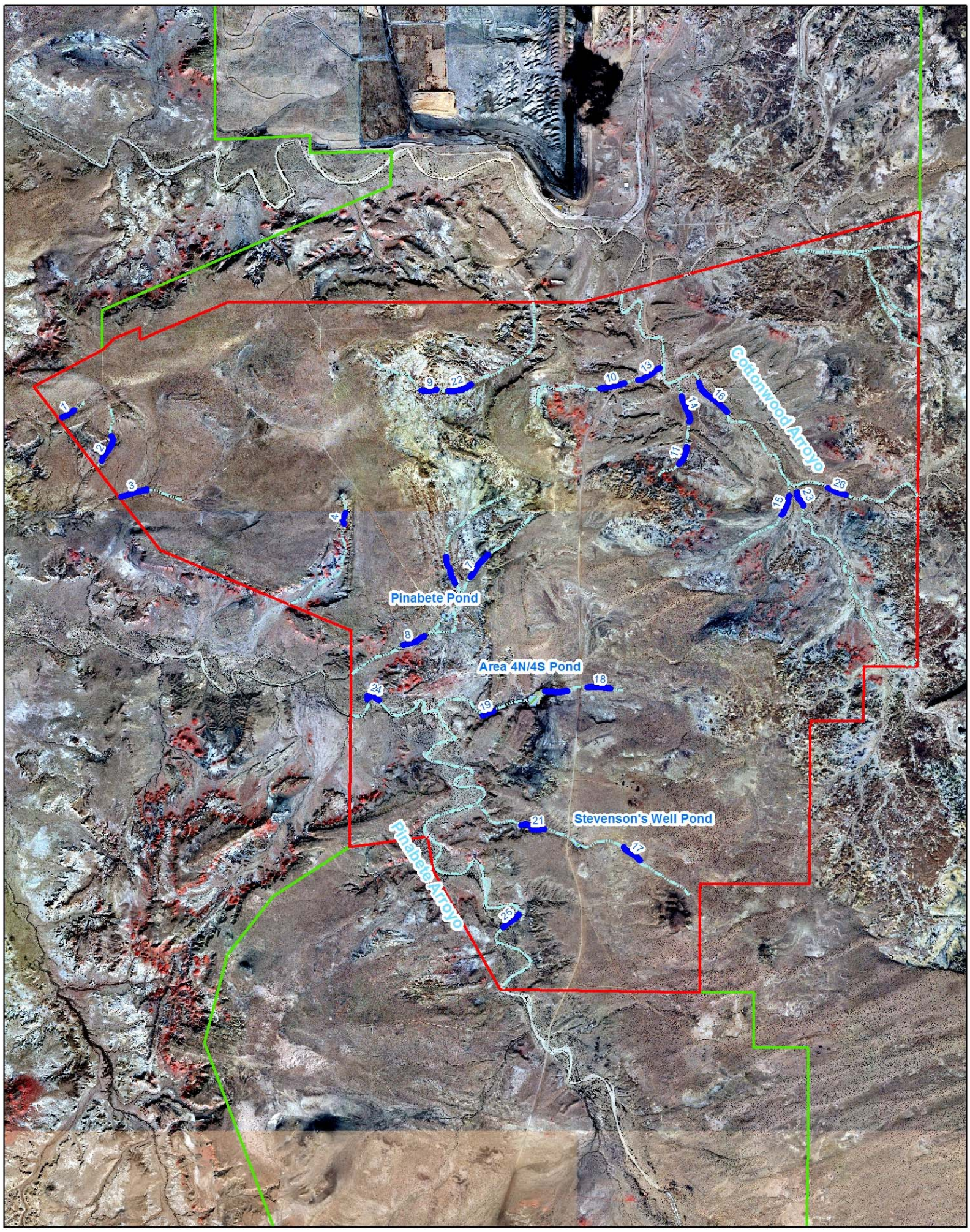




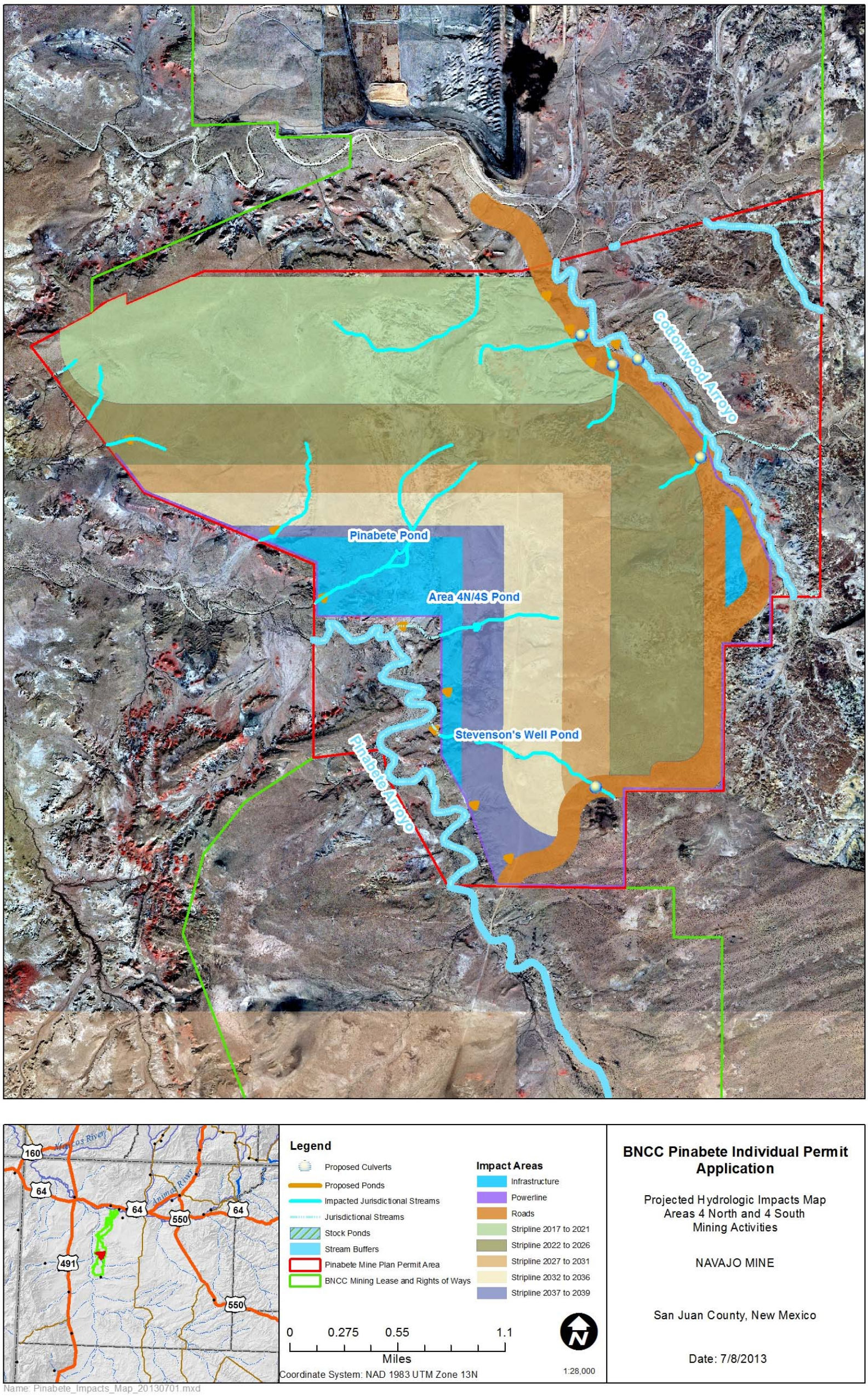
Map 6. Preliminary jurisdictional determination for the Pinabete Permit area



