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ENERGEN RESOURCES CORPORATION
CHACO 23-08-3 #1H AND #2H
OIL AND NATURAL GAS WELLS PROJECT

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U.S. Department of the Interior
Bureau of Land Management
Farmington District
Farmington Field Office
6251 N. College Blvd., Ste. A
Farmington, NM 87402
Phone: (505) 564-7600
FAX: (505) 564-7608

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
APD	Application for Permit to Drill
AQI	air quality index
AUM	Animal Unit Month
bbl	barrels
BLM	Bureau of Land Management
BOP	Blowout preventer
BSR	Biological Survey Report
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO2e	carbon dioxide equivalent
COA	Condition of Approval
DCA	Division of Conservation Archaeology
EA	Environmental Assessment
Energen	Energen Resources Corporation
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FFO	Farmington Field Office
FEL	from the east line
FNL	from the north line
FSL	from the south line
FWL	from the west line
GHG	greenhouse gas
GIS	Geographic Information Systems
GPS	Global Positioning System
HAP	hazardous air pollutant
HUC	Hydrologic Unit Code
Mbbls	Thousand barrels of liquid
MBTA	Migratory Bird Treaty Act
MLA	Mineral Leasing Act
MSDS	Material Data Safety Sheet
NAAQS	National Ambient Air Quality Standard
NATA	National Scale Air Toxics Assessments
NEPA	National Environmental Policy Act
NMAAQS	New Mexico Ambient Air Quality Standards
NMPIF	New Mexico Partners in Flight
NNPM	New Mexico Principal Meridian
NO2	nitrogen dioxide
NOx	nitrous oxides
NTL	Notice to Lessees
NTUA	Navajo Tribal Utility Authority
OHWM	Ordinary High Water Mark
PFYC	Potential Fossil Yield Classification
PM	particulate matter
PL	Public Law
PM_{10}	particulate matter with a diameter between 2.5 and 10 micrometers
$PM_{2.5}$	particulate matter with a diameter 2.5 micrometers or less
ppb	parts per billion
ppm	parts per million
PRMP	Proposed Resource Management Plan
RMP	Resource Management Plan
ROD	Record of Decision
ROW	right-of-way
SDA	Specially Designated Area
SO_2	sulfur dioxide
USC	United States Code
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	volatile organic compounds
WOUS	Waters of the United States

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1. PURPOSE AND NEED FOR ACTION

1.1. Background

Energen Resources Corporation (Energen) is proposing to drill two horizontal wells on federal land to develop oil and natural gas resources administered by the BLM Farmington Field Office (BLM-FFO) (Federal Lease No. NMNM 018463). Associated with the wells are one well pad, two natural gas pipeline ties, a new access road, and an overhead power line with associated temporary use area (TUA) to construct the power line. The proposed project would be located in San Juan County, New Mexico, approximately 5.9 miles northwest of Lybrook, New Mexico and 3.2 miles east, southeast of Nageezi, New Mexico (see Figure 1, Appendix A).

Energen has submitted two Applications for Permit to Drill (APDs) and associated right-of-way (ROW) applications to the Bureau of Land Management Farmington Field Office (BLM-FFO) for the proposed project. The Proposed Action is the approval of the two APDs and the associated ROW grant applications. The proposed well pad and new access road would be permitted under lease rights. ROWs would be required for the associated well tie pipelines, the power line, and any associated TUA because these would be considered off-lease actions.

Oil and natural gas account for approximately 36 and 25 percent of the total energy consumed in the U.S., respectively (U.S. Energy Information Administration 2012). The BLM-FFO management area is within the San Juan Basin, one of the most prolific gas-producing basins in the country. Taxes and royalties on oil, natural gas, and carbon dioxide production contribute approximately 25 percent of New Mexico's general fund and the oil and gas industry is one of the largest private sector employers in New Mexico, providing 9.9 percent of all jobs (API 2013). In 2011, revenue from oil and gas totaled $1.32 billion or 25 percent of the General Fund (New Mexico Oil and Gas Association 2015).

1.2. Purpose and Need for Action

The purpose of the Proposed Action is to provide Energen reasonable access to BLM managed lands to develop their leased federal minerals (Federal Lease No. NMNM 018463) for production.

The need for the action is established by BLM's responsibility under the Mineral Leasing Act of 1920, as amended (MLA, 30 U.S. Code [USC] 181 et seq.), to lease and develop federal minerals (including oil, gas, and other hydrocarbons). The MLA authorizes the BLM to issue federal oil and gas leases for exploration of mineral resources and permit development of those leases.

The need for action is also established under BLM's authority in Title V of the Federal Land Policy and Management Act of 1976, as amended (FLPMA, 43 USC 1761-1771), and Section 28 of the MLA (43 USC 185). As codified in 43 Code of Federal Regulations (CFR) 3160 (Onshore Oil and Gas Operations), the BLM is required to respond to a request for an APD.

1.3. Decision to be Made

Based on the information provided in this environmental assessment (EA), the BLM-FFO will decide whether or not to issue the two submitted APDs and four ROW grant applications associated with the proposed project, and if issued, under what terms and conditions. In compliance with the MLA, the decision to be made is how to proceed with resource development. Under the National Environmental Policy Act (NEPA) as amended (Public Law 91-90, 42 USC 4321 et seq.), the BLM-FFO must determine if there are any significant environmental impacts associated with the Proposed Action warranting further analysis in an environmental impact statement (EIS). The BLM-FFO Field Manager is the responsible officer who will decide the following:

- To approve the two APDs and associated ROW grant applications with design features and mitigation as submitted

- To approve the two APDs and associated ROW grant applications with additional mitigations
- To analyze the effects of the Proposed Action in an EIS
- To deny the two APDs and associated ROW grant applications

1.4. Conformance with Applicable Land Use Plan(s)

Pursuant to 40 CFR 1508.28 and 1502.21, this EA incorporates information and analysis contained in the 2003 Farmington Proposed Resource Management Plan (PRMP)/Final Environmental Impact Statement (FEIS) (PRMP/FEIS, USDI BLM 2003a). The Proposed Action is in conformance with the September 2003 Farmington Resource Management Plan with Record of Decision (ROD), as updated in December 2003 (USDI BLM, 2003b).The Proposed Action would be in conformance with the 2003 PRMP/ROD that states, "…to the extent possible, new ROWs will be located within or parallel to existing ROWs or ROW corridors to minimize resource impacts" (USDI BLM 2003a and 2003b).The PRMP/FEIS and ROD are available for review at the BLM-FFO in Farmington, New Mexico or electronically at: http://www.nm.blm.gov/ffo/ffo_home.html. This project EA addresses site-specific resources and impacts that are not covered within the PRMP/FEIS, as required under the NEPA.

A portion of the proposed project is located within the Lybrook Fossil Specially Designated Area (USDI BLM 2003a). The management goal of the Lybrook Fossil Area is to facilitate scientific study and protection of the paleontological resources. Management prescriptions applicable to the Proposed Action include:

- Manage existing oil and gas leases under Controlled Surface Use Constraint
- Paleontological clearance is required for surface-disturbing activities on current and new oil and gas acreage
- ROWs granted on a case-by-case basis with management constraints that protect paleontological values
- Implement Class III and IV Visual Resource Management designation

Oil and gas development is recognized as an appropriate use of public lands in the Farmington Field Office planning area (USDI BLM 2003b). The PRMP/FEIS adheres to the federal mandates contained in the Energy Policy and Conservation Action (42 USC 6217) and Executive Order 13212, as amended, that direct federal land managing agencies to expedite the production of the federal mineral estate for the development of reliable domestic sources of energy. The proposed project would not be in conflict with any local, county, or state plans.

1.5. Relationship to Statutes, Regulations or Other Plans

Energen would comply with all applicable federal, state, and local laws and regulations, as well as obtain the necessary permits for the installation and operation of the proposed project.

The Endangered Species Act (ESA) of 1973 requires all federal departments and agencies to conserve threatened, endangered, and critical and sensitive species and the habitats on which they depend, and to consult with the U.S. Fish and Wildlife Service (USFWS) on all actions authorized, funded, or carried out by the agency to ensure that the action will not likely jeopardize the continued existence of any threatened and endangered species or adversely modify critical habitat. Consultation with the USFWS, as required by Section 7 of the ESA, was conducted as part of the Farmington PRMP/FEIS (Consultation No. 2-22-01-I-389) to address cumulative effects of PRMP/FEIS implementation. The consultation is summarized in Appendix M of the PRMP/FEIS. Farmington Field Office staff reviewed the action alternatives and determined they would be in compliance with threatened and endangered species management guidelines outlined in the September 2002 Biological Assessment (Consultation No. 2-22-01-I-389). No further consultation with the U.S. Fish and Wildlife Service is required.

Applicable federal, state, and local laws and regulations include, but are not limited to:

Federal Regulations

- Antiquities Act of 1906, as amended (Public Law [PL] 52-209; 16 USC 431-433).
- American Indian Religious Freedom Act of 1978 (PL 95-431; 92 Stat. 469; 42 USC 1996).
- Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721; 16 USC § 470aa et seq.), as amended (PL 100-555; PL 100-588).
- National Historic Preservation Act of 1966 as amended (PL 89-665; 80 Stat. 915; 16 USC 470 et seq.) and implemented under regulations of the Advisory Council on Historic Preservation, 36 CFR Part 800;
    - Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their actions on historic properties, and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Compliance with the requirements of the NHPA is met by following the 2014 Protocol Agreement between the New Mexico BLM and New Mexico State Historic Preservation Officer, which is authorized by the Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (2012).
- Bald and Golden Eagle Protection Act of 1940, as amended (PL 86-70, PL 87-884, PL 92-535, PL 95-616; USC 668-668d).
- Clean Air Act of 1972, as amended (PL 88-206; 42 USC § 7401 et seq.);
    - The Clean Air Act establishes national ambient air quality standards (NAAQS) to control air pollution. In New Mexico, the New Mexico Environment Department (NMED) has adopted most of the Clean Air Act into the New Mexico Administrative Code (NMAC). The NMED issues construction and operating permits for air quality and enforces air quality regulations and permit conditions.
- Clean Water Act, as amended (PL 107-303; 33 USC § 1251, et seq.);
    - Under Section 404 of the CWA, the U.S. Environmental Protection Agency (EPA) regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. The Section 404 program is administered by the U.S. EPA and U.S. Army Corps of Engineers. A Section 404 permit is required for projects that would result in discharged material into a water of the U.S. Under Section 402 of the CWA, the U.S. EPA regulates storm water discharges from industrial and construction activities under the National Pollution Discharge Elimination System program. Permits are required if discharge results in a reportable quantity for which notification is required (pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6) or if the discharge contributes to a violation of a water quality standard.
    - Activities affecting Waters of the U.S. are regulated under the Clean Water Act (CWA) (33 USC 1251-1376; Chapter 758; PL 845; 62 Stat. 1155); reauthorized 1991). Specifically section 404 authorizes discharges to waters of the U.S. and section 401 provides water quality certifications for those discharges. The Nationwide Permit (NWP) program under §404 of the Act provides for fills to waters subject to jurisdiction under §404 of the CWA. No such waters fall within or across the proposed project area.
    - Under Section 401 of the CWA, an applicant for a federal license or permit to conduct an activity that may result in a discharge into a Water of the U.S. must provide the federal agency with a Section 401 certification declaring that the discharge would comply with the CWA. The certification would be granted by the NMED.
- Colorado River Salinity Control Act, as amended (PL 93-320; 7 CFR Part 702).
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL 96-510; 42 USC § 9601; 40 CFR Part 307).
- Endangered Species Act of 1973 (PL 93-205; 16 USC § 1531 et seq.).
- Executive Order 11988 Floodplain Management.
- Executive Order 11990 Protection of Wetlands.
- Executive Order 12898 Environmental Justice.
- Executive Order 13007 Indian Sacred Sites.
- Executive Order 13112 Invasive Species.
- Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds.
- Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712; 50 CFR Part 21).

- Native American Graves Protection and Repatriation Act of 1990 (PL 101-601; 104 Stat. 3048; 25 USC 3001; 43 CFR Part 10).
- Paleontological Resources Preservation Act as part of the Omnibus Public Land Management Act (PL 111-011, Title VI, Subtitle D). and
- Safe Drinking Water Act, as amended (PL 93-523; 42 USC 300F-300-9), 40 CFR Parts 144 and 147).

State of New Mexico Regulations

- The New Mexico Oil Conservation Division (NMOCD), which is in the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD), regulates oil and gas operations in New Mexico. The NMOCD has the responsibility of gathering production data, permitting new wells, establishing pool rules and allowables, issuing discharge permits, enforcing rules and regulations, monitoring underground injection wells, ensuring that abandoned wells are properly plugged, and ensuring that the land is responsibly restored. Oil and gas regulations administered by NMOCD are contained in NMAC 19.15. These regulations include but are not limited to:
    - EMNRD requires operators to follow "pit rule" guidelines (NMAC 19.15.17) to reduce groundwater contamination from industry-related activities.
    - NMAC 19.15.15 establishes requirements for well acreage spacing, obtaining approval of unorthodox well locations, and pooling or communitizing small acreage oil lots.
    - NMAC 19.15.16.19 requires the disclosure of hydraulic fracture constituents.

This EA considers the requirements of these and other laws and regulations, as applicable. The Proposed Action, including environmentally-protective design features, complies with the laws and regulations indicated above. Operators are required to obtain all necessary permits and approvals prior to any disturbance activities.

1.6. Scoping, Public Involvement and Issues

1.6.1. *Scoping and Public Involvement*

The BLM-FFO publishes a National Environmental Policy Act (NEPA) log for public inspection. This log contains a list of proposed and approved actions within the BLM-FFO. The log is located on the BLM's New Mexico website (http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html). A portion of the proposed project is located within the Lybrook Fossil Special Management Area. This proposed Chaco 23-08 3 Wells Project will be posted on the BLM-FFO NEPA log for public comment. Two on-site meetings were held at the proposed site on October 16 and December 11, 2014. Attendees included representatives from Energen, BLM-FFO, Williams Four Corners LLC., environmental consultants from the Tegre Corporation, and Scorpion Survey and Consulting, LLC. Nageezi Chapter of the Navajo Nation was invited to the on-site meeting by the BLM-FFO. No members of the Chapter or the Navajo Nation attended these meetings. A public invitation to the on-site meetings was posted online at:

(http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html).

No private citizens or groups attended the on-site meetings.

The proposed Chaco 23-08 3 Wells Project was posted from August 10, 2015 to September 11, 2015 and one comment was received on September 11, 2015 via e-mail and a hard copy was received on September 15, 2015.

The comment was authored by the Western Environmental Law Center (WELC), and named as co-commenters with the San Juan Citizens Alliance (SJCA), Dine Citizens Against Ruining Our Environment (Dine CARE), WildEarth Guardians, and the Natural Resources Defense Council (RDC).

The comment expressed concern that the continued development of the Mancos Shale/Gallup Formation and ongoing BLM Farmington Field Office approval of horizontal and multi-stage fracking will have the following impacts:

1. The drilling and fracking threatens the region's air, water, fish, and wildlife, and fails to reduce greenhouse gases or combat climate change;

2. The commenters claim the Farmington BLM Resource Management Plan (RMP) is outdated and does not adequately address the impacts of the Mancos shale development. They state no oil and gas leasing should take place until the RMP is amended and an EIS completed. The commenters claim that NEPA requires further study on the impacts of developing the Mancos Shale deposits.

The BLM response to the comment is as follows:

The BLM is entitled to continue relying on analysis in the 2003 RMP for the Farmington Field Office. The APDs that the Western Environmental Law Center has asked the BLM to reject or deter are supported by NEPA analysis under the 2003 RMP and by the EAs prepared for each APD. These EAs have concluded that there is no significant impact to the environment resulting from approval of the APDs.

1.6.2. *Issues to be Analyzed*

A BLM-FFO Interdisciplinary Team meeting was held in December 2014 to discuss the Proposed Action. The following potential issues of concern were identified by the Interdisciplinary Team during internal scoping:

- How would the proposed project impact air resources?
- How would the proposed project impact surface water resources?
- Where will water for drilling be sourced from and how much water will be needed?
- How would vegetation-clearing, project activities, and final reclamation impact soils?
- How would vegetation-clearing, project activities, and final reclamation associated with the project impact upland vegetation?
- How would the proposed project impact noxious weeds?
- How would the proposed project impact rangeland resources, grazing livestock and the grazing permittee(s)?
- How would vegetation-clearing, project activities, and final reclamation impact wildlife, including migratory birds?
- How would vegetation-clearing, project activities, and final reclamation impact the following BLM Special Status Species: American peregrine falcon *(Falco peregrinus anatum*), prairie falcon (*Falco mexicanus*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), yellow-billed cuckoo *(Coccyzus americanus*), mountain plover *(Charadrius montanus*), western burrowing owl (*Athene cunicularia*), Aztec gilia (*Aliciella formosa*) and Brack's hardwall cactus (*Sclerocactus cloveriae* var*. brackii*)?
- How surface-disturbing activities would associate with the proposed project impact cultural resources?
- How would the proposed project impact paleontological resources?
- How would the proposed project impact environmental justice?
- How would the proposed project impact public health and safety?

1.6.3. *Issues Considered but Not Analyzed*

The BLM-FFO Interdisciplinary Team identified the following resources during internal scoping as potential issues of concern that would not be significantly impacted or have been evaluated in previous analyses.

Areas of Critical Environmental Concern (ACECs) and Other Specially Designated Areas

The nearest Area of Critical Environmental Concern (ACEC) is the Pierre's Site ACEC and the Chacoan Roads ACEC, both are 13.75 miles to the east of the proposed project area. The Ah-Shi-Sle-Pah

Wilderness Study Area is located 11.65 miles to the southwest of the proposed project area. The proposed project is located 1.45 miles to the northeast of the Betonnie Tsosie SDA. The Crow Mesa (Big Game) Specially Designated Area (SDA) is 3.40 miles to the east, northeast of the proposed project and the Chaco Culture National Historical Park is located 16.27 miles to the southwest of the proposed project area.

Native American Religious Concerns

For No Action (Alternative A), Proposed Action (Alternative B) and Alternative C, identification efforts for Native American Religious Concerns were limited to a review of existing published and unpublished literature (e.g., Van Valkenburgh 1941, 1974; Brugge 1993; Kelly, et al. 2006), and two site-specific Class III survey reports prepared for the Proposed Action, Alternative B and Alternative C. One cultural report by the Division of Conservation Archaeology (DCA) New Mexico Cultural Resources Inventory System (NM CRIS) Report No. 132381 and the second by Dykeman Roebuck Archaeology, LLC NMCRIS Report No.132530 included all known information on Native American Religious Concerns and presence of Traditional Cultural Properties (TCPs). The BLM-FFO's cultural resources program continues to address Native American Religious Concerns and the presence of TCPs identified through ongoing BLM tribal consultation efforts. There are currently no known remains that fall within the purview of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001) or the Archaeological Resources Protection Act (ARPA; 16 USC 470) within the proposed project area. The Proposed Action would not impact any known TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere with or hinder the performance of traditional ceremonies and rituals pursuant to the American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996) or Executive Order (EO) 13007.

Threatened and Endangered Species

No federally listed species with the potential to occur in San Juan County or potential habitats for federally listed species were observed within the proposed project study area. Furthermore, no designated critical habitat for any federally listed species occurs within the proposed analysis area. A biological survey report (BSR) of the proposed project area was prepared in May 2015. The BLM-FFO reviewed this BSR and determined that the Proposed Action is in compliance with listed species management guidelines outlined in the September 2002 Biological Assessment (US Fish and Wildlife Service Consultation No. 2-22-01-I-389) (USDI BLM 2002).

Water for well construction would be sourced from one of two water wells:

Blanco Trading Post: located in the SW¼NE¼ (southwest quarter of the northeast quarter) of Section 32, of Township 25 North, Range 09 West, New Mexico Principle Meridian (NMPM). This well is permitted by the State of New Mexico. The well has been assigned the Point of Diversion Number SJ 01979 by the New Mexico Office of the State Engineer.

OR

Turtle Mountain: located SW¼SW¼ of Section 36, of Township 24 North, Range 08 West, NMPM. This well is permitted by the State of New Mexico. The well has been assigned the Point of Diversion Number SJ 00960 by the New Mexico Office of the State Engineer.

No new water depletions would result from implementation of the Proposed Action. Therefore, no further consultation with the U.S. Fish and Wildlife Service (USFWS) is required. Produced water from nearby, existing gas wells may also be utilized for well completion operations if such activity proves practicable.

Hydraulic Fracturing

Stimulation (i.e., hydraulic fracturing or "fracking") is a process used to maximize the extraction of underground resources by allowing oil or natural gas to move more freely from the rock pores to production wells that bring the oil or gas to the surface. Fluids, commonly made up of water (99 percent) and chemical additives (1 percent), are pumped into a geologic formation at high pressure during hydraulic fracturing (USEPA 2004). Chemicals added to stimulation fluids may include friction reducers,

surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. When the fracking pressure exceeds the rock strength, the fluids open or enlarge fractures that typically extend several hundred feet away from the well bore, and may occasionally extend up to 1,000 feet from the well bore. After the fractures are created, a propping agent (usually sand) is pumped into the fractures to keep them from closing when the pumping pressure is released. After fracturing is completed, a portion of the injected fracturing fluids returns to the wellbore and is recovered for future fracturing operations (USEPA 2004) or disposal. Stimulation techniques have been used in the United States since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone hydraulic fracturing have allowed development of gas fields that previously were uneconomic, including the San Juan Basin.

Hydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled. The producing zone targeted by the Proposed Action is well below any underground sources of drinking water. The Mancos Shale formation is overlain by the Lewis Shale formation, which is a continuous confining layer, and is located above both the Mancos Shale and Mesaverde formations. The Lewis Shale provides an impermeable layer that isolates the Mancos Shale and Mesaverde formations from identified sources of drinking water and surface water. On average, the total depth of the proposed well bore would be about 5,000 feet below the ground surface. Fracturing in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracturing could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been identified as an underground source of drinking water based on its depth and relative high levels of total dissolved solids (TDS). No impacts to surface water or freshwater-bearing groundwater aquifers are expected to occur from hydraulic fracturing of the proposed wells.

2. PROPOSED ACTION AND ALTERNATIVES

2.1. No Action: Alternative A

Under the No Action Alternative, the proposed project would not be constructed. This includes the Chaco 23-08 3 #1H and Chaco 23-08 3 #2H wells, the associated well pad, the access road, the power line with its associated TUA, and the two well-tie pipelines. Federal minerals from the Basin Mancos Pool within the north half of Section 3, Township 23 North, Range 08 West, NMPM would not be produced.

The No Action alternative would deny the approval of the proposed applications. The current land and resource uses would continue to occur in the proposed project area. No mitigation measures would be required. The No Action Alternative provides a baseline reference, enabling decision maker(s) to compare the magnitude of environmental effects of the alternatives.

2.2. Proposed Action: Alternative B

The proposed project would include the drilling, production, and final abandonment of the Chaco 23-08 3 #1H and #2H horizontal wells, the construction, use and reclamation of an associated well pad with a 50 foot wide construction zone, the construction use and final abandonment of a new access road with a TUA for road construction, the construction use and final abandonment of a power line with a TUA for power line construction, and the construction use and final abandonment of two natural gas pipelines. The pipelines would be permitted, installed and operated by Williams Four Corners, LLC.

The Proposed Action would include the approval, by the BLM, of two APDs, one for each well, and four ROW grant applications, one for the power line, one for the power line's TUA, and one for each well-tie pipeline. The associated new access road and well pad would be approved by the APDs.

2.2.1. *Location of Proposed Action*

The Proposed Action would be located in San Juan County, New Mexico, approximately 5.9 miles northwest of Lybrook, New Mexico and 3.2 miles east, southeast of Nageezi New Mexico (Appendix A; Figure 1). Figure 2 (Appendix A) shows the proposed project area on the Lybrook NW, New Mexico United States Geological Survey (USGS) 7.5-minute topographic map. Figure 3 (Appendix A) shows the proposed project area on the Lybrook NW, New Mexico 2013 digital orthophoto. Construction plats associated with the proposed project are provided in Appendix B. Photographs of the proposed project areas are provided in Appendix C.

The proposed project is within Sections 3, 4, and 9 of Township 23 North, Range 8 West, New Mexico Principal Meridian (NMPM), San Juan County, New Mexico. Table 2-1 lists the location of the proposed project under the Proposed Action.

Table 2-1. Proposed Action (Alternative B) Location; San Juan County, New Mexico, New Mexico Principal Meridian

Project Component	Surface Legal Descriptions[1]	Bottom Hole Location
Chaco 23-08 3 #1H Well	1994 feet from the north line (FNL) & 187 feet from the east line (FEL), Section 3, Township 23 North (T. 23N.), Range 08 West (R. 08W.)	380 FNL & 380 FWL Section 3, T. 23N., R. 08W.
Chaco 23-08 3 #2H Well	2119 FNL & 213 FEL Section 3 T. 23N., R. 08W.	2260 FNL & 380 FWL Section 3, T. 23N., R. 08W.
Chaco 23-08 3 #1H and #2H Well Pad	SE¼NE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H and #2H Access Road	SE¼NE¼, NE¼SE¼ Section 3 T. 23N., R. 08W.	N/A

Project Component	Surface Legal Descriptions[1]	Bottom Hole Location
Chaco 23-08 3 #1H and #2H Access Road TUA	NE¼SE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H Well-Tie Pipeline	SE¼NE¼, N½SE¼, E½SW¼, SW¼SW¼ Section 3 S½SE¼ Section 4 NW¼NE¼, NE¼NW¼ Section 9 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #2H Well-Tie Pipeline	SE¼NE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H & #2H wells power line	SE¼NE¼, N½SE, E½SW¼, Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H & #2H wells power line TUA	SE¼NE¼, N½SE, E½SW¼, Section 3 T. 23N., R. 08W.	N/A
[1] SW¼=southwest quarter, NW¼=Northwest quarter, NE¼=northeast quarter; SE¼=southeast quarter, N½=North half. S½=South half. E½=East half.		

2.2.2. *Description of Proposed Action*

The proposed well pad would be approximately 210 feet in length on the northern boundary, 684 feet on the eastern boundary, 430 feet of the southern boundary and 450 feet in length on the western boundary. A 50-foot wide construction zone would surround the entire well pad. Due to topographical constraints, this well pad is an irregular shape. Approximately 16.4 feet of cut and 10.5 feet of fill will be needed to create the graded well pad surface. Total disturbance from the proposed well pad would be 5.82 acres (see Table 2-2). Following interim reclamation, about one acre of the well pad would remain unseeded. These areas would be the production area and the teardrop access.

A new access road is proposed to access the above well pad that would be 2,108.88 linear feet with about 20 feet of driving surface, and have a permanent ROW width of 40 feet. A short term road construction TUA of 310.1 linear feet and 30 feet in width (15 feet on either side of the 40 foot road ROW) is also proposed. The new access road would result in 2.15 acres of disturbance—1.94 acres of access ROW and 0.21 acre of TUA (see Table 2-2). Following reclamation, about 1.53 acres would remain as unreclaimed driving surface.

The ROW for the Chaco 23-08 3 #1H well-tie pipeline would be 11,086.48 linear feet and 40 feet wide. It would commence from the #1H well head and continue south-west along the proposed new access road, the existing access road and the proposed San Juan Basin Gathering Sarah B pipeline for all but 515.20 feet. It would terminate and tie into the Williams Four Corners LLC Lateral H-28 Pipeline (see Appendix B for Plats). Fifteen feet of its width would overlap existing disturbances for its entire route. No TUAs are proposed for this well-tie pipeline. Total surface disturbance from the Chaco 23-08 3 #1H well-tie pipeline would be 9.62 acres, resulting in 5.14 acres of new disturbance and 4.48 acres of disturbance to previously disturbed surface (see Table 2-2).

The Chaco 23-08 3 #2H well-tie pipeline would be constructed entirely within the proposed Chaco 23-08 3 #1H and #2H well pad. The Chaco 23-08 3 #2H well-tie pipeline ROW would be 38.84 linear feet and 40 feet wide (see Appendix B for Plats). Total disturbance from the Chaco 23-08 3 #2H well-tie pipeline would be 0.04 acre (see Table 2-2).

The proposed power line would be 5,749.92 linear feet and constructed within a 20-foot-wide corridor. A 15-foot TUA on either side of the corridor would be required to access the pole and anchor locations and to string the wire. These TUAs would be short term in nature, being utilized for power line installation only. Total surface disturbance from the proposed power line and the associated TUA would be 2.34 acres, with 0.49 of these acres over previously disturbed surface and 1.85 acres as new disturbance. The

proposed power line would parallel existing roads and pipelines, and the proposed new access road for its entire length (see Appendix B for Plats)

The overall footprint for the Proposed Action surface disturbances would be approximately 22.87 acres, about 5.71 of these acres are over previously existing disturbances.

Table 2-2. Summary of Proposed Disturbances for the Proposed Project, Proposed Action (Alternative B)

Chaco 23-08 3 Wells Project Components	New Disturbance (acres)	Previous Disturbance (acres)
Well Pad	5.82	0.00
Chaco 23-08 3 #1H Well-Tie Pipeline ROW	5.14	4.48
Chaco 23-08 3 #2H Well-Tie Pipeline ROW	0.00	0.00[1]
Chaco 23-08-3 Power Line	1.85	0.49
Chaco 23-08-3 Power TUA	2.68	0.67
Chaco 23-08 3 Access Road	1.48	0.05
Chaco 23-08 3 Access Road TUA	0.19	0.02
Total Disturbance	17.16	5.71

[1]All disturbance created from this component occurs completely within the well pad. Therefore, the disturbance from this component is already accounted for in the well pad disturbance calculation.

2.2.3. *Well Pad and Access Road Construction*

Heavy equipment would be required for constructing the well pad and access road. The proposed well pad and its construction zone and the access road ROW and its TUA would be cleared of vegetation. The vegetation (including trees less than 3 inches in diameter [at ground level] and slash/brush) would be chipped or mulched and incorporated into the stored topsoil as additional organic matter. Larger woody debris would be removed for off-site disposal. Trees would be cut to ground level and delimbed. All root-balls and tree stumps would be removed and hauled to a designated, approved disposal facility. Tree trunks larger than six inches or greater would be left whole and collected in a designated pile for fuel wood.

Following vegetation removal, the top six inches of topsoil would be stripped and stockpiled within the well pad construction zone and access road ROW for use in reclamation. Excavated materials from cuts would be used to general fill portions of the well pad and new access road. Four culverts would be installed and following establishment of the roadway surface, eight inches of Type I base course would be added to the road surface (approximately 1,145 cubic yards). Well pad construction would require approximately four to five days. Access road construction would require approximately five to seven days.

The existing road utilized to reach the proposed new access road would be upgraded. Eight inches of Type I base course would be added to the road surface (approximately 1,700 cubic yards). The existing culverts would be extended to accommodate the upgraded roadway. The upgraded culverts would maintain the existing drainage patterns.

2.2.4. *Drilling and Completion Operations*

After well pad construction is complete, Energen would mobilize a drilling rig to drill the wells. During drilling operations, equipment on the site would include:

- The drilling rig
- Pipe Racks with drill pipe and casing
- A closed-loop system and above-ground tanks for collecting cuttings and fluid,
- Mud shakers to separate the cuttings from the fluid
- Safety stations
- Equipment and material storage units

- Fuel storage
- Dog House (equipment control room)
- Various service company equipment (cement trucks, fracturing trucks & equipment, wireline trucks, etc.)
- Generators to provide power to the drill rig
- Office trailers equipped with sleeping quarters for essential personnel

Approximately 10 to 40 personnel would be on the proposed site at any time during drilling and completion. Drilling operations for the Chaco 23-08 3 #01 and #2H wells would be conducted in compliance with all Federal Onshore Oil and Gas Orders, all applicable Federal and State of New Mexico rules and regulations, and BLM Notice to Lessees. The proposed wells would be horizontal wells targeting the Basin Mancos Pool. The proposed wells would be drilled to a vertical depth of approximately 5,155 feet and then horizontally drilled approximately 4,800 feet for a total wellbore length of approximately 10,000 feet. Each well would be drilled utilizing the procedures outlined below.

Using a fresh water-based drilling mud system, drilling will commence through the fresh-water bearing formations. A surface casing would then be set to an approximate measured depth of 500 feet. After the surface casing is installed, the casing would be cemented in place by pumping cement down the casing, circulating the cement back up the outside of the casing to create a cement sheath around the entire casing string to provide necessary isolation, and then tested to ensure the quality and integrity of the casing and cement. Prior to drilling below the surface casing, a blowout preventer and associated equipment (BOPE) would be installed on the surface casing, and both the BOPE and surface casing would be pressure tested to ensure integrity. After installation and testing of the BOPE, the intermediate hole would be drilled to approximately 5,775 feet with a fresh water based drilling mud system. After the hole is drilled, a string of intermediate casing would be installed. The intermediate casing would be set and cemented, and then tested to ensure the quality and integrity of the casing and cement. After cementing the intermediate string, a water-based synthetic drilling mud system would be used to drill the horizontal portion of the wellbore.

Additives may be mixed with the mud system to achieve borehole stability, minimize possible damage to geologic formations, provide adequate viscosity to carry the drill cuttings out of the wellbore and reduce downhole fluid losses. All drilling fluids used to drill the holes from the surface to total measured depth would be contained in steel tanks. During drilling operations, drilling fluids are circulated from the tanks, circulated downhole, and then back to the surface in a process called closed loop drilling.

After drilling the wellbore to its final depth, a production liner would be run downhole and cemented in place using centralizers to provide adequate stand-off for good cement placement and isolation. The production liner provides additional isolation of the wellbore and creates a pathway for natural gas and liquids to travel from the formation to the surface.

After the production liner has been cemented and secured into place, the drilling rig would be removed, and a completion rig moved to the site. The completion rig would run a completions string of the same size, weight, and grade as the production liner into the wellbore to tie-in to the liner/liner hanger, providing a secondary barrier during completions that protects intermediate casing from pressures needed to pump into the formation. During completions activities, the well pad would house a completions rig, a completion command center, steel water storage tanks, pump trucks and transports, blending and mixing facilities, and related ancillary completions equipment.

Completing the well would require hydraulic fracturing—the process of injecting a controlled mixture of nitrogen, water, sand, and a small amount of fluid additives into the wellbore under high pressure to fracture the formation and release the oil and gas. To achieve this, a series of charges would be set through the producing interval in the horizontal portion of the wellbore to perforate the production liner and casing and create small fractures in the target formation. A fluid and sand mixture would be injected at high pressure into the formation to create cracks or fractures, the sand would be pumped into these fractures and would act as a propping agent to keep the fractures open and allow oil and gas to move more efficiently into the wellbore. The fracturing process would be done in stages, with each stage

continuing in the same manner along the horizontal portion of the wellbore, using a series of plugs to isolate portions of the well that were previously fractured. After all of the stages are completed, the plugs would be drilled out to allow gas or oil to flow to the wellhead. Nitrogen foam is used to minimize water usage and improve fluid recoveries during the flowback period.

Approximately 23,000 barrels, or three acre-feet of useable water, would be required to drill and complete each well. Of the 23,000 barrels used during the stimulation process, approximately 10,000 to 11,000 barrels would be recovered for reuse. Water for drilling would be obtained from San Juan Basin Water Haulers Association, who would obtain and truck the water from permitted water wells. Two water sources have been identified for this project: 1) Blanco Trading Post Well (located in the SW¼NE¼ of Section 32, of Township 25 North, Range 09 West, NMPM. This well is permitted by the State of New Mexico, and has been assigned the Point of Diversion Number SJ 01979 by the New Mexico Office of the State Engineer); and 2) Turtle Mountain Well (located SW¼SW¼ of Section 36, of Township 24 North, Range 08 West, NMPM. This well is permitted by the State of New Mexico, and has been assigned the Point of Diversion Number SJ 00960 by the New Mexico Office of the State Engineer). Produced water from existing wells may also be used, if appropriate. Water would be stored on-site in steel storage tanks.

During the drilling and completion processes, vehicles would use existing access roads and highways in the region. Traffic would include light vehicles (such as cars and pick-up trucks) and heavy vehicles (such as water trucks and large tractor-trailers hauling equipment). Drilling activities would occur continuously for approximately two weeks per well and would require on-site supervision 24 hours a day. Completions activities are expected to take about a week per well.

2.2.5. ***Well Production***

Production facilities on the well pad would consist of two wellheads, two metering units, separators, flare stacks, above-ground condensate and produced water tanks (about two tanks per well), Lease Area Custody Transfer Units (LACT), and compressors. If artificial lift is required, conventional pumping units (pump jacks) or a gas lift system would be installed. Electric power for the site would be provided by an overhead power line.

Installation of production equipment would take two to three weeks. Production facilities would be located within an approximate 250-by-75-foot facility area at the southeastern end of the proposed well pad. Tank batteries would be placed within a corrugated steel secondary containment berm and would be sized to contain a minimum of 110 percent of the storage capacity of the largest tank within the berm. The containment berm would include an impermeable liner attached to the rings and laid under the tanks. All loading lines would be placed inside the containment berm or would have secondary containment vessels. The well pad tear drop would consist of a looped, 20-foot-wide driving surface with curve widening for trucks and truck-pup access. The teardrop would be used to access the wellhead and other production facilities on location. Production facilities would be in place for the life of the wells, which are anticipated to be 30 to 50 years.

Site security guidelines would be followed, as identified in 43 CFR 3162.7-5 and Onshore Oil and Gas Order No. 3. Equipment would be painted Juniper Green to blend with the surrounding environment, with the exception of equipment subject to safety requirements. Production facilities would be placed, to the extent practicable, to minimize visual impacts. Production would comply with noise standards outlined in Notice to Lessee (NTL) 04-2 FFO (BLM 2004). During production, normal up-keep would be required to monitor production and resolve any problems. It is anticipated that one pick-up truck would visit the proposed well pad daily during the normal work week.

Occasionally, workover or recompletion of the proposed well would be necessary to ensure efficient well production is maintained. Workover activities may include repairs to the wellbore equipment (e.g., casing, tubing, rods, and pump), wellhead, or production facilities.

2.2.6. *Interim Well Pad and Access Road Reclamation*

After production facilities are installed on the pad, the pad size would be reduced to the minimum surface area needed for production facilities and safe future operations. During this phase, heavy equipment and a tractor with seeding capabilities would be used.

Interim reclamation would consist of grading and re-contouring the portion of the well pad not needed for safe production facilities/future operations. The interim reclaimed areas would be contoured to blend with adjacent natural surroundings as much as practicable, and would be covered with salvaged topsoil material, and re-seeded to reestablish vegetation. The BLM-FFO Saltbush Shadscale/Winterfat Community Seed Mixture would be used. The operator would be responsible for monitoring reclaimed surfaces to document successful interim reclamation, as per the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013d). Reclamation monitoring and reporting are discussed in the proposed project's reclamation plan.

Sediment and erosion control measures (such as water diversions, silt traps, and culverts) would be installed as necessary. Interim reclamation would reduce the well pad disturbed area to approximately 2.53 acres for the long term. Access road disturbances beyond the stabilized driving surface, including the short term TUA (0.21 acre), would also be reclaimed.

Interim reclamation activities would be initiated within 90 days after completion of the second well, following the BLM-FFO Bare Soil Reclamation Procedures (BSRP) (BLM 2013d). The BLM-FFO would be notified at least 48 hours prior to the start of interim reclamation activities. Reclamation procedures would take 2 to 4 weeks. Reclamation procedures are also detailed in the proposed project's Reclamation Plan.

2.2.7. *Well Pad and Access Road Abandonment and Final Reclamation*

If both the wells prove to be unproductive, or when both of the wells are no longer commercially viable, the well(s) would be plugged and abandoned. Downhole well abandonment would be carried out under current BLM-FFO and State of New Mexico regulations. The bore would be plugged with cement and the production facilities would be removed. Energen would provide the BLM with technical and environmental aspects of the final plugging and abandonment, and reclamation procedures. An aboveground marker containing well identification information would be placed over the plugged hole.

The goal of final reclamation would be to return disturbed well pad and access road project areas to as close to the pre-construction conditions as practicable following plugging and abandonment. When both wells are plugged and abandoned, the well pad and access road would be returned to pre-construction conditions, to the extent practicable. This would include grading and re-contouring to blend with adjacent natural surroundings, covering the area with salvaged topsoil material and seeding to reestablish vegetation. Portions of the project area that were not fully reclaimed during interim reclamation would be cleared (if vegetated), re-contoured to as near to pre-construction topographical contours as practicable, covered with salvaged topsoil, and seeded. If the access road is needed for another authorized purpose, it would remain unreclaimed.

Sediment and erosion control measures would be implemented, as necessary. Heavy equipment and a tractor with seeding capabilities would be used to complete re-vegetation efforts. Reclamation procedures are also detailed in the proposed project's reclamation plan.

2.2.8. *Pipeline Installation, Operation and Reclamation*

The proposed well-tie pipelines would be 4.5-inch outside diameter buried steel pipelines with a maximum allowable operating pressure of 500 pounds per square inch gauge. Any related aboveground structures such as cathodic protection, block valves with blowdowns, pig launchers and receivers, meter run and other pipeline related appurtenances would require installation within the pipeline ROW.

The trench lines, or ditches, would be excavated and sloped in accordance with Occupational Safety and Health Administration (OSHA) specifications. The cover from top of pipe to ground level would be a

minimum of 36 inches through soils and rock, and a minimum depth of 48 inches at road crossings. All excavated material would be stockpiled at the edge of the ROW. The trenching operation would be followed by pipeline installation, which would include stringing the pipeline segments, bending pipe for horizontal or vertical angles in the alignment, welding pipe segments together, inspecting the pipeline, coating joints to prevent corrosion, and lowering the pipeline into the trench. Backfilling would be done incrementally, as each section of the pipeline is completed.