Map 7. Location of CRAM Assessment Areas within the overall Project Area

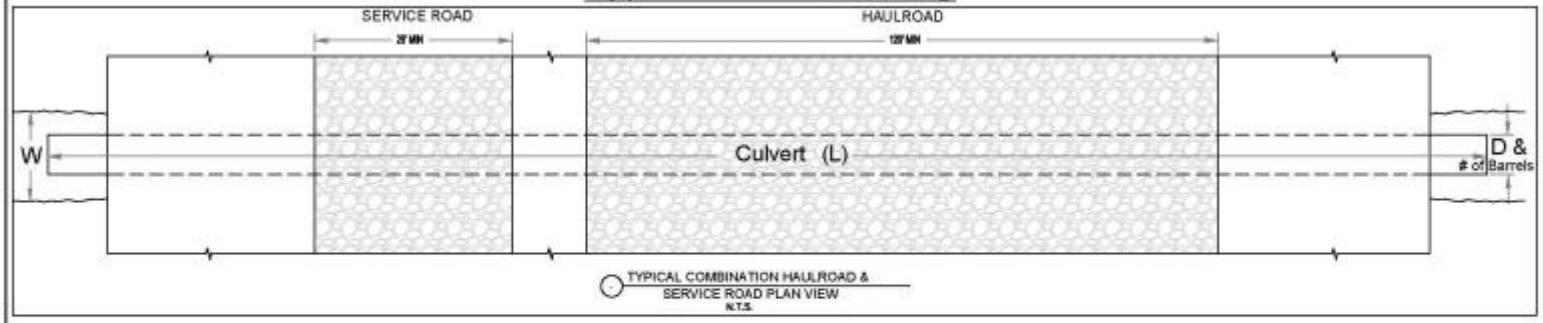


Map 8. Impacts to Waters of the U.S. in Area 4 North and Area 4 South from the Pinabete Permit Area

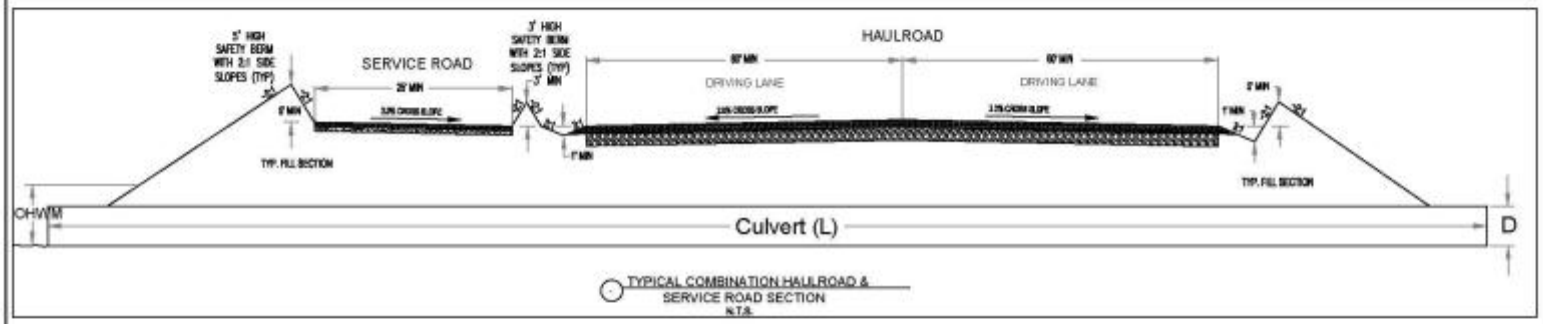


Attachment B – Typical Construction Drawings

Typical Road Crossing



TYPICAL COMBINATION HAULROAD & SERVICE ROAD PLAN VIEW
N.T.S.



TYPICAL COMBINATION HAULROAD & SERVICE ROAD SECTION
N.T.S.

Structure	Location	Station	Watershed (Ac.)	Culvert Diam. (ft) D	Culvert Length (ft) L	# of Barrels	Channel Width (ft) W	OHWM (ft)
CP-213	Area 4 access Road	4+20	12,683.4	16' x 9.5'	255	1	31.0	1.7
CP-401	East Haulroad/BR	16+77	23.9	3.5	89	1	N/A	N/A
CP-402	East Haulroad/BR	29+71	6.3	2.0	107	1	N/A	N/A
CP-403	East Haulroad/BR	35+98	21.8	3.0	119	1	1.4	0.2
CP-404	East Haulroad/BR	50+38	38.9	3.0	88	2	N/A	N/A
CP-405	East Haulroad/BR	76+10	9.5	2.0	117	1	N/A	N/A
CP-406	East Haulroad/BR	115+90	12.4	2.5	180	1	N/A	N/A
CP-407	East Haulroad	167+20	448.4	5.0	220	2	N/A	N/A
CP-408	East Haulroad	189+89	6.7	2.0	252	1	N/A	N/A
CP-409	East Haulroad	200+62	148.2	3.5	227	2	3.0	0.6
CP-410	East Haulroad	211+31	248.9	4.0	216	3	N/A	N/A
CP-411	East Haulroad	251+84	266.7	4.0	217	3	2.0	0.2
CP-412	East Haulroad	274+66	76.6	3.0	177	2	N/A	N/A
CP-413	East Haulroad	3+40	4.1	2.0	98	1	N/A	N/A
CP-414	East Haulroad	15+00	156.1	3.0	97	3	N/A	N/A
	West Haulroad (Future)		85.5	2.0	250	1	2.4	0.3
	West Haulroad (Future)		179.3	3.5	450	1	1.5	0.7

N/A - Not applicable, culvert does not intersect a jurisdictional Waters of the U.S.