Cleanup activities would be initiated as soon as practicable after backfilling activities have been completed. The pipeline ROW would be seeded with the Saltbush Shadescale/Winterfat Community Seed Mixture at the seeding rate provided in the pipeline Plans of Development (PODs). Reclamation procedures are also detailed in the proposed project's reclamation plan.

Construction and well-tie pipeline installation activities would take four to six weeks. Reclamation activities would take one to two weeks. The entire proposed pipeline ROW would be reclaimed, excepting for areas that overlap the proposed access road and existing road, and where there are above-ground structures. The pipelines and related above-ground structures would be in place for the life of the wells, which are anticipated to be 30 to 50 years.

2.2.9. *Power Line Installation, Operation and Reclamation*

The proposed project's power line would be a three-phase overhead distribution power line with a voltage of 14.4/24.9kv. It would be constructed on a series of single wooden poles (18 poles in total). The poles would be 40 to 45 feet in height when installed and would be buried 5.5 to 7.5 feet in the ground. The typical span between poles would be about 400 feet. Span distances may vary by about 25 feet to accommodate surface resources such as drainages or rocky areas. The permanent power line ROW would accommodate the wooden poles, anchors and the wires between poles. Pole anchors would typically extend up to 45 feet from the wooden pole. The temporary use areas on either side of the permanent ROW would be used only short term for pole and anchor placement, and for stringing of the wire. Power line installation would follow the Rural Electric Association (REA) standards and the National Electrical Safety Code.

During power line construction, vegetation may be crushed and soils may be incidentally disturbed by vehicles within the ROW in order to install the poles and string the conductor. Soil disturbance would be minimized to the area of the actual power pole and anchor placements.

2.2.10. *Long and Short Term Disturbances*

Short-term impacts include those occurring during construction and drilling activities or those that are mitigated (i.e., reclamation of disturbed areas) within five years following construction. Long-term impacts include those that exist throughout or beyond the life of the project, through abandonment and reclamation. Table 2-3, below lists the planned short and long term disturbances for the proposed project.

Table 2-3. Short- and Long term Disturbance for the Proposed Action (Alternative B)

Surface Land Status	Proposed Disturbance (New and Previous Disturbances - acres)	Short Term Disturbance (acres)	Long Term Disturbance (acres)
Bureau of Land Management	22.87	20.34	2.53

2.2.11. *Design Features and Best Management Practices*

All areas of proposed surface disturbance were field inspected to ensure that potential impacts to natural resources would be minimized through the implementation of design features and best management practices. The proposed project under the Proposed Action was planned to the extent reasonable and feasible to utilize existing disturbances. For a detailed description of the design and construction practices

associated with the Proposed Action, refer to the Chaco 23-08 3 #1H and #2H APDs and associated ROW grants on file at the BLM-FFO Office, Farmington, New Mexico. Plats located in Appendix B also detail project component specifications.

Energen would adhere to all APD conditions of approval (COAs) and ROW grant stipulations. The following general design features and Best Management Practices (BMPs) would be implemented for the Proposed Action (Alternative B):

Air Resources

- The BLM's regulatory jurisdiction over field production operations has resulted in the development of BMPs designed to reduce impacts to air quality by reducing all emissions from field production and operations. Typical measures could include flaring hydrocarbons and gases at high temperatures in order to reduce emissions of incomplete combustion, requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, ensuring that compressor engines 300 horsepower or less have nitrogen oxide (NOx) emissions limited to two grams per horsepower hour.
- Revegetation would occur in areas not required for production facilities in order to reduce dust. Dirt roads would be watered during periods of high use in order to reduce fugitive dust emissions. Magnesium chloride, organic-based compounds, or polymer compounds could be also be applied to roads or other surfaces to reduce fugitive dust. Petroleum-based products or produced water would not be used for dust reduction.
- The USEPA Natural Gas Star Program established in 1993 has been a leader in developing and reporting on strategies to reduce methane emissions (USEPA, 2015). These reductions can help to control not only greenhouse gases but also VOCs, which contribute to ozone formation. Numerous opportunities for emissions reduction, including costs to implement, are documented on USEPA's the Natural Gas Star website (USEPA 2014) http://www.epa.gov/gasstar/index.html. As a member of the Energy STAR Program, Energen would implement emission reduction practices where it is feasible and compatible with drilling, completion and production.
- Engines would be equipped with mufflers and sound-proofing barriers would be installed to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the jurisdiction of the FFO NTL 03-1.

Reclamation

- All project activities would be confined to permitted areas only. All vehicle and pedestrian traffic associated with the Proposed Action would be restricted to proposed disturbance areas and existing roads.
- Prior to construction, the access road and pipeline ROWs would be staked at 100- to 200-foot intervals.
- Clearing, removal of topsoil, and grading would be limited to the permitted area and the minimum area required for safe and efficient construction.
- Trees larger than three inches in diameter would be cut at ground level and de-limbed. The wood may be donated to the local Navajo Nation Chapter houses for the elderly and needy. The operator would need to purchase a commercial wood permit to be able to donate the wood. Stumps would be cut as close to the ground as possible. Stumps and root balls would be hauled to an approved disposal site.
- Trees smaller than three inches in diameter, slash, and brush would be chipped, shredded, or mulched and would then be incorporated into the topsoil for later use in interim reclamation. Remaining brush would be brush-hogged or scalped at ground level prior to ground disturbance.
- Topsoil would be segregated and stockpiled at the edge of the workspace. Topsoil is defined as the top six inches of soil.
- Vehicle/equipment traffic would be prevented from crossing topsoil stockpiles.
- Cover from top of pipe to ground level would be a minimum of 36 inches through typical soil and rock and a minimum of 48 inches at drainage of road crossings. Inspection would be conducted to verify that minimum cover is provided, the trench bottom is free of rocks and debris, external pipe coating is not damaged, and the pipe is properly fitted and installed into the ditch.

- Rocks and limbs removed during clearing would be scattered across the workspace in a random arrangement using rubber-tired equipment.
- Energen would take appropriate measures to prevent topsoil loss, if a location becomes prone to wind or water erosion. Such measures may include using tackifiers, blankets, straw bales, straw wattles or water to wet the topsoil stockpile to create a crust across the exposed soil to prevent soil loss. Permanent erosion control measures would be installed after the workspace has been re-contoured.
- Energen would construct waterbars on all disturbed areas over slopes to the spacing and cross sections specified by the BLM-FFO Authorized Officer.
- Cut and fill slopes would be seeded with hydro-mulch excelsior netting and/or mulch with netting.
- Construction of the proposed access road would follow the engineer design. The existing roads would be upgraded as specified in the engineer design.
- Two 18-inch and two 24-inch culverts would be installed along the proposed access road. The existing culverts under the existing access road would be lengthened to accommodate the upgraded existing road.
- Any additional culverts would be installed, as needed. Culverts would be sized and installed in accordance with BLM Gold Book standards (USDI USDA 2007) and BLM 9113-1 (Roads Design Handbook) and BLM 9113-2 (Roads National Inventory and Condition Assessment Guidance and Instructions Handbook).
- Both the proposed and existing roads would be graveled with eight-inches of Type I Base course.
- Road maintenance would continue until final abandonment and reclamation of the well pad location.
- Dust emissions would be controlled on the roads and locations, as necessary, with the application of dust suppressants (e.g., magnesium chloride) and/or water.
- All disturbed areas, including areas that would be re-disturbed, would then be seeded with the BLM-FFO saltbush shadscale/winterfat community type mixture. Seeding would be accomplished within 90 days from completion of the second well.

Water Resources

- A closed-loop system would be used. Cuttings would be stored on-site in aboveground storage tanks and would be disposed at an approved waste disposal facility. The closed-loop system storage tanks would be sized to ensure confinement of all fluids and would provide sufficient freeboard to prevent uncontrolled releases.
- Drilling fluids would be stored on-site in aboveground storage tanks. Upon termination of drilling operations, the drilling fluids would be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical. Residual fluids would be disposed at an approved waste disposal facility.
- The water-based solution that flows back to the surface during and after completion operations would be placed in storage tanks on the location. Flowback water would be confined to a storage tank for a period not to exceed 90 days after initial production and would be disposed at an approved waste disposal facility.
- Compressor units on well locations not equipped with a drip pan for containment of fluids shall be lined with an impervious material at least 8 mils thick and a 12 inch berm. The compressor would be painted to match the well facilities. Any variance to this would be subject to approval by the Authorized Officer. When compressor units are washed, or any other equipment associated with the locations, the fluids (i.e., scrubber cleaners) would be properly disposed of to avoid ground contamination or hazard to livestock or wildlife.
- Existing and proposed access road culverts would be installed to maintain existing drainage patterns.

Control of Noxious Weeds

- A pre-disturbance noxious weed inventory would be conducted on all surface disturbing projects to determine the presence of noxious weeds prior to beginning the project, and to determine whether treatment is needed prior to disturbance. If noxious weeds are found, the following would be documented:
    - A GPS location recorded in North American Datum 1983,
    - Species,
    - Canopy cover or number of plants, and

    - Size of infestation (estimate of square feet or acres).
- Information would be provided to the FFO BLM Weed Coordinator prior to disturbance, and documented in the annual reclamation report.
- The following steps are required under the Farmington Field Office Bare Soil Reclamation Procedures:
    - During the onsite inspection, the Authorized Officer (AO) and operator's representative(s) would conduct a survey of the proposed well pad and well-tie pipelines to determine if noxious weeds are present. Noxious weeds are those species listed on the New Mexico Department of Agriculture's A and B List (2009) (Weed Fact Sheets are available at: http://weeds.nmsu.edu/). If there are no noxious weeds on the proposed pad or well-tie pipelines, the AO would indicate that on the standard onsite check list form. If noxious weeds are found, the AO would fill out the Onsite Noxious Weed form. The AO and the operator's representative would sign the form, and the AO would submit the completed form to the FFO BLM weed coordinator.
    - The BLM-FFO weed coordinator would review the form and analyze the noxious weed issues. The BLM-FFO weed coordinator would submit specific requirements and instructions for weed treatments to the operator within 30 days of the onsite. The requirements and instructions would include the time frame of treatment, approved herbicides that may be used, required documentation to be submitted to the BLM-FFO after treatment, and any other site specific instructions that may be applicable. Due to the seasonal nature of effective weed treatment techniques, the operator may be required to treat before ground disturbance, or may be required to treat the area after ground disturbance to avoid unreasonable delays to the operator's drilling program.
    - Control and management of noxious weeds and invasive species infestations would use the principles of integrated weed management including chemical, mechanical, and biological control methods. An approved Pesticide Use Proposal is required for all planned herbicide applications. Herbicides would be applied by a certified applicator. A Biological Use Proposal is required for new biocontrol agents in the Farmington Field Office Administrative Area.
- It would be the operator's responsibility to monitor, control, and eradicate all invasive, non-native plant species within the permitted area throughout the life of the proposed project. The operator would contact the BLM-FFO regarding acceptable weed-control methods. If the operator does not hold a current Pesticide Use Proposal, a Pesticide Use Proposal would be submitted prior to pesticide application. Only pesticides authorized for use on BLM lands would be used. The use of pesticides would comply with federal and state laws. Pesticides would be used only in accordance with their registered use and limitations. The operator would contact the BLM-FFO prior to using these chemicals.

Plants/Wildlife

- Survey results located the presence of sensitive habitats for Brack's hardwall cactus and Aztec gilia in the project vicinity.
- All Brack's hardwall cacti impacted by the proposed Chaco 23-08 3 Wells Project would be transplanted under the direction of the BLM-FFO, using the most current transplant protocols (BLM 2013c). Transplant details are specific in the Biological Survey Report for the proposed project.
- Open pits would be netted and vent caps placed on all open pipes to prevent bird entry and nesting.
- A migratory bird nest survey would be conducted if any vegetation-disturbing activities occur from May 15th through July 31st. The survey must be conducted by a BLM-FFO approved biologist using a survey protocol developed and provided by the BLM-FFO. If active nests are located within the proposed permitted area, project activities would not be permitted without written approval by a BLM-FFO Biologist.
- Any spills of non-freshwater fluids would be immediately cleaned up and removed to an approved disposal site.
- Should any active raptor nests be observed within one-third mile of the proposed project area or should any previously un-recorded Special Status Species be observed within the proposed project area prior to or during construction, construction would cease and the BLM-FFO would be immediately contacted. The BLM-FFO would then evaluate of the resource. Should a discovery be evaluated as significant (protected under the Endangered Species Act (ESA) or any other wildlife

protection law or policy.), the resource would be protected in place until mitigation could be developed and implemented according to guidelines set by the BLM-FFO.

- Wildlife hazards associated with the project would be fenced, covered, and/or contained in storage tanks, as necessary.

Cultural Resources

- All BLM-FFO cultural resources stipulations would be followed as indicated in the Cultural Resource Records of Review, attached to the APD COAs and ROW grant stipulations. These requirements may include, but are not limited to temporary or permanent fencing or other physical barriers, monitoring of earth-disturbing construction, reduction and/or specific construction avoidance zones, and employee education. All employees, contractors, and sub-contractors working on the project would be informed by the project proponent that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment. All employees, contractors, and sub-contractors working on the project would also be informed that it is illegal to collect, damage, or disturb cultural resources and that such activities are punishable by criminal and/or administrative penalties under the provisions of the Archaeological Resources Protection Act. In the event of a discovery during construction, the project proponent would immediately stop all construction activities in the immediate vicinity of the discovery and then immediately notify the archaeological monitor, if present, or the BLM-FFO. The BLM-FFO would then evaluate or cause the site to be evaluated. If a discovery is determined to be significant, it would be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM-FFO.
- A temporary barrier fence would be erected along the northern edge of the Chaco 23-08 3 #1H Pipeline ROW. The fence would begin at the western edge of the existing well pad access road perpendicular to approximately engineering station (ES) 62+70 and extend to the west, southwest to a point perpendicular to approximately ES 61+50. All construction would stay on the southern side of the barrier fence. An archaeological monitor would be present for the initial phases of the pipeline right-of-way blading and trenching, and during access road improvement activities within 100 feet of the cultural site. The existing well pad access road extends further, along the eastern margin of the cultural site. Energen is not proposing to utilize this portion of the existing access road. If Energen should decide to utilize this portion of the access road, the protective barrier fencing would be extended north along the western edge of the road to the southwestern corner of the existing well pad. If cultural material is discovered, construction would be temporarily halted and the BLM FFO Archaeologist immediately contacted.
- A temporary barrier fence would be erected along the southern and eastern edges of the existing road between ES 46+00 to ES 53+00 of the Chaco 23-08 3 #1H pipeline. All construction would stay on the west and north sides of the barrier fence. An archaeological monitor would be present for the initial phases of the pipeline right-of-way blading and trenching, and during access road improvement activities within 100 feet of the cultural site. If cultural material is discovered, construction would be temporarily halted and the BLM FFO Archaeologist immediately contacted.
- A temporary barrier fence would be erected along the eastern and southern ends of the Chaco 23-08 3 Wells Project power line. All construction and vehicle traffic would remain on the western and northern side of the protective barrier fence. An archaeological monitor would be present for monitoring hand-carried cable, and construction of one pole and two anchor locations. If cultural material is discovered, construction would be temporarily halted and the BLM-FFO.

Paleontological Resources

- A paleontological survey of the proposed project area was completed and no monitoring was recommended (Burris and Heil 2014).
- During excavation or disturbance, vertebrate fossils may be uncovered, at which point excavation or disturbance in a 50 foot radius of the discovery should halt until the BLM-permitted paleontologist can examine the specimen to determine the appropriate next steps. The operator may then be allowed to continue excavation through the site, or would be given the choice of either:
    - (1) following the BLM-permitted paleontologist's instructions for stabilizing the fossil resource in place and avoiding further disturbance to the fossil resource, or
    - (2) following the BLM-permitted paleontologist's instructions for mitigating impacts to the fossil resource prior to continuing construction through the project area, which may include

halting excavation in the vicinity until the specimen can be safely collected by a BLM-permitted paleontologist.

Workers would be informed that it is illegal to collect, damage, or disturb some such resources, and that such activities are punishable by criminal and/or administrative penalties.

Grazing Permittees

- Grazing permittees would be notified when construction is scheduled to begin.
- If livestock are present, providing monitors or barriers to ensure livestock do not come into contact with hazards (i.e., fencing of exposed ditch-type holes and covering smaller holes is required during each active bore hole construction during periods when personnel are not present on the site).
- Crossings and escape ramps would be installed every 100 feet during pipeline construction.
- All hazards to livestock would be fenced or contained.
- Containment of any contaminants, fluid leaks, or hazards that could cause injury to livestock (i.e. antifreeze for compressors, drilling pits, equipment, pump jacks).
- Safety meetings or briefs to employees to increase awareness about livestock (i.e. open range and driving speeds to avoid livestock collisions).

All existing improvements (such as fences, gates, and bar ditches) would be repaired to previous or better than pre-construction conditions.

Public Health and Safety

- Production equipment would be placed on location in such a manner to minimize long term disturbance and maximize interim reclamation. As practical, access would be provided by a tear-drop shaped road through the production area so that the center may be re-vegetated.
- A berm would be constructed completely around any production facilities that contain fluids (i.e., production tanks, produced water tanks, etc.). These berms would be constructed of compacted subsoil, corrugated metal or equivalent that is impervious, and would hold 110 percent of the capacity of the largest tank.
- Production facilities would be painted Juniper Green, with the exception of equipment subject to safety requirements, to blend with the natural color of the landscape and would be located, to the extent practical, to reasonably minimize visual impact.
- Engines would be equipped with mufflers and barriers or other sound-proofing measures would be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the jurisdiction of the FFO NTL 03-1 FFO. Roads would be maintained in better condition as what existed prior to the commencement of operations,
- No chemicals subject to reporting under the Superfund Amendments and Reauthorization Act as amended (SARA) in an amount equal to or greater than 10,000 pounds would be used, produced, stored, transported, or disposed of annually in association with the drilling, testing, or completing of either well.
- No extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, would be used, produced, stored, transported, or disposed of in association with the drilling, testing, or completing of this well.
- Self-contained, chemical toilets would be provided for human waste disposal. The toilet holding tanks would be pumped, as needed, and the contents thereof disposed of in an approved sewage disposal facility. Toilets would be on-site during all operations.
- Garbage, trash, and other waste materials would be collected in a portable, self-contained, and fully-enclosed trash container during drilling and completion operations. Accumulated trash would be removed, as needed, and disposed of at an authorized sanitary landfill. No trash would be buried or burned on location.
- Immediately after removal of the drilling rig, all debris and other waste materials not contained in the trash container would be cleaned up and removed from the well location.
- All structures, facilities, improvements, and equipment would be maintained in a safe and orderly manner. All appropriate and reasonable measures to protect the public, wildlife and livestock from hazardous sites, equipment, materials or conditions resulting from project operations would be taken.
- Where pipeline construction parallels or crosses public roads, warning signs would be placed to alert motorists of construction. Safety measures would also be implemented along the construction

workspace by either using the topsoil or subsoil piles or strung pipe as a barrier. Trenches left open at road crossings would be fenced with orange safety fence and barricades would be installed, if needed.

- The amount of open trench would be minimized ahead of pipe laying and backfilling. No more than ½-mile of trench or the amount of trench that can be worked in a day would be open at any given time. Backfilling operations would be performed within a reasonable amount of time of the lowering operation to ensure the trench is not left open for more than 24 hours. Trenches left open overnight would be fenced with a temporary fence or other methods approved by the Authorized Officer. The ends of the trench would be sloped (3:1) to allow animals to escape.
- Escape ramps/crossovers would be constructed every 1,320 feet. In areas where active grazing is taking place escape ramps/crossovers would be placed every 500 feet. The ends of the open trench would be sloped each night with a 3:1 slope. Established livestock and wildlife trails would be left in place as crossovers. Escape ramps/crossovers would be constructed with a minimum 3:1 slope at each end of the crossover. Crossovers would be a minimum of 10 feet wide and not fenced.
- The end of the pipe would be plugged to prevent animals from crawling in. Before the trench is closed, it would be inspected for animals. Any trapped wildlife or livestock would be promptly removed and released at least 150 yards from the trench.

Other Regulatory Requirements

- Appropriate agencies would be contacted early in the planning process to identify potentially sensitive ecological resources, especially potentially threatened, endangered, and sensitive species and designated critical habitat that might be present in the area. Prior to any clearing or construction in or near the project area, a seasonally appropriate walkthrough would be conducted. Attendees at the walkthrough should include appropriate federal and state representatives.

2.3. Alternative C: Alternative Analyzed in Detail

Alternative C is the same as the proposed action except Alternative C would implement onsite generators instead of the overhead power line, a shorter well tie pipeline for the Chaco 23-8 3 #1H, and both well tie pipelines would be constructed by San Juan Basin Gathering, not Williams Four Corners, LLC. Alternative C would include the approval of two APDs, one for each well, and two ROW grant applications, one for each well-tie pipeline. All other components of Alternative C, such as construction, drilling and completion, production, and reclamation, would be the same as outlined in the Proposed Action description.