NOTES
CP-213: Structural Plate Pipe Arch (SPPA) is designed for 1,562 cfs peak flow.

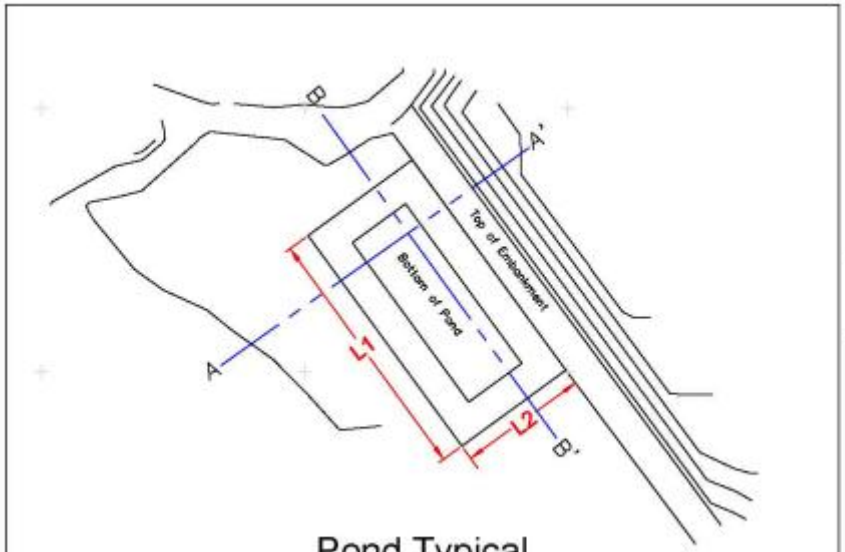
Exhibit 2

bhpbilliton

BHP Navajo Coal Company

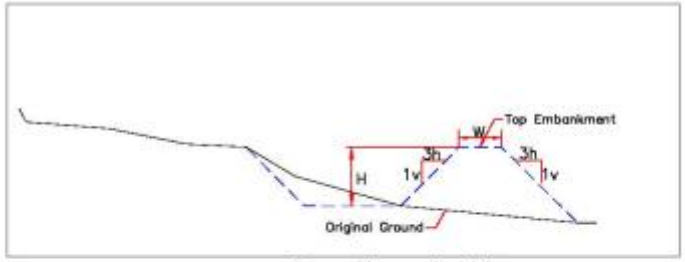
Typical Road Crossing

PREPARED BY RV	DRAWN BY RV	SCALE: NTS
APPROVED BY MD	DATE: Jan 2013	

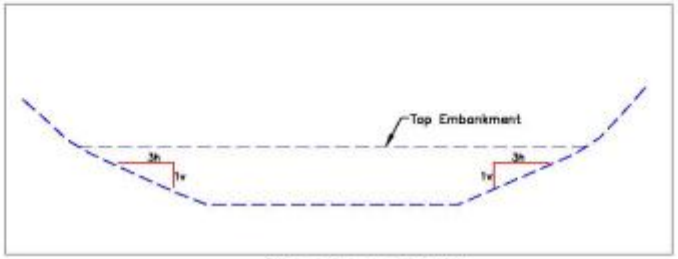


Pond Typical

Scale: NTS



Section A-A'



Section B-B'

Pond	H (ft.)	L1 (ft.)	L2 (ft.)	Min. W (ft.)	Capacity (Ac-ft)
Pond 415	7	70	144	9.0	1.0
Pond 416	10	211	481	9.0	18.7
Pond 417	10	214	491	9.0	19.5
Pond 418	10	214	491	9.0	19.5
Pond 419	10	214	491	9.0	19.5
Pond 420	12	203	453	10.0	19.1
Pond 421	10	190	430	9.0	14.7
Pond 422a	12	202	452	10.0	19.1
Pond 422b	12	202	452	10.0	19.1
Pond 423a	12	204	457	10.0	19.5
Pond 423b	8	204	474	9.0	14.9
Pond 424	8	113	245	9.0	3.6
Pond 425	8	196	455	9.0	13.6
Pond 426	8	134	299	9.0	5.6
Pond 427	7	74	153	9.0	1.1
Pond 428	7	61	120	9.0	0.6