2.3.1. *Location of Alternative C*

The general location of the proposed project under Alternative C is detailed in Table 2-4.

Table 2-4. Alternative C Location; San Juan County, New Mexico, NMPM

Project Component	Surface Legal Descriptions[1]	Bottom Hole Location
Chaco 23-08 3 #1H Well	1994 feet from the north line (FNL) & 187 feet from the east line (FEL), Section 3, Township 23 North (T. 23N.), Range 08 West (R. 08W.)	380 FNL & 380 FWL Section 3, T. 23N., R. 08W.
Chaco 23-08 3 #2H Well	2119 FNL & 213 FEL Section 3 T. 23N., R. 08W.	2260 FNL & 380 FWL Section 3, T. 23N., R. 08W.
Chaco 23-08 3 #1H and #2H Well Pad	SE¼NE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H and #2H Access Road	SE¼NE¼, NE¼SE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H and #2H Access Road TUA	NE¼SE¼ Section 3 T. 23N., R. 08W.	N/A
Chaco 23-08 3 #1H Well-Tie Pipeline	SE¼NE¼, Section 3 T. 23N., R. 08W.	N/A

Project Component	Surface Legal Descriptions[1]	Bottom Hole Location
Chaco 23-08 3 #2H Well-Tie Pipeline	SE¼NE¼ Section 3 T. 23N., R. 08W.	N/A
[1] SW¼=southwest quarter, NW¼=Northwest quarter, NE¼=northeast quarter; SE¼=southeast quarter, N½=North half. S½=South half. E½=East half.		

2.3.2. *Description of Alternative C*

Alternative C is the same as the Proposed Action (Alternative B) described in **SECTION 2.2** except;

- The Chaco 23-8 3 #1H well-tie pipeline would connect to San Juan Basin Gathering's Sarah B Pipeline instead of the Williams Four Corners, LLC pipeline. The connecting pipeline ROW under Alternative C would be approximately 315.81 feet in length and 40 feet in width. Fifteen feet of the 315.81-foot pipeline ROW width would overlap the proposed access road and 25 feet of the width would be new disturbance. No TUAs would be required. This pipeline would be about 10,770.67 feet shorter than the Proposed Action pipeline.

- Two generators would be used as the energy source for the proposed wells in lieu of a power line.

The overall footprint for Alternative C surface disturbances associated with the project components would be approximately 7.85 acres, approximately 0.07 acres of which would overlap existing disturbances associated with an existing access road and a pipeline corridors (see Table 2-5).

Table 2-5 Summary of Proposed Disturbances for the Proposed Project under Alternative C

Chaco 23-08 3 Wells Project Components	New Disturbance Area (acres)	Previously Disturbance Area (acres)
Well Pad	5.82	0.00
Chaco 23-08 3 #1H Well-Tie Pipeline ROW	0.29	0.00
Chaco 23-08 3 #2H Well-Tie Pipeline ROW	0.00	0.00[1]
Chaco 23-08 3 Access Road	1.48	0.05
Chaco 23-08 3 Access Road TUA	0.19	0.02
Total Disturbance	7.78	0.07
[1]All disturbance created from this component occurs completely within the well pad. Therefore, the disturbance from this component is already accounted for in the well pad disturbance calculation.		

2.3.3. *Long and Short Term Disturbances*

Table 2-6 below lists the planned short and long term disturbances for the proposed project under Alternative C.

Table 2-6. Short- and Long term Disturbance for the Proposed Project under Alternative C

Surface Land Status	Proposed Disturbance (New and Previous Disturbances - acres)	Short Term Disturbance (acres)	Long Term Disturbance (acres)
Bureau of Land Management	7.85	5.32	2.53

2.3.4. *Design Features and Best Management Practices*

All areas of proposed surface disturbance were located to ensure that potential impacts to natural resources would be minimized through the implementation of design features and best management practices. The proposed project under Alternative C was planned to the extent reasonable and feasible to utilize existing disturbances. Alternative C would have all of the design features and best management practices as those listed under the Proposed Action **SECTION 2.2.11**, except the following:

Air Resources

- Two internal combustion generator units would be required.

Grazing Permittees

- The proposed Chaco 23-08 3 #1H well-tie pipeline under Alternative C would be less than ½ mile in length; therefore, it would not require compliance with the minimum open trench stipulation.
- The proposed Chaco 23-08 3 #1H well-tie pipeline under Alternative C would be less than 500 feet; therefore not require escape ramps/crossovers.

2.4. Comparison of Alternative B (Proposed Action) and Alternative C

The Proposed Action (Alternative B) and Alternative C would result in the same long term surface disturbances (approximately 2.53 acres). New disturbances in the Proposed Action (Alternative B – 17.16 acres) would be greater than those contemplated in Alternative C (7.78 acres) by 9.38 acres. The total disturbance of the Proposed Action (Alternative B) would be greater than Alternative C by 15.02 acres. Table 2-7 compares the disturbance acreages of the Proposed Action (Alternative B) with disturbance acreages under Alternative C.

Table 2-7 Comparison of Proposed Disturbances between Alternative B (Proposed Action) and Alternative C

Chaco 23-08 3 Wells Project Components	Alternative B Disturbance		Alternative C Disturbance	
	Acres New	Acres Existing	Acres New	Acres Existing
Well Pad	5.82	0.00	5.82	0.00
Chaco 23-08 3 #1H Well-Tie Pipeline ROW	5.14	4.48	0.29	0.00
Chaco 23-08 3 #2H Well-Tie Pipeline ROW	0.00	0.00[1]	0.00	0.00[1]
Chaco 23-08 3 Access Road	1.48	0.05	1.48	0.05
Chaco 23-08 3 Access Road TUA	0.19	0.02	0.19	0.02
Chaco 23-08 3 Power Line ROW	1.85[2]	0.49[2]		
Chaco 23-08 3 Power Line TUA	2.68[2]	0.67[2]		
Subtotal	**17.16**	**5.71**	**7.78**	**0.07**
Total New and Existing	**22.87**		**7.85**	

[1]Disturbance from this component is already accounted for in the well pad disturbance calculation.
[2] Actual surface disturbance expected to be lower because of span lengths between poles.

2.5. Alternatives Considered but Eliminated from Detailed Study

An alternative access route was considered. The access would be over an existing roadway within the NW¼ of Section 2, Township 23 North, Range 08 West, NMPM. However, this road is extremely eroded and entrenched. Construction of an entire new roadway on higher topography to the northeast of the existing road would be required. Additionally, surface resources within the SW¼NW¼ of Section 2, T. 23N., R. 08W., NMPM would preclude new road construction in this area.

No alternate well pad placement would result in less surface disturbance and still permit the targeted mineral development. Therefore, no other alternatives for the well pad were analyzed in this environmental assessment.

Originally the Chaco 23-08 3 #1H well-tie pipeline was located adjacent to two proposed pipelines as well as an existing pipeline. One of the proposed pipelines was withdrawn by the proponent from the BLM. Therefore, the proposed Chaco 23-08 3 #1H well-tie pipeline was staked closer to the remaining proposed pipeline (Sarah B Pipeline). The new staked pipeline is now that represented by the Proposed Action (Alternative B).

An alternate power line route was assessed that would make a direct route from its origin to the proposed well pad. It would result in less pole structures but would span undisturbed land between the existing access road meanders. Following the BLM-FFO direction given at the December 11, 2014 onsite, the power line was realigned to follow the existing access road meanders. The new staked route is that represented by the Proposed Action (Alternative B).

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the environment that would be affected by implementation of the alternatives described in Chapter 2. Aspects of the affected environment described in this section focus on the relevant major resources and issues.

The No Action Alternative reflects the current situation within the project area and would serve as the baseline for comparing the environmental impacts of the analyzed alternatives. Under the No Action Alternative, the Proposed Action would not be implemented. The No Action Alternative would result in the continuation of the current land and resource uses in the area. This alternative will not be evaluated further in this EA.

Field resource investigations of the Proposed Action areas were conducted on October 28 and 29, November 6, 8 and 20, and again on January 9 2015 by Tegre Corporation biologists. Cultural resource surveys were conducted by Division of Conservation Archaeology (DCA) and Dykeman Roebuck Archaeology LLC on various dates between September 2014 and January 2015.

3.1. Methodology

3.1.1. *Direct and Indirect Impacts*

Direct and indirect impacts are described as direct, indirect, short-term and long-term. Direct impacts include those occurring during the implementation of the action. Indirect impacts are caused by the action but occur later in time or farther removed in distance. Short-term impacts include those occurring during construction and drilling activities or those that are mitigated (i.e., reclamation of disturbed areas) within five years following construction. Long-term impacts include those that exist throughout or beyond the life of the project, through abandonment and reclamation.

3.1.2. *Cumulative Impacts*

A Reasonably Foreseeable Development scenario (RFD) was prepared for the FFO in October 2014 (Engler, et al., 2014). The RFD identified high, moderate, and low potential regions for oil development of the Mancos-Gallup Formation. Within the high potential region, full development would include 5 wells per section, resulting in 1,600 completions. Within the moderate potential region, full development would include one well per section, resulting in 330 completions. Within the low potential region, full development would include one well per township, resulting in 30 well completions. Additionally, the RFD predicted 2,000 gas wells could be development in the northeastern corner of the FFO.

The following methods and assumptions were used to predict the potential impact of the development predicted in the RFD.

Past Oil and Gas Development

Past oil and gas wells were identified using Ongard. Following interim reclamation, the average total disturbance for past development is 2.48 acres per wellpad. The average long term disturbance is 0.75 acres per wellpad. The average reclaimed disturbance is 1.73 acres per wellpad.

Present and Future Oil Development

Based on previous development, it was assumed that development of the high potential region would involve the twinning of wellpads. This is the placement of two or more wells on one wellpad. The assumption for the analysis is that the development of a section would include two twinned wellpads and one single wellpad, resulting in three wellpads for five wells. In the moderate and low potential regions, it was assumed that development would involve single wellpads. The proposed action is located in the high potential region.

The average wellpad size for a twinned wellpad was assumed to be 500 feet by 530 feet, or 6.08 acres. An additional 0.6 acres was added to account for any associated road or pipeline development, resulting 6.68 acres of short-term disturbance. Following completion of the well, interim reclamation of the wellpad and reclamation of any pipelines would occur, resulting in 1.50 acres of long-term disturbance.

The average wellpad size for a single wellpad was assumed to be 500 feet by 500 feet, or 5.74 acres. Again, an additional 0.6 acres was added to account for associated road or pipeline development, resulting in 6.34 acres of long-term disturbance. Following completion of the well, interim reclamation of the wellpad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The Random Point Tool in ArcMap was used to randomly assign points representing wellpads and associated disturbance based on the RFD assumptions: five wells per section in the high potential region, one well per section in the moderate potential region, and one well per township in the low potential region. The allowed both long-term and short-term disturbance from oil development of the Mancos-Gallup Formation to be calculated for the analysis areas used in this EA.

3.2. Air Resources

3.2.1. *Affected Environment*

The proposed well is located in San Juan County, New Mexico. Additional general information on air quality in the area is contained in Chapter 3 of the Farmington PRMP/FEIS (USDI 2003a). In addition, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions have emerged since this document was prepared. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO_2) methane (CH_4); nitrous oxide (N_2O); water vapor; and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase measurably, and may contribute to overall climatic changes, typically referred to as global warming.

Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report; (USDI BLM 2014). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

The Environmental Protection Agency (USEPA) has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants (criteria pollutants). These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). The USEPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. USEPA has approved New Mexico's State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology and terrain, and also includes applications of noise, smoke management, and visibility. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. USEPA has proposed or completed actions recently to implement Clean Air Act requirements for greenhouse gas emissions. Climate has the potential to influence renewable and non-renewable resource management.

Air Quality

Criteria Air Pollutants

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and state standards. The USEPA's Green Book web page (USEPA 2013) reports that all counties in the Farmington Field Office area are in attainment of all National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act. The area is also in attainment of all state air quality standards (NMAAQS*).* The current status of criteria pollutant levels in the Farmington Field Office are described below.

"Design Values" are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design values for criteria pollutants are listed below in Table 3-1. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM_{10} design concentrations are not available for San Juan County.

Table 3-1. 2012 Criteria Pollutant Monitored Design Values in San Juan County, New Mexico

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O_3	0.071 ppm	8-hour	0.075 ppm[1]	
NO_2	13 ppb	Annual	53 ppb[2]	50 ppb
NO_2	38 ppb	1-hour	100 ppb[3]	
$PM_{2.5}$	4.7 µg/m^3	Annual	12 µg/m^3[3,4]	60 µg/m^3[3,6]
$PM_{2.5}$	14 µg/m^3	24 hour	35 µg/m^3[3,3]	150 µg/m^3[3,6]
SO_2	19 ppb	1-hour	75 ppb[5]	

Source: U.S. Environmental Protection Agency, 2014
[1] Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
[2] Not to be exceeded during the year
[3] 98th percentile, averaged over 3 years
[4] Annual mean, averaged over 3 years
[5] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
[6] The NMAAQS is for Total Suspended Particulate (TSP)

In 2005, the USEPA estimates that there was less than 0.01 ton per square mile of lead emitted in the New Mexico counties under BLM-FFO administration, which is less than 2 tons total (USEPA 2012). Lead emissions are not an issue in this area, and will not be discussed further.

Air quality in a given region can be measured by its Air Quality Index value. The air quality index (AQI) is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Mean AQI values for San Juan County were generally in the good range (AQI<50) in 2013 with 80% of the days in that range. The median AQI in 2013 was 42, which indicates "good" air quality. The maximum AQI in 2013 was 156, which is "unhealthy".

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade, there are no patterns or trends to the occurrences (Table 3-2). On 8 days in the past decade, air quality has reached the level of "unhealthy" and on two days, air quality reached the level of "very unhealthy". In 2009 and 2012, there were no days that were "unhealthy for sensitive groups" or worse in air quality. In 2005 and 2013, there was one day that was "unhealthy" during each year. In 2010, there were five "unhealthy" days and two "very unhealthy days."

Table 3-2. Number of Days classified as "unhealthy for sensitive groups" (AQI 101-150) or worse

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Days	3	6	9	18	1	0	12	9	0	1
Source: U.S. Environmental Protection Agency, 2013a										

Hazardous Air Pollutants

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (USDI BLM 2014). The USEPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (USEPA 2012).

Climate

The analysis area is located in a semiarid climate regime typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the range of 80 or 90 degrees Fahrenheit (°F), and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100°F in June and July and have dipped below zero in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico. Table 3-3 shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico, area.

Table 3-3. Climate Normals for the Farmington Area, 1981-2010

Month	Average Temperature (^{O}F [(1)])	Average Maximum Temperature (^{O}F)	Average Minimum Temperature (^{O}F)	Average Precipitation (inches)
January	30.5	40.8	20.3	0.53
February	35.8	46.8	24.8	0.59
March	43.2	56.1	30.3	0.78
April	50.4	64.7	36.2	0.65
May	60.4	74.8	46.1	0.54
June	69.8	85.1	54.5	0.21
July	75.4	89.6	61.2	0.90
August	73.2	86.5	59.8	1.26
September	65.4	79.1	51.7	1.04
October	53.3	66.4	40.1	0.91
November	40.5	52.2	28.8	0.68
December	31.0	41.2	20.7	0.50

Source: data collected at New Mexico State Agricultural Science Center – Farmington
[(1)] degrees Fahrenheit

Very recently, pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort, Frankenberg, Costigan, Lindenmaier, Dubey, & Wunch, 2014). A subsequent study (Schneising, Burrows, Dickerson, Buchwitz, Reuter, & Bovensmann, 2014) indicated larger anomalies over other oil and gas basins in the U.S. Methane is 34 times more potent at trapping greenhouse gas emissions than CO_2 when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change, 2013). While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that

a significant amount of methane is emitted during oil and gas well completion (Howarth, Santoro, & A.Ingraffea, 2011). Methane is also emitted from process equipment, such as pneumatic controllers and liquids unloading, at oil and gas production sites. Ground-based, direct source monitoring of pneumatic controllers conducted by the Center for Energy and Environmental Resources (Allen, et al., 2014) show that methane emissions from controllers exhibit a wide range of emissions and a small subset of pneumatic controllers emitted more methane than most. Emissions measured in the study varied significantly by region of the U.S., the application of the controller and whether the controller was continuous or intermittently venting. The Center for Energy and Environmental Resources had similar findings of variability of methane emissions from liquid unloading (Allen, et al., 2014a)

In October 2012, the USEPA promulgated air quality regulations controlling VOC emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds. These same mitigation measures have a co-benefit of reducing methane emissions. Future ground-based and space-borne studies planned in the Four Corners region with emerging pollutant measurement technology may help to pinpoint significant, specific sources of methane emissions in the region.

The BLM Air Resources Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

3.2.2. *Impacts from the Proposed Action (Alternative B)*

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Report. This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal oil well. The calculators give an approximation of criteria pollutant, HAP, and greenhouse gas (GHG) emissions to be compared to regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (USDI BLM 2014).

Direct and Indirect Impacts

Criteria Pollutants

Table 3-4 shows estimated emissions from ***one*** proposed horizontal oil well for criteria pollutants, volatile organic compounds (VOC) and greenhouse gas (GHG). The Proposed Action would result in the completion of ***two*** horizontal wells. For comparison, Table 3-5 shows total human-caused emissions for each of the counties in the BLM-FFO administrative area and La Plata County, Colorado, based on USEPA's 2011 emissions inventory (USEPA 2014).

Table 3-4. Criteria Pollutant and VOC Emissions Estimated for Construction and Production of One Horizontal Oil Well; Average 25 Days to Drill and Complete

Activity	Nox	CO	VOC	PM10	PM2.5	SO2	CH4	CO2
One time operations (tons)								
Construction	5.5	1.5	0.5	2.5	0.25	0.1	0.007	598.85
Completion	0.5	0.1	0.03	0.025	0.025	-	-	55.00
Interim Reclamation	0.006	0.006	0.006	0.001	-	0.003	-	1.24
Final Reclamation	0.006	0.006	0.006	0.001	-	0.004	-	1.66
Ancillary Operations (tons)								
Workover	0.129	0.04	0.01	0.01	0.01	-	-	10.59
Road Maintenance	-	-	-	-	-	-	-	0.26

Activity	Nox	CO	VOC	PM10	PM2.5	SO2	CH4	CO2
Road Traffic	-	-	-	-	-	-	-	0.06
Annual operations (tons/yr)								
Oil Haul Truck and Small Truck (100 bbl/day)	0.009	0.006	0.0012	0.0009	0.0008	-	0.0001	3.88
Total	**6.13**	**1.64**	**0.55**	**2.54**	**0.29**	**0.11**	**0.01**	**671.54**

Oil storage tanks on the well location may result in venting of VOC. Oil well production is generally presented as barrels per day produced. The emissions calculator estimated that for every barrel per day produced there may be 0.12 tons of VOC vented per year.

The average horizontal oil well in the planning area produces approximately 100 barrels per day. One hundred barrels per day is estimated to result in 12 tons of VOC emissions per year. Oil storage tanks would be subject to current EPA regulations regarding the capture or flaring of VOC emissions.

Table 3-5. Analysis Area Emissions in Tons/Year, 2011

County	NO_X (1)	CO (2)	VOC (3)	PM_{10} (4)	$PM_{2.5}$ (5)	SO_2 (6)
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
La Plata	4,838.2	17,116.3	3,740.1	2,330.0	919.6	127.9
Total	**75,187.7**	**144,551.5**	**57,265.1**	**222,168.9**	**26,407.2**	**7,237.9**

(1) NO_X – nitrogen oxides
(2) CO – carbon monoxide
(3) VOC – volatile organic compounds
(4) PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
(5) $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
(6) SO_2 – sulfur dioxide

Table 3-6 displays the percent increase in total emissions in the analysis area. Additionally, current USEPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over six tons of VOC emissions per year.

Table 3-6. Percent Emissions Increase in Analysis Area

	NO_X(1)	CO(2)	VOC(3)	PM_{10}(4,5)	$PM_{2.5}$(5,6)	SO_2(5,7)
Total Emissions	75,187.7	144,551.5	57,265.1	222,168.9	26,407.2	7,237.9
Conventional Oil Well Emissions	6.13	1.64	12.55(8)	2.54	0.29	0.11
Percent Increase	**0.008**	**0.001**	**0.02**	**0.001**	**0.001**	**0.002**

(1) NO_X – nitrogen oxides
(2) CO – carbon monoxide
(3) VOC – volatile organic compounds
(4) PM_{10} – particulate matter with an aerodynamic diameter equal to or less than 10 microns
(5) Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.
(6) $PM_{2.5}$ – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns
(7) SO_2 – sulfur dioxide
(8) Current USEPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over six tons of VOC emissions per year

Hazardous Air Pollutants

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs would be equivalent to 10 percent of VOC emissions. Therefore, the estimated HAP emissions of 1.25 tons/year should be considered a very gross estimate. Most of the VOC emissions estimated for one horizontal oil well result from venting from oil storage tanks. Current USEPA regulations require operators to reduce VOC emissions by 95% if their oil storage tanks emit over 6 tons of VOC emissions per year. A reduction of 95% of oil storage tank VOC emissions would reduce the estimated HAP emissions to 0.12 tons/year.

Total Greenhouse Gases

The available statewide GHG summary combines GHG emissions from CO_2 and CH_4. To compare the GHG emissions from the Proposed Action estimated by the calculator with statewide GHG emissions, CO2e emissions for both CH_4 and CO_2 were summed. The total statewide GHG emission estimate for 2007 was 76,200,000 metric tons CO2e (76.2 million metric tons; (New Mexico Environment Department, 2010). The estimated CO2e metric tons emissions from one horizontal oil well (609.2 metric tons) would represent a 0.0008 percent increase in New Mexico CO_2 emissions. The estimated CO2e metric tons emissions from two horizontal oil wells (1,218.4 metric tons) would represent a 0.0016 percent increase in New Mexico CO_2 emissions

Cumulative Impacts

The BLM-FFO manages federal hydrocarbon resources in San Juan, Sandoval, Rio Arriba, and McKinley counties. There are approximately 21,150 active oil and gas wells in the San Juan Basin. About 14,843 of the wells in these counties are federal wells. Analysis of cumulative impacts for reasonable development scenarios and the 2003 Reasonable Foreseeable Development Scenario (RFDS) of oil and gas wells on public lands in the BLM-FFO were presented in the 2003 RMP (USDI BLM 2003a and USDI BLM 2003b). This included modeling of impacts on air quality. A more detailed discussion of Cumulative Effects can be found in the Air Resources Technical Report (USDI BLM 2014).

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries, and vehicle travel. The Air Quality Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present, and reasonably foreseeable impacts to air resources (USDI BLM 2014). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and GHGs as a result of implementing the Proposed Action (Alternative B). The very small increase in emissions that could result would not be expected to result in exceeding the NAAQS for any criteria pollutants in the analysis area.

The very small increase in GHG emissions that could result from implementing the Proposed Action (Alternative B) would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the action alternatives cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the action alternatives on global or regional climate.

The Air Resources Technical Report (USDI BLM 2014) discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

3.2.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Under Alternative C, when compared to the Proposed Action, the addition of two natural-gas fired generators would increase the estimated Nox by about 0.27 tons per year (tpy), the estimated CO by about 0.71 tpy and the estimated VOC by about 0.06 tpy. Additionally, natural gas would be required as fuel for the generators and consume approximately 11.8 million cubic feet of produced gas per year. Impacts to air quality would be slightly increased at a localized scale under Alternative C, as compared with Alternative B.

All other direct and indirect impacts to air resources would be similar to those described under Alternative B (Proposed Action) in **SECTION 3.2.2**.

Cumulative Impacts

Cumulative impacts to air resources under Alternative C as calculated would not differ from Alternative B for the analysis areas. Specifics of the cumulative impacts to air resources under Alternative C are detailed in **SECTION 3.2.2**.

3.3. Soils

3.3.1. *Affected Environment*

Surface geology in the proposed project area is underlain by the Paleocene Nacimiento Formation (New Mexico Bureau of Geology and Mineral Resources 2003). The bedrock is often covered with a thick soil layer with no visible Nacimiento Formation outcrops occurring at the surface. The Nacimiento Formation is exposed in badlands topography and along escarpments. Most of the outcrops consist of mudrock, though some quartz sandstone layers exist. The mudrock varies in grain size from clay to silt and laminations are not visible in the outcrops. The mudrock ranges in color, including white, gray, green and black. Some gypsum crystals are found on the surface of the shale layers as well as iron-rich sandstone concretions and coarse-grained, friable, iron-cemented laterally discontinuous quartz sandstone beds. Gravel lag deposits rich in chert are also common (Burris 2014).

Two mapped soil types occur across the proposed project area. The Badland Map Unit and Blancot-Notal Association, gently sloping (USDI NRCS 2015).

The Blancot-Notal Association is on fans and in valleys. It is 55 percent Blancot loam, 0 to 5 percent slopes, and 25 percent Notal silty clay loam, 0 to 2 percent slopes. Blancot loam is on fans and in upland valleys, and Notal silty clay loam is on fans and valley bottoms. Both soils are generally deep and well drained and formed in alluvium from shale and sandstone. Vegetative cover of these soils is greater than that of the Badland type, and are primarily used for livestock grazing, windbreaks, and wildlife habitat.

The Badland soil type consists of nonstony barren shale uplands that are dissected by deep intermittent drainages and gullies, and is located on slopes ranging from 5 to 80 percent. The badland soils do not support vegetation in significant quantities, but can be utilized by wildlife. BLM-FFO reviewed Natural Resource Conservation Service (NRCS) soil surveys and has identified the Badland soil unit as potentially fragile.

Fragile soils exhibit physical characteristics and features that affect soil behavior. Characteristics consist of Erosion Factors (Kw's) that indicate the susceptibility and erodibility of a soil to sheet and rill erosion by water. The Kw estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Features consist of slope length, gradient and runoff potential based on the rate of water infiltration when the soils are not protected by vegetation.

Biological soil crusts were observed throughout the proposed project area (0 to 5 percent cover).

3.3.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

The Proposed Action (Alternative B) would result in direct impacts to approximately 22.87 acres of area soils—11.78 acres in the Blancot-Notal Association and 11.09 acres in the Badland soil. The proposed action overlaps approximately 5.71 acres of previously disturbed soils. The remaining 17.16 acres would be considered as new disturbance. Direct impacts to soils on these areas include redistribution, loss, compaction, and mixing of soils affected by construction activities. All but 2.53 acres would be reclaimed in accordance with the Chaco 23-08 3 Wells Project Reclamation Plan and the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013a).

All vehicle and pedestrian traffic would be restricted to disturbed areas and existing roads during construction and drilling activities. For the operational life of the well, activities at the well site would be restricted to the new access road surface (1.53 acres) and about 1.00 acre of the well pad. These areas of the well pad and access would remain as bare (not subject to interim reclamation) soil during the production phase of the project. This area would be subject to erosion until the well pad is reclaimed when both wells are plugged and abandoned. The driving surface of the proposed and existing access roads would be graveled, reducing erosion and sedimentation from the road driving surface.

There would be greater potential for soil erosion during the short term. Susceptibility to erosion would be the highest during construction and drilling activities. During this time, strong winds and/or precipitation events would mobilize soils. The potential for erosion would be reduced once the well pad is reclaimed and revegetated. Soils adjacent to the project area would be indirectly impacted from storm water runoff. Proper storm water controls (diversions) and reclamation procedures would minimize the impacts to the adjacent soils.

Cumulative Impacts

The proposed project area would occur across the Escavada Wash Watershed (HUC 1408010603) and the Blanco Canyon Watershed (HUC 1408010305). These watersheds represent the spatial analysis area for cumulative soil impacts. There are a total of 316,912 acres in these watersheds. Past, present, and reasonably foreseeable future impacts to soils within the Escavada Wash and Blanco watersheds are mainly associated with oil and gas extraction activities, among others. Currently, the Escavada and Blanco Canyon watersheds have 1,639 existing oil/gas wells with a total of 4,176.64 disturbed acres or about 1.32% of the watershed area acres. Of the 4,176.64 disturbed acres, 1,229.25 acres are long term disturbance and 2,947.19 acres are reclaimed (based on BLM-FFO data, 2015).

The Proposed Action would contribute 2.53 acres of long term disturbance, and 20.34 acres of reclaimed disturbance to the analysis area. These acres would be additive to the existing disturbance acres and would be a 0.21% increase in the existing long term disturbances and 0.69% increase in the existing reclaimed disturbances.

667 new wells targeting development of the Mancos Formation could be added to the existing wells within the analysis area (Engler et. al. 2014). These wells with associated access roads and pipelines could occupy a total of about 4,295 acres resulting in additional disturbance within the analysis area, or about 1.36% of the watershed acres. Of these acres, the potential new Mancos wells could add additional long term disturbance of 1000.50 acres and 3,295 acres of reclaimed disturbance. The Proposed Action would represent about 0.25% of these long term disturbances and about 0.62% of the reclaimed disturbances within the analysis area.

Based on the BLM-FFO existing well data (2015) combined with potential new wells outlined in the 2014 Reasonably Foreseeable Development Scenario (RFD) (Engler et. al. (2014)), the analysis area could contain a total of 2,306 wells. These wells with the associated access roads and pipelines could disturb approximately 8,472 acres, or 2.7% of the analysis area. Approximately 2,230 of these acres would be long term disturbance and 6,242 would be reclaimed disturbance (based on BLM-FFO data, 2015). The

Proposed Action would represent about 0.11% of these long term and about 0.33% of the reclaimed disturbances.

Table 3-7. Cumulative Oil and Gas Impact Acreages within the Escavada Wash and Blanco Canyon watersheds – Alternative B.

Impact	Wells (number)	Total Disturbance (acres)	Long Term Disturbance (acres)	Reclamation (acres)
Proposed Action (Alternative B)	2	22.87	2.53	20.34
Existing Oil and Gas	1,639	4,176.64	1,229.25	2,947.19
Alternative B %	**0.12%**	**0.55%**	**0.21%**	**0.69%**
Future Oil and Gas	667	4,295.15	1000.50	3,294.65
Alternative B %	**0.30%**	**0.53%**	**0.25%**	**0.62%**
Total (Existing & Future)	**2,306**	**8,471.79**	**2229.75**	**6,241.84**
Alternative B %	**0.09%**	**0.27%**	**0.11%**	**0.33%**

The above cumulative effects to soil (e.g. soil compaction and soil loss) as a result of energy development are additive to soil effects from other activities within the watersheds, such as authorized and unauthorized livestock grazing, residents, other private and public roadways, and commercial developments. Although not as common within the region, other activities that may impact soils include vegetation manipulation and management activities such as prescribed and natural fires.

3.3.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Alternative C would result in soil impacts similar in nature to those detailed under the Proposed Action. Total surface disturbance would be 7.85 acres—5.35 acres in the Blancot-Notal Association and 2.50 acres in the Badland soil. All but 2.53 acres of the total surface disturbance would be reclaimed. Alternative C would result in 15.02 acres less surface disturbance than the Proposed Action (see Table 2-7, Section 2.4). This decrease in soil disturbance would result in a decrease in soil erosion and sedimentation, relative to the Proposed Action. All other direct and indirect soil impacts would remain as detailed in **Section 3.3.2.**

Cumulative Impacts

Cumulative impacts analysis for Alternative C is similar as that for the Proposed Action because the alternatives are in the same area, and are of similar scope. Similarly, Alternative C impacts analysis uses the same analysis area. Existing energy development and potential future Mancos energy development for the analysis area is presented in **SECTION 3.3.2**.

Alternative C would contribute 2.53 acres of long term disturbance, and 5.32 acres of reclaimed disturbance to the analysis area. The reclaimed disturbances are 15.02 acres less than those under the proposed action. Alternative C would result in a 0.21% increase in the existing long term disturbances and 0.18% increase in the existing reclaimed disturbances.

When compared against the proposed future wells outlined in Engler et. al (2014) for the analysis area, Alternative C would represent about 0.25% of the long term disturbances and 0.16% of the reclaimed disturbances.

Compared with the existing and proposed future wells, Alternative C would represent 0.11% of the long term and 0.09% of the reclaimed disturbances.

Table 3-8. Cumulative Oil and Gas Impact Acreages within the Escavada Wash and Blanco Canyon watersheds – Alternative C.

Impact	Wells (number)	Total Disturbance (acres)	Long Term Disturbance (acres)	Reclamation (acres)
Alternative C	2	7.85	2.53	5.32
Existing Oil and Gas	1,639	4,176.64	1,229.25	2,947.19
Alternative C %	**0.12%**	**0.19%**	**0.21%**	**0.18%**
Future Oil and Gas	667	4,295.15	1000.50	3,294.65
Alternative C %	**0.30%**	**0.18%**	**0.25%**	**0.16%**
Total (Existing & Future)	**2,306**	**8,471.79**	**2229.75**	**6,241.84**
Alternative C %	**0.09%**	**0.09%**	**0.11%**	**0.09%**

3.4. Water Resources – Surface Water

3.4.1. *Affected Environment*

The proposed project area is located in the Upper Colorado River Hydrologic Region and is within the greater Chaco Watershed. (Hydrologic Unit Code [HUC] 14080106) and the Blanco Canyon Watershed. (Hydrologic Unit Code [HUC] 14080103). The Natural Resource Conservation Service (NRCS) lists high sedimentation and water runoff as resource concerns within the watersheds (USDA NRCS undated publication). The analysis area is characterized by flat lowlands surrounded by mud-stone hills, dissected by many intermittent drainage channels. Total vegetative cover is low across the project area habitats (about 0-30%). This results in higher runoff discharge volume and velocities and less runoff occurring as sheet flow. Physical features of the area indicative of these conditions are multiple braided shallow-concentrated flow channels and a high amount of ephemeral drainages. Within the above watersheds, two catchments occur across the proposed project area. Much of the east half of the northeast quarter corner of Section 3 rests on an elevated flat which flows north easterly to Blanco Wash. The remaining portions area to the west and south present eroded escarpment slopes which drain south and west toward Kimbeto Wash. There are no perennial surface water resources such as rivers, lakes, ponds, streams, wetlands or springs within the project area.

Under the Clean Water Act, the US Army Corps of Engineers (USACE) has jurisdiction over “waters of the U.S.” These jurisdictional waters include those that have a “significant nexus” to traditional navigable waters. The BLM/FFO and USACE Durango Regulatory Division have determined that jurisdictional waters may include USGS watercourses (i.e., “blue line” on USGS 1:24,000 topographic maps). The proposed road, pipeline and power line cross two (2) USGS watercourses. Table 3-9 provides a description of the two ephemeral USGS drainages identified in the project area.

Table 3-9. Project Components, Ordinary High Water Mark measurement, and the Water Feature Type in the Proposed Project Area

Project Component	Ordinary High Water Mark		Location	Water Feature Type
	Width (feet)	Height (feet)		
Chaco 23-08 3 Access, Pipeline, and Power Line	5.0	1.5	At the entrance of the proposed access road/pipeline/power to the well pad	Ephemeral
Chaco 23-08 3 #1H Well-Tie Pipeline and Power Line	15	2.0	Chaco 23-08 3 #1H Well-tie Pipeline At E.S. 44+78.99	Ephemeral

3.4.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Under the Proposed Action the access road and the #1H well-tie pipeline would cross one USGS watercourse (Table 3-9) near to the well pad. The proposed Chaco 23-08 3 Wells Project #1H well-tie pipeline would cross an additional USGS drainage (Table 3-9) at E.S. 44+78.99. The proposed road meets the requirements to be covered under the US Army Corps of Engineers Nationwide Permit # 14 (Linear Transportation Projects) and the proposed pipeline and power line meet the requirements to be covered under Nationwide Permit #12 (Utility Line Activities).

Direct impacts to the drainage near the entrance to the well pad would be from temporary disturbances associated with the installation of the buried #1H well-tie pipeline and access road. The pipeline activities would result in 7.5 square feet of affects within the drainage's OHWM. Permanent fills to this drainage would result from the installation of the access road with culvert. About 600 cubic feet of clean dirt fill with culvert would remain across the drainage as a result of the proposed action. No impact to this drainage would occur from the power line because it is overhead and spans the drainage's extent. The drainage located at survey station 44+78.99 on the #1H well tie-pipeline would be affected by pipeline installation activities only. This would result in 450 square feet of affects. Overall, the Proposed Action would temporarily disturb and expose 22.87 acres of soil. During the production phase of the proposed project, approximately 2.53 acres would remain exposed on the well pad and access road. Grading for the proposed new access road and the well pad would change the topography over about 7.3 acres.

Indirect impacts to surface water could include the accidental spills of produced water, stored oil, and hazardous substances stored and utilized during the drilling and completions phases. Discharge from these spill events could reach into nearby ephemeral drainages and ultimately the water quality of receiving perennial surface water features could be affected if response measures are not implemented timely. Occurrence of these spills is reduced due to state and federal handling and spill prevention regulations, proposed design features, and industry Best Management Practices (i.e. sized sufficiently impervious secondary containments, routine inspections and maintenance, integrity testing, drip pans, and spill response plans). Additionally, the proposed wells would be drilled using a closed-loop system, therefore an earthen pit is not needed for the drilling fluids and cuttings. Any spills of non-freshwater fluids would be immediately cleaned up and removed to an approved disposal site in accordance with federal and state regulations.

Indirect impacts to soil as assessed within **SECTION 3.3.2** above would have potential to indirectly impact surface water resources from increased sediment. Additionally, localized runoff patterns would be affected by topographic changes from the well pad and access road. The potential for sediment transport into the drainages would be minimized through the implementation of the BLM-FFO Bare Soil Reclamation Procedures (BLM 2013d), and BMPs detailed in Section 2.2.11. Reclamation would occur over 20.34 acres of the Proposed Action area. The re-establishment of vegetation and proper site hydrological diversions would also mitigate sedimentation and therefore water quality.

Impacts to surface water resources would be low and short term from exposed soils and long term from affects such as localized topographic changes.

Cumulative Impacts

The spatial analysis area for cumulative surface water impacts is the Escavada Wash (HUC 1408010603) and Blanco Canyon (HUC 14080103605) watersheds. The Proposed Action would cumulatively contribute 2.53 acres of long term disturbance within the analysis area and 20.34 acres of reclaimed disturbance. The primary past, present, and reasonably foreseeable future impacts to surface water in the analysis area are associated with oil and gas extraction activities (**SECTION 3.3.2 CUMULATIVE IMPACTS**). Proposed Action surface disturbance impacts relative to existing and future surface disturbances

associated with oil and gas activities within the Escavada Wash and Blanco Canyon watersheds are summarized in Table 3-7 of **SECTION 3.3.2**.

Cumulative effects to surface water (e.g. sedimentation, salinity, and spilled pollutants) as a result of energy development are additive to the effects from other activities within the watersheds, such as authorized and unauthorized livestock grazing, residents, other private and public roadways, and commercial developments. The potential for cumulative effects to surface water from spilled pollutants from drilling, completion or workover operations is relative to the number of well sites undergoing these activities within the watersheds and the distance of those sites from waterways. Although not as common within the region, other activities that may impact surface water include vegetation manipulation and management activities such as prescribed and natural fires.

3.4.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Under Alternative C, the access road and the #1H well-tie pipeline would cross the same USGS watercourse (Table 3-9) near to the well pad as under the Proposed Action. No other drainages would be crossed under Alternative C. Therefore, Alternative C would reduce the number of drainage crossings under the Proposed Action by one.

Direct impacts to the drainage near the entrance to the well pad under Alternative C would be from temporary disturbances associated with the installation of the buried #1H well-tie pipeline and the access road. The pipeline activities would result in 200 square feet of affects within the drainage's OHWM. Permanent fills to this drainage would result from the installation of the access road with culvert. About 600 cubic feet of clean dirt fill with culvert would remain across the drainage. These impacts would not differ from those realized under the Proposed Action. The second drainage affected under the Proposed Action would not be impacted under Alternative C. Overall, Alternative C would disturb and expose 7.85 acres of soil. This is 15.02 acres less than that disturbed under the Proposed Action. During the production phase of the proposed project, 2.53 acres would remain exposed on the well pad and access road, 5.32 acres would be reclaimed. Constructing the proposed new access road and the well pad would change the topography over about 7.3 acres. These two components remain unchanged from the Proposed Action.

Indirect impacts under Alternative C would be similar to those described in **SECTIONS 3.3.2**. However at 7.78 acres of surface disturbance, Alternative C would expose a smaller amount of soils to sediment transport. As a result, impacts to surface water quality under Alternative C would be decreased relative to the Proposed Action.

Cumulative Impacts

The spatial analysis area for cumulative surface water impacts under Alternative C is the same as that analyzed under the Proposed Action. Alternative C would cumulatively contribute 2.53 acres of long term disturbance within the analysis area and 5.32 acres of reclaimed disturbance. The primary past, present, and reasonably foreseeable future impacts to surface water in the analysis area are associated with oil and gas extraction activities (see **SECTION 3.3.2 CUMULATIVE IMPACTS**). Alternative C surface disturbance impacts relative to existing and future surface disturbances associated with oil and gas activities within the analysis area are summarized in Table 3-8 of **SECTION 3.3.3**.

Other than a decrease in the amount of acres of surface disturbance the cumulative impacts of Alternative C would be similar to those of Alternative B.

3.5. Upland Vegetation

3.5.1. *Affected Environment*

The BLM-FFO is comprised of the Plateau Ecoregions, including the Arizona/New Mexico Plateau and the Colorado Plateau Ecoregions. These ecoregions support extensive arid and semiarid desert-scrub and shrubland habitats, such as Great Basin sagebrush, saltbush, greasewood, shadscale; or shrublands of big sagebrush and other shrubs, grasslands, and pinyon juniper woodlands and savannas.