NOTES

Exhibit 1

bhpbilliton

BHP Navajo Coal Company

Typical Pond

PREPARED BY: RV	DRAWN BY: RV	SCALE: NTS
APPROVED BY: MO	DATE: Jan 2013	

Attachment C– Complete CRAM Scores for Ephemeral Streams within the Project Area

CRAM ID	1		2		3		4		6		7		8		9		10		11		13		14		15		16		17		18		19		20		21		22		23		24		25		26		Orig Avg Scores	Proj Avg Scores	Impact (delta)
Drainage Type	Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Cottonwood		Headwater		Headwater		Headwater		Headwater		Headwater		Headwater		Cottonwood		Pinabete		Pinabete		Cottonwood				
Impact Type	Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Haul Road		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Mining Strip		Buffer Impacts		Buffer Impacts		Buffer Impacts		Burnham Road				
CRAM Projection	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj	Orig	Proj			
Buffer and Landscape Connectivity	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	0	22	13	22	0	22	0	22	0	22	0	22	0	22	0	22	21	22	21	22	22	22	22	22.4	4.1	18
Landscape Connectivity	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	3	12	0	12	0	12	0	12	0	12	0	12	0	12	12	12	12	12	12	12	12	12.0	2.1	10
Buffer Metrics	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	10.39	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	0.00	10.39	8.74	10.39	8.74	10.39	9.67	10.39	10.39	10.4	2.0	8
% of AA with Buffer	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	12	12	0	12	0	12	0	12	0	12	0	12	0	12	12	12	12	12	12	12	12	12.0	2.5	10
Average Buffer Width	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	12	12	0	12	0	12	0	12	0	12	0	12	0	12	6	12	6	12	9	12	12	12.0	1.9	10
Buffer Condition	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	9	9	0	9	0	9	0	9	0	9	0	9	0	9	9	9	9	9	9	9	9	9.0	1.9	7
Raw Score	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	13.4	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	0.0	22.4	20.7	22.4	20.7	22.4	21.7	22.4	22.4	22.4	4.1	18
Final Score	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	55.9	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	0.0	93.4	86.5	93.4	86.5	93.4	90.3	93.4	93.4	93.4	17.2	76
Hydrology	24	0	24	0	21	0	24	0	27	0	30	0	30	0	33	0	24	0	27	0	24	0	30	0	21	0	33	27	27	0	21	0	21	0	27	0	18	0	24	0	30	30	33	33	33	33	27	27	26.4	6.3	20
Water Source	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	0	12	9	12	0	12	0	6	0	12	0	6	0	12	0	12	12	12	12	12	12	12	12	11.5	2.4	9
Hydroperiod	6	0	9	0	6	0	9	0	6	0	9	0	9	0	9	0	6	0	6	0	9	0	9	0	6	0	9	9	9	0	6	0	9	0	9	0	9	0	6	0	9	9	9	9	9	9	12	12	8.1	2.0	6
Hydrologic Connectivity	6	0	3	0	3	0	3	0	9	0	9	0	9	0	12	0	6	0	9	0	3	0	9	0	3	0	12	9	6	0	3	0	6	0	6	0	3	0	6	0	9	9	12	12	12	12	3	3	6.8	1.9	5
Raw Score	24.0	0.0	24.0	0.0	21.0	0.0	24.0	0.0	27.0	0.0	30.0	0.0	30.0	0.0	33.0	0.0	24.0	0.0	27.0	0.0	24.0	0.0	30.0	0.0	21.0	0.0	33.0	27.0	27.0	0.0	21.0	0.0	21.0	0.0	27.0	0.0	18.0	0.0	24.0	0.0	30.0	30.0	33.0	33.0	33.0	33.0	27.0	27.0	26.4	6.3	20