The proposed Chaco 23-08 3 Wells Project is located within the Arizona/New Mexico Plateau Ecoregion. This ecoregion is a large transitional region between the semiarid grasslands and low relief tablelands to the east, the drier shrublands and woodland covered higher relief tablelands of the Colorado Plateau in the north, and the lower, hotter, less vegetated areas in the west and southeast. Local relief in the region varies from a few feet on plains and mesa tops to well over 1,000 feet along tableland side slopes (USEPA 2013g). The Continental Divide splits the region, but is not a prominent topographic feature. The region extends across northern Arizona, northwestern New Mexico, and into Colorado in the San Luis Valley. This ecoregion is characterized by rugged tableland topography, with large basins, ridges, spectacular canyons, and colorful geological formations. The higher elevations support extensive pinyon-juniper woodlands. Groundcover in these woodlands is sparse and consists of grama and other grasses, forbs, and shrubs, such as big sagebrush (*Seriphidium tridentatum*) and alderleaf cercocarpus (*Cercocarpus montanus*). Lower areas contain saltbrush-greasewood shrublands, typical of hotter, drier areas.

BLM-FFO GIS data depicts the proposed project area within four different vegetation types:

- Big Sagebrush
- Greasewood
- Grassland
- Badland/Rock/Wash

Field verification of the proposed project area indicates that the Chaco 23-08 3 Wells Project vegetation is predominantly within the Saltbush Shadscale/Winterfat Community with Badland/Rock/Wash occurring across much of the eroded escarpment slopes leasing into Kimbeto Wash. Ground cover was visually estimated at 0 to 30 percent, dependent upon soil type. The Saltbush Shadscale/Winterfat vegetation type is dominated by saltbush (*Atriplex* spp.) and sagebrush (*Artemisia* spp. And *Seriphidium* spp.). Overstory vegetation includes widely-scattered Utah juniper (*Juniperus osteosperma*), one-seed juniper *(J. monosperma*), and to a lesser extent pinyon pine (*Pinus edulis*). Within the Saltbush Shadscale/Winterfat Vegetation Community common brush species include big sagebrush, black sagebrush (*Artemisia nova*), bud sagebrush (*Artemisia spinescens*), white sagebrush (*Artemisia ludovicana*), four-wing salt brush (*Atriplex canescens*), shadscale (*Atriplex confertifolia*), winterfat (*Krascheninnikovia lanata*), rubber rabbitbrush (*Ericameria nauseosus*), greasewood (*Sarcobatus vermiculatus*), broom snakeweed (*Gutierrezia sarothrae*), and horsebrush (*Tetradymia canescens*). Understory species include blue grama (*Chondrosum gracile*), galleta (*Hilaria jamesii*), sand dropseed (*Sporobolus cryptandrus*), alkali sacaton (*Sporobolus airoides*), needle-and-thread grass (*Hesperostipa 37ormos*), western wheatgrass (*Elymus smithii*), buckwheat species (*Erigeron* spp.), and forbs. Biological soil crusts occur in the project area—particularly across the well pad

The project area intersects approximately 123 juniper and pinyon pine trees of varying sizes and ages within the above saltbush shadscale/winterfat community type. Twenty-five juniper trees are located within the proposed well pad (eight trees are greater than 3-inches in diameter and 17 trees are less than 3-inches in diameter). The proposed access road intersects approximately 65 juniper and pinyon trees (15 trees are greater than 3-inches in diameter and about 50 trees are less than 3-inches in diameter). The proposed Chaco 23-08 3 #1H well-tie pipeline intersects 23 juniper and pinyon trees (12 trees are greater than 3-inches in diameter and 11 trees are less than 3-inches in diameter). The proposed Chaco 23-08 3 #1H power line intersects 10 juniper and pinyon trees (three trees are greater than 3-inches in diameter and seven trees are less than 3-inches in diameter). The majority of the pinyon pine trees are

sapling to intermediate in age. The majority of the one-seed junipers and Utah junipers are mature, with a few sporadic saplings. No unique, riparian or aquatic vegetation is found within the proposed project area. A complete list of plant species observed during the field investigations can be found in the Chaco 23-08 3 Wells Project BSR.

3.5.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Direct impacts would include 22.87 acres of vegetation removal during construction of the Proposed Action. A total of 38 trees greater than 3-inches in diameter and 85 trees less than 3 inches in diameter would be removed under the Proposed Action. Eight juniper trees greater than three inches in diameter and 17 juniper trees less than 3-inches in diameter would be removed by well pad construction. Fifteen juniper trees greater than three inches in diameter and 50 juniper trees less than 3-inches in diameter would be removed by access road construction. The proposed Chaco 23-08 3 power line would result in removal three juniper trees over 3-inches in diameter and 7 trees less than 3-inches in diameter. The proposed Chaco 23-08 3 #1H well-tie pipeline would remove 23 juniper and pinyon trees of which 12 trees are greater than 3-inches in diameter and 11 trees are less than 3-inches in diameter. The proposed Chaco 23-08 3 #2H well-tie pipeline would be constructed entirely within the proposed well pad and would therefore not result in the removal of any additional vegetation. Biological soil crusts that occur in the project areas would be removed, these are most prominent on the well pad area.

Indirect impacts of the Proposed Action include alteration of drainage patterns leaving the affected areas that would result in changes to vegetation distribution, disturbance of the soil seed bank within the affected areas, alteration on on-site slopes and aspect, development of conditions conducive to non-native and invasive plant species establishment (**SECTION 3.6.2**), alteration of infiltration capacity of disturbed soils, soil moisture alterations of unaffected soils around the perimeter, the establishment of volunteer species to unaffected areas from the re-seeded species, and dust. Successful interim and final reclamation would reduce these impacts. These impacts would be experienced during the interim-reclaimed life of the project as well as following final reclamation, though these impacts would be recognized more so during the interim-reclamation stage.

Reclamation would occur over 20.34 acres of the Proposed Action area. While reclaiming the areas of disturbances, Energen and Williams Four Corners, LLC. would follow the guidelines established in the Farmington Field Office Bare Soil Reclamation Procedures (USDI BLM 2013a), to meet the standards and guidelines set forth by the BLM-FFO and Onshore Oil and Gas Order No. 1 for reclaiming disturbed lands. A Reclamation Plan is prepared that is site-specific to proposed project outlining measures to implement interim and final reclamation. Successful reclamation would serve to minimize water and wind erosion, reduce off-site sedimentation, and improve habitat for wildlife and grazing livestock.

The deposition of fugitive dust (including associated salts) on plant surfaces could also be recognized as an indirect effect from the implementation of the Proposed Action. The dust could reduce photosynthesis and productivity (Thompson et al. 1984; Hirano et al. 1995), cause injury to leaves, and increase water loss (Eveling and Bataille 1984) in plants in and near the proposed project area. Considerable amounts of fugitive dust could be generated during clearing and grading activities, by vehicle traffic on the existing access roads, and from all areas of disturbed soils. Plant community composition could subsequently be altered, resulting in habitat degradation. In addition, pollinator species could be affected by fugitive dust, potentially reducing pollinator populations in the vicinity. Localized impacts on plant populations and communities could occur if seed production in some plant species is reduced.

Impacts would be incurred during initial site preparation and would continue throughout the operational life of the proposed project, typically extending over a period of several decades. Plant communities and habitats affected by direct project impacts include long term changes in species composition, abundance, and distribution. Indirect impacts would also continue after the decommissioning of the proposed project. Reclamation would be implemented to reduce the degree of impacts for the operational life of the project and following final abandonment.

Cumulative Impacts

The spatial analysis area for cumulative vegetation impacts is the combined Escavada Wash (HUC 1408010603) and Blanco Canyon (HUC 14080103605) watersheds. The Proposed Action would cumulatively contribute 2.53 acres of long term disturbance within the analysis area and 17.16 acres of reclaimed disturbance. The primary past, present, and reasonably foreseeable future impacts to vegetation in the analysis area are associated with oil and gas extraction activities (see **SECTION 3.3.2 CUMULATIVE IMPACTS**). Proposed Action surface disturbance impacts relative to existing and future surface disturbances associated with oil and gas activities within the analysis area are calculated and summarized in Table 3-7 (**SECTION 3.3.2**).

Cumulative effects to vegetation (e.g. removal, and invasive species) as a result of energy development are additive to vegetation effects from other activities within the watersheds, such as authorized and unauthorized livestock grazing, residents, other private and public roadways, and commercial developments. Although not as common within the region, other activities that may impact vegetation include vegetation manipulation and management activities such as prescribed and natural fires.

3.5.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct impacts under Alternative C would include 7.85 acres of vegetation removal during project construction. As a result, direct impacts to upland vegetation under Alternative C would be 15.02 acres less than the Proposed Action. A total of 23 trees greater than 3-inches in diameter (Fifteen less than under the Proposed Action) and 67 trees less than 3 inches in diameter (Eighteen less than under the Proposed Action) would be removed under Alternative C. Under Alternative C, the number of tree removal for the well pad and access road would remain the same as the Proposed Action. No additional trees would be removed by either the Chaco 23-08 3 #1H or #2H well-tie pipelines under Alternative C. Under Alternative C, reclamation would occur over 5.32 acres of the project area.

The potential for and type of direct and indirect impacts identified for the Proposed Action would be similar under Alternative C. However, because the disturbance area is less under Alternative C, the resulting direct and indirect impacts would be decreased accordingly. Details of direct and indirect impacts to upland vegetation resources for the Proposed Action are detailed in **SECTION 3.5.2**. Under Alternative C, San Juan Basin Gathering would be the responsible Grant Holder.

Cumulative Impacts

The spatial analysis area for cumulative vegetation impacts is the same as that analyzed under the Proposed Action. Alternative C would cumulatively contribute 2.53 acres of long term disturbance within the analysis area and 5.32 acres of reclaimed disturbance. The primary past, present, and reasonably foreseeable future impacts to vegetation in the analysis area are associated with oil and gas extraction activities (see **SECTION 3.3.2 CUMULATIVE IMPACTS**). Alternative C surface disturbance impacts relative to existing and future surface disturbances associated with oil and gas activities within the combined Escavada Wash and Blanco Wash watersheds are summarized in above in Table 3-8 (**SECTION 3.3.3**).

Alternative C would have a smaller additive effect as a result of less surface disturbance acreage and the resultant decrease in impacts to vegetation area-wide. Other details of cumulative impacts to upland vegetation under Alternative C would be the same as those detailed in **Section 3.5.2**, for the Proposed Action (Alternative B).

3.6. Noxious Weeds and Invasive Species

3.6.1. *Affected Environment*

Management of invasive and non-native species is mandated under the Lacey Act, as amended, the Federal Noxious Weed Act of 1974, as amended and Executive Order 13112 Invasive Species (February 3, 1999). Native vegetation and undisturbed soils are less prone to the establishment of noxious and invasive plant species. Invasive species generally establish faster and tolerate disturbed soils better than other native on non-native desirable plants.

Two noxious weed species, as listed by the State of New Mexico as Class C (New Mexico 2009), were observed within the proposed project area. Cheatgrass (*Bromus tectorum*) was observed scattered throughout the proposed project area, and salt cedar (*Tamarix chinensis*) was observed within the unnamed intermittent drainage immediately west of the start of the proposed new access road. This tree population is limited to the drainage and is small in size.

3.6.2. Impacts from the Proposed Action (Alternative B)

Direct and Indirect Impacts

Following clearing for construction of the Proposed Action, 22.87 acres of disturbed ground would be available to increased weed and invasive species establishment. During construction and operation, noxious weed sources could be introduced to disturbed areas from vehicles, equipment, people, wind, water, or other mechanisms. Of particular concern are annual grasses, such as cheatgrass, which is already established within the project area and is difficult to control by mechanical and chemical applications. The spread of cheatgrass as a result of the Proposed Action is likely. There would be a long term potential for noxious, native and non-native invasive weeds to establish in the disturbed areas.

While reclaiming the areas of disturbances, Energen and Williams Four Corners, LLC. would follow the guidelines established in the Farmington Field Office Bare Soil Reclamation Procedures (USDI BLM 2013a), to meet the standards and guidelines set forth by the BLM-FFO and Onshore Oil and Gas Order No. 1 for reclaiming disturbed lands. Reclamation will occur over 20.34 acres of the Proposed Action area.

Energen and Williams Four Corners, LLC. would be responsible for monitoring and controlling all noxious and non-native invasive weed species within the permitted project areas for the life of the project. Weed species would be managed following the recommendations of the BLM-FFO. Long term control of noxious and non-native invasive weed species would serve to improve reclamation success, improve native species composition and vigor, and reduce the spread of noxious and non-native invasive weed species. Successful reclamation also serves as a weed control mechanism that reduces weed and invasive species growth through competition, but will not reduce the amount of viable weed and invasive species seeds within the soil.

Cumulative Impacts

The spatial analysis area for cumulative vegetation impacts is the combined Escavada Wash (HUC 1408010603) and Blanco Canyon (HUC 14080103605) watersheds. The Proposed Action would cumulatively contribute 2.53 acres of long term disturbance and 20.34 acres of short-term disturbance within the analysis area. The primary past, present and reasonably foreseeable future effects of noxious and invasive plant species to the analysis area are associated with oil and gas extraction activities (see **SECTION 3.3.2 CUMULATIVE IMPACTS**). Proposed Action surface disturbance impacts relative to existing and future surface disturbances associated with oil and gas activities within the Escavada Wash Watershed is calculated and summarized in Table 3-7 (**SECTION 3.3.2**).

Cumulative effects of noxious and invasive species as a result of energy development are additive to the effects from other activities within the watersheds, such as authorized and unauthorized livestock grazing, residents, other private and public roadways, and commercial developments. Although not as common

within the region, other activities that may introduce, spread or result in an increase in the noxious and invasive weeds include vegetation manipulation and management activities such as prescribed and natural fires.

3.6.3. Impacts from Alternative C

Direct and Indirect Impacts

Direct impacts under Alternative C would include 7.85 acres of ground disturbance during project component construction. As a result, the potential for the introduction, establishment and spread of noxious and invasive weed species under Alternative C would be 15.02 acres less than the Proposed Action.

The potential for introduction, establishment and spread of noxious and invasive weed species under Alternative C would be the same as identified for the Proposed Action. However, because the disturbance area is less under Alternative C, the resulting potential for establishment of noxious and invasive weed species under Alternative C would be decreased. Details of direct and indirect impacts to noxious weeds and invasive species resources for the Proposed Action are detailed in **SECTION 3.6.1**. Under Alternative C, San Juan Basin Gathering would be the responsible Grant Holder.

Cumulative Impacts

The spatial analysis area for cumulative noxious weeds and invasive species impacts under Alternative C is the same as that analyzed under the Proposed Action. Alternative C would cumulatively contribute 2.53 acres of long term disturbance within the analysis area and 5.32 acres of reclaimed disturbance. The primary past, present and reasonably foreseeable future potential for introduction, establishment and spread of noxious and invasive weed species in the analysis area are associated with oil and gas extraction activities (see **SECTION 3.3.2 CUMULATIVE IMPACTS**). Alternative C surface disturbance impacts relative to existing and future surface disturbances associated with oil and gas activities within the analysis are summarized in above in Table 3-8 (**SECTION 3.3.3**).

Alternative C would have a slightly less additive effect as a result of new surface disturbance acreage and the resultant decrease in the potential for introduction, establishment and spread of noxious and invasive weed species impacts to the area. Other cumulative effects as a result of noxious and invasive weed species under Alternative C would be the same as those detailed in **Section 3.6.2**, for the Proposed Action (Alternative B).

3.7. Wildlife

3.7.1. Affected Environment

Wildlife impacts from a disturbance can be categorized in two ways; direct habitat loss and effective habitat loss. Direct habitat loss is the result of disturbance to soil and vegetation, reducing the extent or quality of habitat. Habitat removal deprives wildlife of food and/or cover. Direct habitat loss can be quantified by comparing the direct habitat loss area to the remaining habitat area.

The amount of available habitat is termed effective habitat. Effective habitat loss is when a species avoids using an area. Effective habitat area loss usually exceeds direct habitat loss. Effective habitat loss can occur from habitat fragmentation, disturbance, and interference with movement. It has been demonstrated that wintering mule deer respond to natural gas well pads by selecting habitats greater than 3 kilometers away (1.864 miles) (Sawyer et al. 2006).

The impacts of habitat fragmentation are related to the loss of large contiguous areas of habitat and the relative increase in habitat “edge” in smaller areas. Construction of roads and other development, as well as human and vehicular traffic on existing roads, can cause habitat fragmentation. Such disturbance can cause animals to shift their activity or alter their behavior. Sawyer (2009) found that mule deer avoided all types of well pads, but tended to select areas farther from well pads with higher levels of traffic. The

negative response of mule deer to traffic levels suggested that impacts of gas development on mule deer may be reduced by minimizing traffic (Sawyer, H., Kauffman, M., and Nielson R. 2009).

Habitat avoidance by wildlife may be influenced by various factors including time of day, time of year, human activity level, topography, weather, and cover type. Additionally, data collected by the BLM-FFO and New Mexico Department of Game and Fish in the Rosa Wildlife Specially Designated Area (SDA) between 1994 and 2012 indicate a positive correlation between the increasing number of gas wells and accompanying roads with the decline in mule deer fawn to doe ratios (unpublished BLM-FFO data 2014).

No crucial winter ranges for elk, deer, pronghorn, and other species occur within the proposed project area. The proposed Chaco 23-08 3 Wells Project is not located within any BLM-FFO specially designated wildlife area. There are no unique habitats within the analysis area. However, the proposed Chaco 23-08 3 Wells Project area supports a variety of wildlife species. Wildlife common to the project area include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), fox (*Vulpes* spp.), black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*),) coyote (*Canis latrans*), North American porcupine (*Erethizon dorsatum*), kangaroo rat (*Dipodomys* spp.), and woodrat (*Neotoma* spp.).

According to the BLM-FFO, the closest known historical or currently active raptor nest (American peregrine falcon, *Falco peregrinus anatum)* occurs approximately 7.6 miles to the north, northeast of the project area (BLM 2014). Seven golden eagle *(Aquila chrysaetos)* nests and one American peregrine falcon nest occur within a 15-mile radius of the proposed project area (BLM 2014). No sign of raptor use, such as whitewash or nests, were observed in the proposed project or action area. The closest known western burrowing owl (*Athene cunicularia*) nest site is 12 miles to the northeast of the proposed project area. No prairie dog towns or western burrowing owls, or their sign were observed within the proposed project area.

Coyote, black-tailed jackrabbit, desert cottontail, and wood rat sign (burrows, tracks, and scat) were observed during the biological survey field visits. Desert cottontails were observed along the pipeline/powerline corridor routes on each field day. Western scrub jays (*Aphelocoma califonnica*), western blue birds (*Sialia mexicana*), American crow (*Corvus brachyrhynchos*), and lark sparrows (*Chondestes grammacus*) were also observed. A list of plants and wildlife observed during the field surveys is included in the Biological Survey Report for the Chaco 23-08 3 Wells Project.

Thiessen Polygon Analyses

To study the potential impacts of the Proposed Action components and the project in total, a Thiessen Polygon Analysis of existing and proposed well pads was completed using GIS. The Thiessen analysis area included a 2-mile radius area around all components of the Proposed Action and those polygons that intersected the 2-mile radius area (Figure 3.1). Existing wells were extracted from the NMOCD database, for past, existing and approved oil and/or gas wells. Other disturbances incorporated included BLM permitted actions, as displayed on the Master Title Plats (MTPs), and disturbances visible from the 2014 National Aerial Imagery Project (NAIP) orthophotographic coverage at 1:6000 scale, regardless of type. The Thiessen Analyses was overlaid with the disturbances for the existing environment and the Proposed Action (Alternative B). Power lines were not included in the analysis, as verification via orthophotographic coverage could not be done.

Displaying the existing environment, the total number of polygons associated with existing well pads that intersect the 2 mile buffer is 96. These polygons have a total area of about 19,990.38 acres. The average polygon size is about 208.23 acres. The median size polygon is 132.24 acres. The smallest polygon is 23.67 acres while the largest polygon is 1253.65 acres. Contiguous undisturbed areas were calculated by overlaying existing roads and other existing human disturbances (as seen on NAIP 2014 digital orthophotographic coverage at 1:6000 scale). The largest contiguous area represents the largest leftover undisturbed area within the Thiessen polygon described. Table 3-10 details the polygon data in terms of area for the existing environment. Figure 3.1 gives a visual representation of the analysis for the existing environment.