Final Score	66.7	0.0	66.7	0.0	58.4	0.0	66.7	0.0	75.0	0.0	83.4	0.0	83.4	0.0	91.7	0.0	66.7	0.0	75.0	0.0	66.7	0.0	83.4	0.0	58.4	0.0	91.7	75.0	75.0	0.0	58.4	0.0	58.4	0.0	75.0	0.0	50.0	0.0	66.7	0.0	83.4	83.4	91.7	91.7	91.7	91.7	75.0	75.0	73.3	17.4	56
Physical Structure	6	0	9	0	6	0	6	0	9	0	9	0	6	0	9	0	6	0	6	0	6	0	9	0	6	0	12	12	9	0	9	0	9	0	9	0	9	0	6	0	12	12	9	9	9	9	9	9	8.1	2.1	6
Structural Patch Richness	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	6	6	3	0	3	0	3	0	3	0	3	0	3	0	6	6	3	3	3	3	3	3	3.3	0.9	2
Topographic Complexity	3	0	6	0	3	0	3	0	6	0	6	0	3	0	6	0	3	0	3	0	3	0	6	0	3	0	6	6	6	0	6	0	6	0	6	0	6	0	3	0	6	6	6	6	6	6	6	6	4.9	1.3	4
Raw Score	6.0	0.0	9.0	0.0	6.0	0.0	6.0	0.0	9.0	0.0	9.0	0.0	6.0	0.0	9.0	0.0	6.0	0.0	6.0	0.0	6.0	0.0	9.0	0.0	6.0	0.0	12.0	12.0	9.0	0.0	9.0	0.0	9.0	0.0	9.0	0.0	9.0	0.0	6.0	0.0	12.0	12.0	9.0	9.0	9.0	9.0	9.0	9.0	8.1	2.1	6
Final Score	25.0	0.0	37.5	0.0	25.0	0.0	25.0	0.0	37.5	0.0	37.5	0.0	25.0	0.0	37.5	0.0	25.0	0.0	25.0	0.0	25.0	0.0	37.5	0.0	25.0	0.0	50.0	50.0	37.5	0.0	37.5	0.0	37.5	0.0	37.5	0.0	37.5	0.0	25.0	0.0	50.0	50.0	37.5	37.5	37.5	37.5	37.5	37.5	33.9	8.9	25
Biotic Structure	12	0	12	0	13	0	11	0	12	0	12	0	12	0	13	0	13	0	10	0	13	0	12	0	13	0	19	18	13	0	13	0	13	0	14	0	16	0	11	0	19	19	19	19	13	13	19	19	13.6	3.7	10
PC: No. of plant layers	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	6	0	9	6	6	0	6	0	6	0	9	0	9	0	6	0	9	9	9	9	6	6	9	9	6.8	1.6	5
PC: No. of codominants	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	6	6	3	0	3	0	3	0	3	0	3	0	3	0	3	3	3	3	3	3	3	3	3.1	0.8	2
PC: Percent Invasion	9	0	9	0	12	0	6	0	9	0	9	0	9	0	12	0	12	0	3	0	12	0	9	0	12	0	6	6	12	0	12	0	12	0	3	0	9	0	6	0	9	9	9	9	12	12	9	9	9.3	1.9	7
Plant Community Metrics	6	0	6	0	7	0	5	0	6	0	6	0	6	0	7	0	7	0	4	0	7	0	6	0	7	0	7	6	7	0	7	0	7	0	5	0	7	0	5	0	7	7	7	7	7	7	7	7	6.4	1.4	5
Interspersion	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	6	6	3	0	3	0	3	0	3	0	3	0	3	0	6	6	6	6	3	3	6	6	3.5	1.1	2
Vertical Biotic Structure	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	3	0	6	6	3	0	3	0	3	0	6	0	6	0	3	0	6	6	6	6	3	3	6	6	3.8	1.1	3
Raw Score	12.0	0.0	12.0	0.0	13.0	0.0	11.0	0.0	12.0	0.0	12.0	0.0	12.0	0.0	13.0	0.0	13.0	0.0	10.0	0.0	13.0	0.0	12.0	0.0	13.0	0.0	19.0	18.0	13.0	0.0	13.0	0.0	13.0	0.0	14.0	0.0	16.0	0.0	11.0	0.0	19.0	19.0	19.0	19.0	13.0	13.0	19.0	19.0	13.6	3.7	10
Final Score	33.4	0.0	33.4	0.0	36.2	0.0	30.6	0.0	33.4	0.0	33.4	0.0	33.4	0.0	36.2	0.0	36.2	0.0	27.8	0.0	36.2	0.0	33.4	0.0	36.2	0.0	52.8	50.0	36.2	0.0	36.2	0.0	36.2	0.0	38.9	0.0	44.5	0.0	30.6	0.0	52.8	52.8	52.8	52.8	36.2	36.2	52.8	52.8	37.9	10.2	28
Overall AA Score	54	0	56	0	52	0	53	0	59	0	61	0	59	0	64	0	54	0	54	0	54	0	61	0	52	0	72	59	59	0	54	0	54	0	60	0	54	0	53	0	69	68	69	68	64	64	64	64	58.8	13.5	45

Attachment D– South Pacific Division Mitigation Ratio-Setting Checklist

To Be Included at a Later Date