Associated Well Name	Polygon Acres	Undisturbed Acres	Disturbance Acres	Percent Undisturbed	Largest Contiguous Area	Furthest Distance From Disturbance (25' interval)
Affected Polygons						
CHACO 2308 03E 403H	369.18	356.12	13.06	96.46%	186.87	2900
CHACO 2308 04P 149H	58.22	47.75	10.48	82.01%	30.37	1350
FEDERAL 3 023	192.17	178.13	14.03	92.70%	99.73	1500
FEDERAL 3 043	295.66	276.03	19.63	93.36%	109.65	1250
FEDERAL 34 043	371.32	356.56	14.76	96.03%	266.07	3100
HEROS 002M	88.32	81.07	7.25	91.79%	50.95	900
HEROS 003N	127.96	115.17	12.78	90.01%	101.45	1700
HEROS 004O	84.56	82.40	2.17	97.44%	81.87	1725
JEFFERS FEDERAL 2 023	312.42	292.74	19.68	93.70%	158.89	2975
LOGOS 005	38.03	28.11	9.91	73.93%	16.35	1075
TURTLE MOUNTAIN 35 002	227.03	206.57	20.46	90.99%	117.99	1525
Non-Affected polygons						
AH DES PI AH NAVAJO 001	886.66	788.65	98.02	88.95%	397.66	2150
AXEM FEDERAL 001	369.16	350.69	18.48	94.99%	314.92	2075
BLANCO WASH 26 001	130.40	126.89	3.51	97.31%	107.61	1475
BLANCO WASH 26 002	89.47	81.48	8.00	91.06%	46.12	750
BLANCO WASH 27 001	51.21	49.66	1.55	96.97%	47.41	900
BLANCO WASH 27 003	79.69	77.14	2.55	96.80%	39.94	1325
BRIGHT ANGEL 001	321.98	318.86	3.12	99.03%	298.92	3475
BUMBLE 001	50.77	49.98	0.79	98.44%	48.50	675
CHACO 2308 03L 404H	109.19	108.81	0.38	99.65%	108.81	1575
CHACO 2308 04D 282H	205.73	187.80	17.93	91.29%	107.24	1300
CHACO 2308 04L 283H	181.05	176.87	4.18	97.69%	89.56	1700
CHACO 2308 06H 396H	411.59	404.28	7.31	98.22%	251.57	2250
CHACO 2308 09A 145H	55.97	51.57	4.40	92.13%	40.95	850
CHACO 2308 11A 407H	500.93	500.93	0.00	100.00%	500.93	3800
CHACO 2308 14E 151H	130.12	123.67	6.45	95.04%	117.05	1775
CHACO 2308 16I 147H	360.34	346.58	13.76	96.18%	183.04	1800
CHACO 2408 25M 131H	59.02	53.49	5.52	90.64%	24.71	700
CHACO 2408 26E 126H	48.16	45.43	2.73	94.33%	19.92	750
CHACO 2408 32P 114H	48.03	39.55	8.48	82.35%	15.14	400

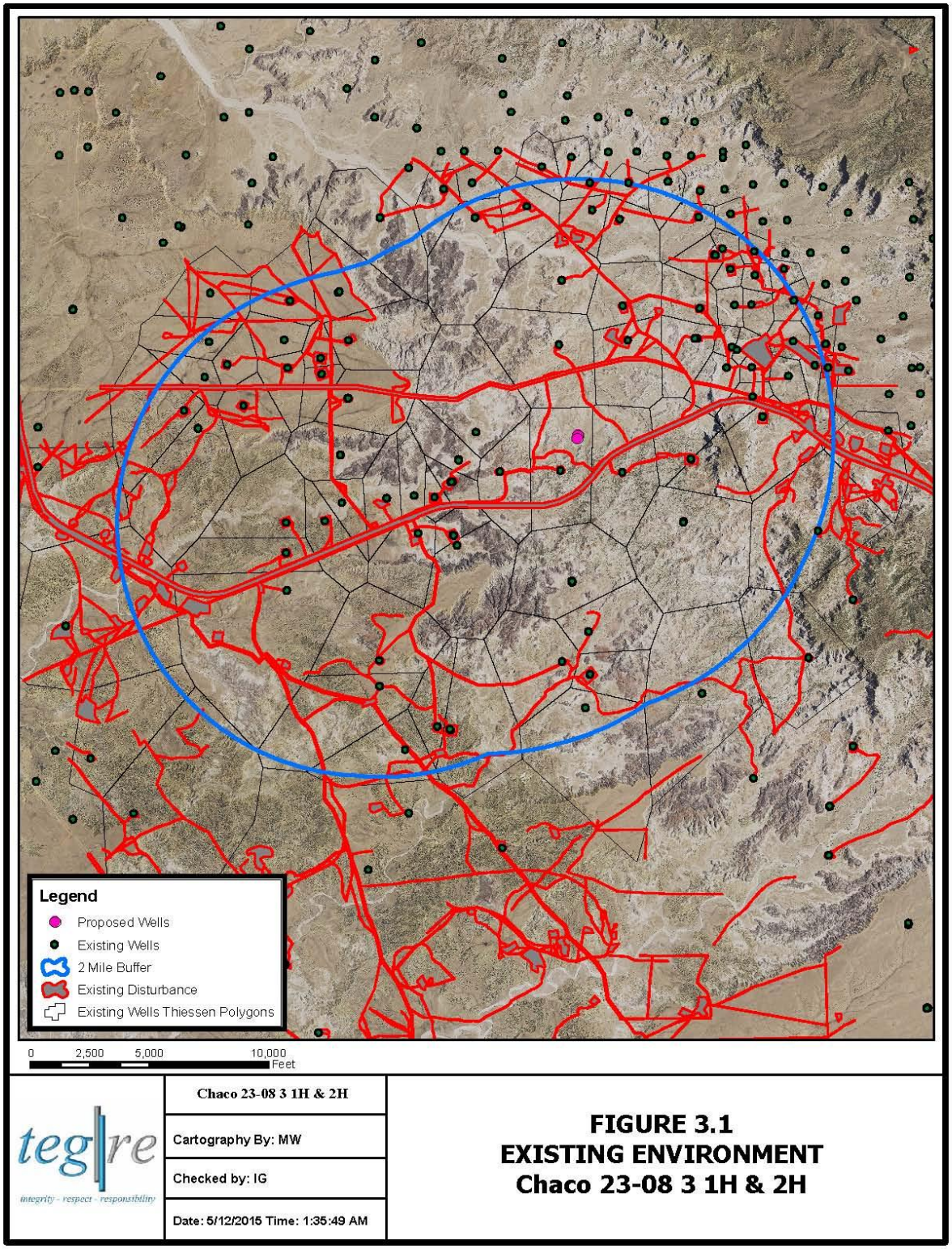
CHACO 2408 32P 115H	64.26	53.04	11.22	82.53%	30.52	1050
CHACO 2408 33D 112H	223.64	219.49	4.15	98.15%	113.12	1725
CHACO 2408 36P 143H	61.52	43.92	17.61	71.38%	15.81	525
CHACO UNIT 002	223.70	210.83	12.86	94.25%	126.50	1525
CHACO UNIT 004	391.54	372.00	19.54	95.01%	112.32	2400
DOME FEDERAL 13 041	441.80	435.36	6.44	98.54%	212.00	2150
ESCRITO D32 2408 002H	183.17	177.36	5.81	96.83%	45.07	1100
ESCRITO L32 2408 001H	137.41	133.30	4.11	97.01%	56.90	1050
ESCRITO M32 2408 001H	77.84	71.42	6.42	91.75%	53.06	1025
FEDERAL 15 041	284.09	277.33	6.75	97.62%	187.98	2975
FEDERAL 35 043R	134.08	127.04	7.04	94.75%	44.77	1150
FEDERAL 6 022	226.49	174.38	52.12	76.99%	53.62	775
FEDERAL 6 041	313.55	293.06	20.49	93.46%	201.17	1050
FEDERAL 9 031	178.75	167.75	11.00	93.85%	144.17	1675
FEDERAL D 002	606.57	528.49	78.08	87.13%	115.65	1125
FEDERAL F 001	822.35	752.43	69.92	91.50%	286.89	2150
GREAT WESTERN FED 001	60.39	50.68	9.71	83.93%	27.32	1075
LAVA FALLS 001	148.76	143.26	5.51	96.30%	65.96	1650
LOGOS 004	228.51	202.17	26.34	88.47%	137.23	1575
LOGOS 006	188.19	171.56	16.63	91.16%	157.63	1825
LYBROOK H09 2308 001H	314.37	311.35	3.03	99.04%	299.65	3050
LYBROOK H14 2308 001H	635.09	630.46	4.63	99.27%	311.90	3025
LYBROOK I02 2308 001H	155.48	138.71	16.77	89.21%	72.48	1175
LYBROOK I02 2308 002H	126.06	123.26	2.80	97.78%	123.26	1500
LYBROOK I10 2308 001H	359.48	359.48	0.00	100.00%	359.48	3225
LYBROOK L14 2308 001H	581.96	579.06	2.89	99.50%	528.72	2525
LYBROOK M11 2308 001H	207.52	206.72	0.80	99.62%	206.72	2700
NAGEEZI FEDERAL 001	983.16	966.75	16.41	98.33%	648.90	2675
NEW MEXICO STATE 001	97.11	87.02	10.08	89.62%	36.99	900
NEW MEXICO STATE 002	75.05	70.47	4.59	93.89%	69.81	600
NEW MEXICO STATE 003	164.89	156.51	8.39	94.91%	57.63	650
NEW MEXICO STATE 004	82.62	81.08	1.54	98.13%	65.66	900
NOEL REYNOLDS 001	234.12	227.61	6.51	97.22%	221.66	3025

RIDDEL FEDERAL 001	505.81	486.79	19.03	96.24%	312.50	1450
S BLANCO STATE 36 F 001	49.26	46.21	3.05	93.81%	30.69	725
SAPP 002	97.88	92.73	5.15	94.74%	54.39	2050
SAPP 092	339.35	337.13	2.23	99.34%	318.29	2825
SOUTH BLANCO COAL 36 001	23.67	18.08	5.59	76.39%	18.08	725
SOUTH BLANCO FEDERAL 25 002	33.86	30.03	3.82	88.71%	13.02	450
SOUTH BLANCO FEDERAL 25 003	24.25	21.67	2.59	89.33%	19.24	725
SOUTH BLANCO FEDERAL 25 005	39.19	37.66	1.52	96.11%	36.16	725
SOUTH BLANCO FEDERAL 26 002	53.65	50.59	3.06	94.30%	20.34	650
SOUTH BLANCO FEDERAL 26 007	66.79	64.98	1.81	97.29%	56.03	800
SOUTH BLANCO FEDERAL 33 001	251.10	246.25	4.84	98.07%	236.28	2750
SOUTH BLANCO NAVAJO 26A 004	89.08	86.77	2.31	97.41%	69.29	875
SOUTH BLANCO STATE 36 002	39.20	33.26	5.94	84.85%	18.41	575
SOUTH BLANCO STATE 36 003	49.90	45.61	4.29	91.40%	21.23	575
SOUTH BLANCO STATE 36 005	32.28	28.58	3.71	88.52%	28.33	625
SOUTH BLANCO STATE 36 006	55.67	43.31	12.36	77.80%	20.69	600
SOUTH BLANCO STATE 36 007	78.82	69.42	9.40	88.08%	57.42	700
STATE OF NEW MEXICO 16 021	344.40	335.82	8.58	97.51%	212.61	1575
STATE OF NEW MEXICO 16 043	123.77	114.97	8.81	92.88%	69.77	1350
STATE OF NEW MEXICO 36 012	40.20	39.47	0.73	98.18%	39.47	800
STATE OF NEW MEXICO 36 013	26.05	22.76	3.29	87.38%	13.48	750
STATE OF NEW MEXICO 36 014	85.78	77.57	8.22	90.42%	35.77	875
STATE OF NEW MEXICO 36 021	31.20	27.35	3.85	87.67%	15.36	600
STATE OF NEW MEXICO 36 024	43.72	24.27	19.45	55.52%	8.56	450
STATE OF NEW MEXICO 36 031	31.57	28.99	2.58	91.83%	28.78	600
STATE OF NEW MEXICO 36 043	23.86	20.28	3.58	85.00%	9.63	475
STATE OF NEW MEXICO 36 044	36.29	27.03	9.25	74.50%	22.71	725
THE BEAR 001	1253.65	1177.74	75.91	93.95%	680.26	1825
TURTLE MOUNTAIN	104.94	100.01	4.92	95.31%	57.07	875

35 001						
TURTLE MOUNTAIN 35 003	169.78	161.88	7.90	95.35%	74.95	1350
UNION NAVAJO ALLOT 5 021	189.21	176.50	12.71	93.28%	123.80	2175
WARNER CALDWELL 001A	147.85	133.99	13.87	90.62%	70.69	1575
WARNER CALDWELL 003B	240.50	237.24	3.26	98.64%	237.24	2350
TOTALS	**19990.38**	**18891.24**	**1099.13**			

Table 3-10. Thiessen Polygon Analysis for the Existing Environment

Figure 3.1 Existing Environment Thiessen Analysis Map



3.7.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Direct impacts from the Proposed Action would result in the disturbance and modification of 22.87 acres of wildlife habitat. Removed vegetation would not be replaced with the same vegetation species, structure, diversity or density—at least across the 17.16 acres not previously disturbed. This direct habitat alteration would result in the adjustment of wildlife use of the project area. Wildlife habitat impacts would include the long term loss of natural vegetation and the long term changes in vegetation composition and structure. The direct habitat loss would be long term, as reclaimed areas would differ in vegetation composition and diversity. Long term operation of the well on 2.53 acres would both directly and indirectly affect wildlife.

Excepting the proposed well pad and access road, all other project components of the proposed project under Alternative B were located adjacent to existing disturbances to minimize impacts on wildlife and wildlife, including sensitive species and their habitats. The proposed Chaco 23-08 3 #1H well-tie pipeline has been located parallel to existing pipelines and an existing access road.

Most species observed or expected to inhabit the area are generalists and would be minimally affected by the changes in vegetation composition. During construction and drilling activities, wildlife within the project area would be displaced to adjacent habitat or may temporarily avoid the area because of noise and human activity. Once construction and drilling is complete, wildlife may return to the area. Small wildlife, particularly burrowing species, may be killed during construction activities. During the operational phase of the wells, the level of human and vehicular activity in the analysis area would decrease substantially relative to the construction and drilling phases. One light-duty vehicle would continue to access the area on near daily basis. Heavy-duty vehicles (semi-trucks) would access the well pad one to two times a day for approximately six months. After six months of operations, traffic is anticipated to decrease to approximately one trip per month.

Long term impacts from vehicle traffic on roads could include incidental wildlife mortality. Animal-vehicle collisions are variable depending on the time of day, speed and volume of traffic, local topography, structural features of the road, and the size and behavior of the individual species. Wildlife may be displaced during the construction, drilling and completion phases of the Proposed Action. Due to increased human activity and vegetation changes that would be expected if the Proposed Action were implemented, wildlife would likely re-inhabit the project area during the well production phase, but there may be a change in wildlife species composition, diversity, and abundance.

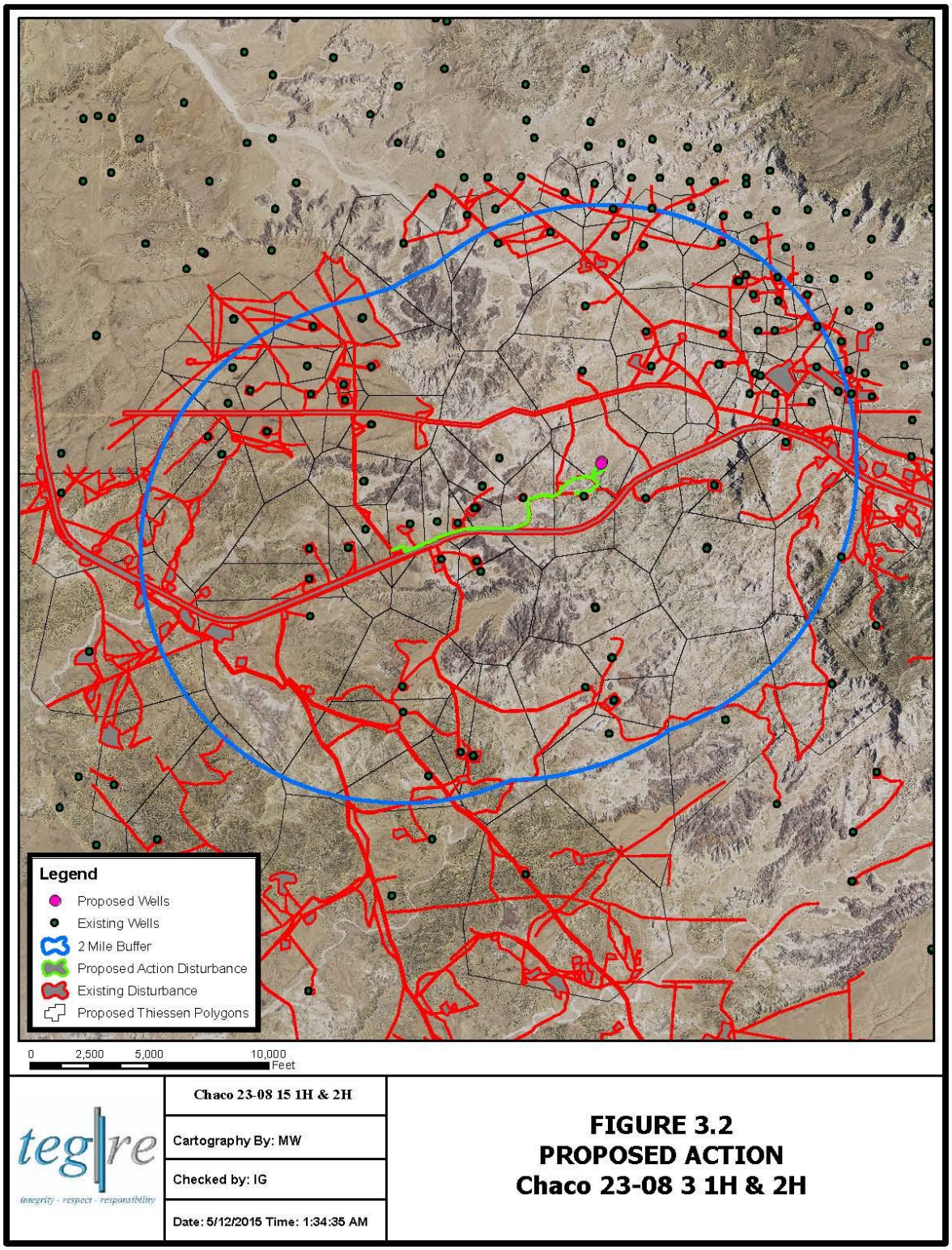
Habitat fragmentation would be considered an indirect impact to wildlife. Fragmentation was examined using the Thiessen Polygon Analysis method. Figure 3.2 shows the Proposed Action Thiessen analysis. This figure demonstrates that the proposed project is on the western edge of intensely developed and moderately fragmented habitat areas. South of the Proposed Action, existing development and habitat fragmentation is considerably less. Minimal additional fragmentation to wildlife habitat would occur as a result of the Proposed Action (Figure 3.2). Displaying the existing environment with the addition of the Proposed Action, the total number of polygons associated with existing well pads that intersect the 2-mile buffer is 97. These polygons have a total area of 19,990.38 acres (unchanged from the existing environment). This represents an increase of one polygon from the existing environment condition. The average polygon size is 206.09 acres, a decrease of 2.15 acres from the existing environment condition. Decreases in average polygon size and increases in polygon numbers is indicative of an increase in habitat fragmentation in the analysis area. However, the median size polygon across affected and unaffected polygons is 134.08. This is an increase of 1.84 acres. Large contiguous polygons are reflective of less fragmentation. Affected polygons are those that resulted in a change in size or shape as a result of the Proposed Action on the analysis area. Unaffected polygons are those that did not change shape or size as a result of the Proposed Action. Similarly, an increase in median polygon size is indicative that the Proposed Action is positioned such that the larger analysis area polygons remain large, while the smaller polygons were further fragmented—the Proposed Action was placed away from largely non-fragmented lands. The smallest polygon under the Proposed Action is 23.67 acres while the largest polygon is 1253.65 acres; both remain unchanged from the existing environment condition. Table 3-11

details the changes in polygons from the existing environment that would be expected by implementation of the Proposed Action. Figure 3.2 gives a visual representation of this analysis for the Proposed Action.

Table 3-11. Thiessen Polygon Analysis for the Proposed Action (Alternative B)

Associated Well Name	Polygon Acres	Undisturbed Acres	Disturbance Acres	Percent Undisturbed	Largest Contiguous Area	Furthest Distance From Disturbance (25' interval)
Affected Polygons						
CHACO 23-8-3 1H	196.81	186.81	10.00	94.92%	131.15	900
CHACO 2308 03E 403H	368.17	355.11	13.06	96.45%	186.87	2900
CHACO 2308 04P 149H	58.22	47.19	11.03	81.05%	30.05	1350
FEDERAL 3 023	191.74	176.10	15.65	91.84%	98.02	1500
FEDERAL 3 043	193.19	172.86	20.33	89.48%	67.40	1225
FEDERAL 34 043	332.76	318.99	13.76	95.86%	266.07	3100
HEROS 002M	88.32	81.07	7.25	91.79%	50.95	875
HEROS 003N	127.96	114.08	13.88	89.15%	99.00	1700
HEROS 004O	84.56	82.31	2.26	97.33%	81.78	1725
JEFFERS FEDERAL 2 023	269.74	250.79	18.95	92.98%	158.89	2950
LOGOS 005	38.03	27.82	10.20	73.17%	16.33	1075
TURTLE MOUNTAIN 35 002	215.36	194.90	20.46	90.50%	106.33	1525
Non-Affected Polygons	**17825.52**	**16870.60**	**954.92**			
TOTALS	**199990.38**	**18874.09**	**116.28**			

Figure 3.2 Proposed Action (Alternative B) Thiessen Analysis Map



Cumulative Impacts

The analysis area for cumulative effects to wildlife is the area within 2 miles of the project area. Based on analysis of the existing environment, the analysis area qualifies as a “High Impact Area” as defined in the **Energy Development Guidelines from the Western Association of Fish and Wildlife Agencies** (Lutz et.al. 2011). The Thiessen analysis of the Proposed Action demonstrates that the Proposed Action would have a minimal increase on cumulative wildlife habitat fragmentation compared to the existing environment. The minimized fragmentation increase is due to the location of the Proposed Action project components being adjacent to and overlapping with existing and other proposed disturbances. The cumulative impact of future oil and gas well development in the analysis area would vary depending on the scope and location of development and their relation to other non-oil and gas disturbances. Due to the expected continued development in the general region (**SECTION 3.3.2 CUMULATIVE IMPACTS**), the proposed action is not expected to have more than a minimal additive effect when considered in conjunction with the likely future development in the analysis area.

3.7.3. *Impacts from Alternative C*

Direct and Indirect Impacts

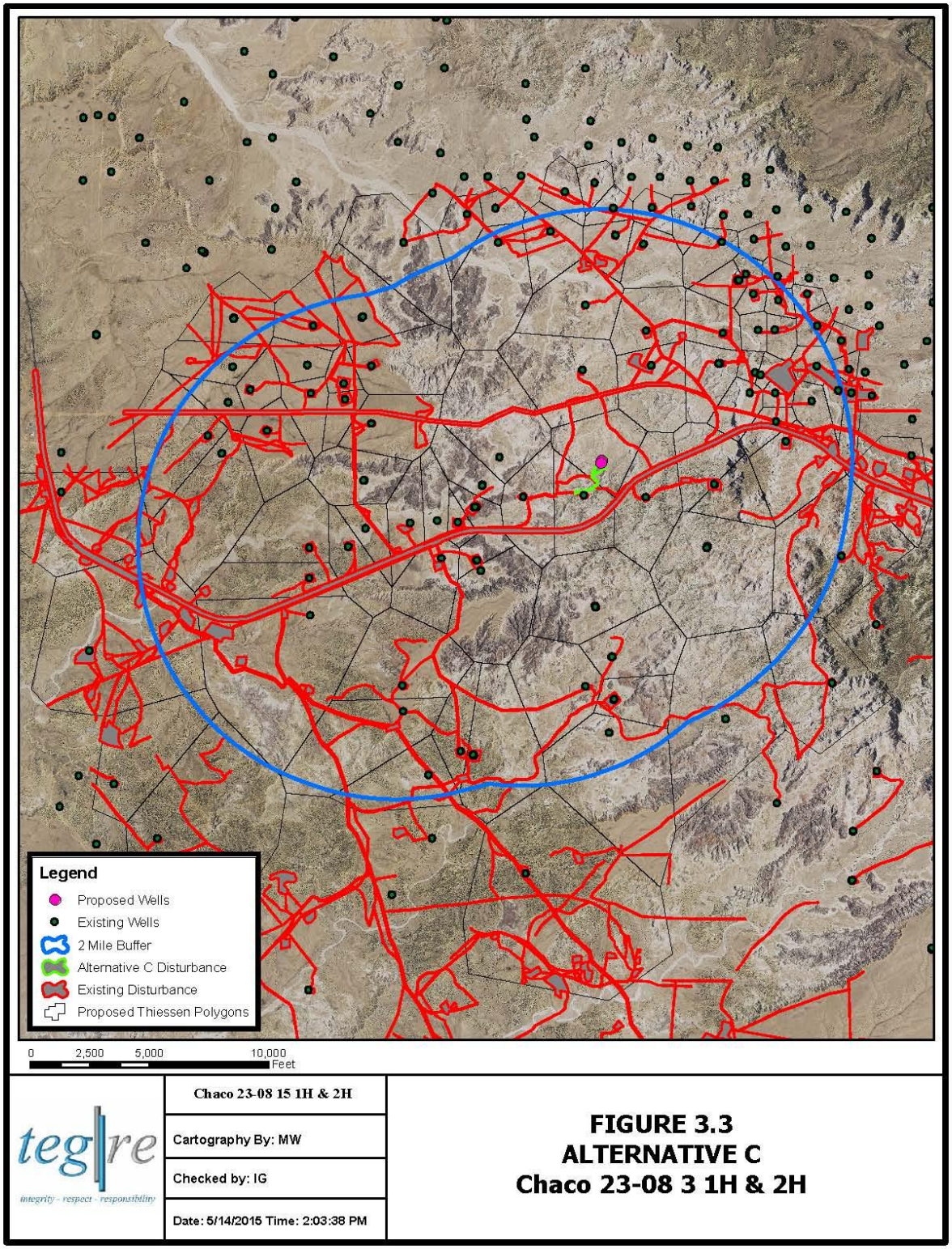
Direct and indirect impacts to wildlife under Alternative C would be similar to those as described for Alternative B (**SECTION 2.7.2**). Alternative C would disturb 15.02 acres less than the Proposed Action, and the project would be located adjacent to the same existing disturbances as the Proposed Action.

Indirect impacts and wildlife habitat fragmentation from Alternative C were examined using the Thiessen Polygon Analysis method. The Thiessen Figure 3.3 shows Alternative C relative to the existing environment. Resulting changes to the affected and unaffected polygons under Alternative C do not differ from the Proposed Action. No additional fragmentation over the existing environment would occur under Alternative C that that analyzed for the Proposed Action.

Table 3-12. Thiessen Polygon Analysis for Alternative C

Associated Well Name	Polygon Acres	Undisturbed Acres	Disturbance Acres	Percent Undisturbed	Largest Contiguous Area	Furthest Distance From Disturbance (25' interval)
Affected Polygons						
CHACO 23-8-3 1H	196.81	186.81	10.00	94.92%	131.15	900
CHACO 2308 03E 403H	368.17	355.11	13.06	96.45%	186.87	2900
CHACO 2308 04P 149H	58.22	47.19	11.03	81.05%	30.05	1350
FEDERAL 3 023	191.74	176.10	15.65	91.84%	98.02	1500
FEDERAL 3 043	193.19	172.86	20.33	89.48%	67.40	1225
FEDERAL 34 043	332.76	318.99	13.76	95.86%	266.07	3100
HEROS 002M	88.32	81.07	7.25	91.79%	50.95	875
HEROS 003N	127.96	114.08	13.88	89.15%	99.00	1700
HEROS 004O	84.56	82.31	2.26	97.33%	81.78	1725
JEFFERS FEDERAL 2 023	269.74	250.79	18.95	92.98%	158.89	2950
LOGOS 005	38.03	27.82	10.20	73.17%	16.33	1075
TURTLE MOUNTAIN 35 002	215.36	194.90	20.46	90.50%	106.33	1525
Non-Affected Polygons	**17,825.52**	**16,870.60**	**954.92**			
TOTALS	**19,990.38**	**18,874.09**	**116.28**			

Figure 3.3 Alternative C Thiessen Analysis Map



All other potential direct and indirect wildlife impacts under Alternative C would be the same as detailed in the Proposed Action, **Section 3.7.2**.

Cumulative Impacts

Cumulative impacts to wildlife under Alternative C would be similar to those under the Proposed Action (see Section 3.5.2). All other potential cumulative wildlife impacts under Alternative C would be the same as detailed in **Section 3.7.2**, Impacts from the Proposed Action (Alternative B).

The analysis area for cumulative effects to wildlife is the area within 2 miles of the project area. Based on analysis of the existing environment, the analysis area qualifies as a "High Impact Area" as defined in the **Energy Development Guidelines from the Western Association of Fish and Wildlife Agencies** (Lutz et.al. 2011). Due to the location of the Alternative C project components being adjacent to and overlapping with existing and other proposed disturbances similarly to the Proposed Action, Alternative C impacts are similar to those under the Proposed Action. Alternative C would have a minimal increase on cumulative wildlife habitat fragmentation compared to the existing environment and the same increase as under the Proposed Action. The cumulative impact of future oil and gas well development in the analysis area would vary depending on the scope and location of development and their relation to other non-oil and gas disturbances. Due to the expected continued development in the general region (**SECTION 3.2.3 CUMULATIVE IMPACTS**), the proposed action is not expected to have more than a minimal additive effect when considered in conjunction with the likely future development in the analysis area.

3.8. Migratory Birds

3.8.1. *Affected Environment*

The Migratory Bird Treaty Act of 1918 as amended (MBTA), makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. Executive Order 13186 dated January 17, 2001 calls for increased efforts to more fully implement the Migratory Bird treaty Act of 1918. In keeping with this mandate, the BLM-FFO has issued an interim policy to minimize unintentional take as defined by the EO 13186 and to better optimize migratory bird efforts related to BLM-FFO activities (BLM 2010). In keeping with this policy, a list of priority birds of conservation concern which occur in similar eco-regions as the Proposed Action area was compiled through a review of existing bird conservation plans including:

- Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC),
- New Mexico Partners in Flight (NMPIF) New Mexico Bird Conservation Plan,
- Comprehensive Wildlife Conservation Strategy for New Mexico (CWCS),
- Gray Vireo Recovery Plan,
- The North American Waterbird Conservation Plan, and
- Recovery plans and conservation plans/strategies prepared for federally-listed candidate species.

The selected species have a known distribution in the BLM-FFO area and may be affected by various types of disturbances. These species and a brief assessment of their habitat are identified in Table 3-12.

Table 3-12. Migratory Birds with Potential to Occur in the Proposed Project Areas

Species Name	Habitat Associations	Potential to Occur in the Project Area
Bendire's thrasher (*Toxostoma bendirei*)	On the Colorado Plateau, inhabits open sagebrush with scattered junipers; sparse or degraded understory, lower elevations. Avoids riparian areas and arroyos with dense shrub cover	Proposed project area has low shrub height, open sagebrush and lack of riparian areas. May occur within the project action area
Black-throated sparrow (*Amphispiza bilineata*)	Xeric habitats dominated by open shrubs with areas of bare ground.	Project area includes areas of open shrubs with areas of bare ground habitat. May occur within the project action area.

Species Name	Habitat Associations	Potential to Occur in the Project Area
Brewer's sparrow (*Spizella breweri*)	Closely associated with sagebrush, preferring dense stands broken up with grassy areas.	Proposed project area has areas of significant sagebrush cover. May occur within the project action area
Gray vireo (*Vireo vicinior*)	In northern NM, stands of piñon pine and Utah juniper 5800 – 7200 ft, open with a shrub component and mostly bare ground; antelope bitterbrush, mountain mahogany, Utah serviceberry and big sagebrush often present. Broad, flat or gently sloped canyons, in areas with rock outcroppings, or near ridge-tops.	Areas of piñon-juniper occur within the western extent of the analysis area. Species may occur, but is not likely to occur within the project action area.
Loggerhead shrike (*Lanius ludovicianus*)	Open country interspersed with improved pastures, grasslands, and hayfields. Nests in sagebrush areas, desert scrub, and woodland edges.	Desert scrub in the analysis area could provide suitable habitat for the species, although significant grassy areas are lacking.
Mountain bluebird (*Sialia currucoides*)	Open piñon-juniper woodlands, mountain meadows, and sagebrush shrublands; requires larger trees and snags for cavity nesting.	Desert scrub in the analysis area provide suitable habitat for the species, although nest habitat is limited. May occur in the project action area.
Mourning dove (*Zenaida macroura*)	Open country, scattered trees, and woodland edges. Feeds on ground in grasslands and agricultural fields. Roost in woodlands in the winter. Nests in trees or on ground.	Desert scrub in the analysis area could provide suitable habitat for the species. May occur in the project action area.
Sage sparrow (*Amphispiza belli*)	Large and contiguous areas of tall and dense sagebrush. Negatively associated with seral mosaics and patchy shrublands and abundance of greasewood.	Low sagebrush cover is present within the action area. The species may occur within the project action area.
Sage thrasher (*Oreoscoptes montanus*)	Shrub-steppe dominated by big sagebrush.	Low sagebrush cover is present within the action area. The species may occur within the Project action area.
Scaled quail (*Callipepla squamata*)	Brushy arroyos, cactus flats, sagebrush or mesquite plains, desert grasslands, Plains grasslands, and agricultural areas. Good breeding habitat has a diverse grass composition, with varied forbs and scattered shrubs.	Desert scrub in the analysis area could provide suitable habitat for the species. May occur in the project action area.
Swainson's hawk (*Buteo swainsoni*)	A mixture of grassland, cropland, and shrub vegetation; nests on utility poles and in isolated trees in rangeland. Nest densities higher in agricultural areas.	Desert scrub in the analysis area could provide suitable habitat for the species. May occur in the project action area.
Vesper sparrow (*Pooecetes gramineus*)	Dry montane meadows, grasslands, prairie, and sagebrush steppe with grass component; nests on ground at base of grass clumps.	Desert scrub in the analysis area could provide suitable habitat for the species. May occur in the project action area.
Source: BLM-FFO 2015		

The proposed Chaco 23-08 3 Wells Project area exhibits suitable nesting habitat for loggerhead shrike, mountain plover, pinyon jay, juniper titmouse, sage thrasher, Bendire's thrasher, gray vireo and sage sparrow. The project area provides suitable foraging, winter and migratory habitat for the long-billed curlew, grasshopper sparrow and chestnut-collared longspur.

Actual potential effects on birds in the project area are difficult to predict. Past studies have shown mixed effects of oil and gas development, including compressor noise, on nesting migratory birds. Frances and Ortega (2006 unpublished report to BLM-FFO) found no significant difference in nest density or nest success between sites with or without wellhead compressors. Some species, such as black-chinned

humming bird and house finch, were more common on sites with compressors while others, such as mourning dove and spotted towhee, appeared to either avoid or nest further from compressors. Holmes and King (2006) found that sage sparrow had lower nest survival in an area with on-going gas development while Brewer's sparrow had higher survival rates when compared with populations in an undeveloped control area.

The BLM-FFO has monitored avian species since 1999. Sage-obligate songbird species have been monitored to determine population trends as a result of reductions in sagebrush habitat. The results show that sage thrasher, sage sparrow, and Brewer's sparrow populations appeared stable, but sage thrashers showed a decline over the study years (USDI BLM 2014b). The BLM-FFO also monitors raptor nesting and applies special stipulations, as outlined in the Special Management Species Policy Update (2008), to protect nesting ferruginous hawk, golden eagle, bald eagle, American peregrine falcon and prairie falcon. Other nesting raptors are also protected by site-specific stipulations. BLM-FFO Special Management Species policy provides for 1/3-mile nest buffers from construction, drilling, or completion activities for active or historic golden eagle nests during the breeding season. Nest buffers are currently enforced from February 1st through June 30th annually (USDI BLM 2014b).

The proposed project and action area were visually scanned for raptors, raptor nests and whitewash. No raptors or their sign were observed during the on-site field survey. According to the most recent BLM-FFO raptor nest GIS data, no raptor nests are located within 1/3 of a mile (approximately 1,200 feet) of the project area. BLM-FFO GIS data indicates that the nearest known historical or currently active raptor nest, Americian peregrine falcon, occurs approximately 7.6 miles to the north, northeast of the project area (BLM 2014). A golden eagle was sighted perching on the shale cliffs approximately 600 feet west of the proposed well pad. No other raptors were observed within the project area. Raptors are unlikely to nest in the project area vicinity and may rarely to occasionally forage in the area.

3.8.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

The proposed project would increase direct migratory bird habitat disturbance by 17.16 acres within the project area. The Proposed Action would also indirectly affect migratory birds in the project area vicinity via the increase in human intrusions, noise and dust. Migratory bird habitat fragmentation would also be realized for all proposed disturbances. Direct impacts to migratory birds would include 22.87 acres of disturbing activities. Within these acres the habitat modification of approximately 17.16 acres of Saltbush Shadscale/Winterfat Vegetation Community would result. Migratory birds in the vicinity of the project area would be impacted by disturbance from all phases of the proposed project. Construction of an overhead power line in the project area would provide additional perches for raptors and songbirds in the vicinity. Disturbance to migratory birds would be the greatest during construction, drilling, completion project phases. During the production phase, long term impacts to migratory birds would result from habitat modifications, periodic vehicle disturbances, and human foot-traffic for well maintenance and operations.

The removal of about 123 juniper and piñon trees of various ages and sizes by the proposed Chaco 23-08 3 Wells Project under the Proposed Action would result in a long term loss of potential perch sites. This loss of perch habitat is not expected to adversely affect the foraging abilities of migratory birds and raptors, given the abundance of similar habitat in the surrounding area. After reclamation, there would be a long term change in vegetation density and composition. This could affect the prey base for raptors. Additional impacts may include avoidance of the analysis area by raptor species during construction, drilling and operation phases due to habitat disturbance, human and vehicle presence, and associated noise.

Impacts to migratory birds would be greater if construction occurs during the breeding season, which is May 15th through July 31st. Construction during this period could result in nest destruction or may cause nest abandonment in adjacent areas. Pre-construction nest surveys would be conducted to identify any active nests should construction occur between May 15th and July 31st (see **SECTION 2.2.11**).

Some birds would be attracted to the vertical and complex structures at the production site, including warm equipment, though composition of species would differ from those occupying the area prior to disturbances. Resultantly, migratory birds could come into contact with chemicals or fluids stored on-site. Open pits would be netted and vent caps placed on all open pipes to prevent bird entry and nesting. Any spills would be promptly cleaned up. Although individual migratory birds could be impacted by the Proposed Action, no population level impacts are expected.

Cumulative Impacts

The spatial analysis area for cumulative impacts to special management wildlife species is the proposed project area and a 2 mile buffer corresponding to the wildlife analysis area (**SECTION 3.7.2**). Habitat disturbance and fragmentation in the analysis area is primarily the result of oil and gas development (including well pads, access roads, and pipeline corridors). Other reasonably foreseeable actions within the analysis area that may impact migratory birds would include other energy development projects, livestock grazing, commercial and residential development, wildfire, and vegetation management. Relative to the existing and likely future impacts to migratory birds in the area, Proposed Action impacts would have a minimal additive effect to cumulative impacts.

3.8.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct impacts to migratory birds under Alternative C would be similar to those described for Alternative B, but decreased by 15.02 acres of disturbance and habitat modification would be decreased by 9.38 acres. All other potential direct and indirect migratory bird impacts under Alternative C would not be altered from those detailed in Proposed Action (see Section 3.8.2.).

Cumulative Impacts

The cumulative spatial analysis area for migratory birds is the proposed project area and immediately adjacent lands. Cumulative migratory bird impacts under Alternative C would similar to those for the Proposed Action due to the similar types of disturbances, including the amount of human intrusions (i.e. construction activities and on-going operations personnel). Details of the cumulative migratory bird impacts are discussed in Section 3.8.2 Cumulative Impacts.

3.9. Special Status Species

3.9.1. *Affected Environment*

In accordance with BLM Manual 6840, the BLM-FFO has prepared the Farmington Field Office Special Management Species (SMS) list. BLM-FFO management efforts are focused toward maintaining habitats for these species, under a multiple use mandate. The BLM-FFO's objective is to manage these species, which are not federally listed as threatened or endangered, in order to prevent or reduce the need to list them as threatened or endangered in the future. The authority for this policy and guidance is established by the Endangered Species Act of 1973, as amended; Title II of the Sikes Act, as amended; the Federal Land Policy and Management Act (FLPMA) of 1976; and Department of Interior Manual 235.1.1A. The BLM-FFO SMS are listed below in Table 3-13 with their potential to occur in the project area, the spotted bat (*Eudema maculatum*) and the Townsend's big-eared bat (*Corynorhinus townsendii*) are not included as the project area and surrounding areas do not provide suitable habitat for the presence of these species. Field investigations of the project area were conducted on November 08, December 02, 06, 11 2014 and January 09 and 10 2015.

The project area provides potential habitat for American peregrine falcon, prairie falcon (*Falco mexicanus*), golden eagle, mountain plover (*Charadrius montanus*), pinyon jay (*Gymnorhinus cyanocephalus*), Bendire's thrasher (*Toxostoma bendirei*), and to a lesser degree ferruginous hawk (Buteo regalis). The proposed project area also provides habitat types that could be occupied by Gunnison's prairie dog (*Cynomys gunnisoni*). No sign of holes or activities by prairie dogs were identified during the on-site visits. The closest known prairie dog town is 9.09 miles to the north, northeast of the

proposed project area. The closest verified mountain plover habitat is 8.78 miles to the west, southwest of the proposed project area.

The proposed project and action area were visually scanned for raptors, raptor nests and whitewash. One golden eagle was observed perched on the shale bluffs approximately 600 feet west of the proposed well pad. No other raptors or their sign were observed during the on-site field surveys. No prairie dog towns or western burrowing owls, or their sign were observed within the proposed project area. According to the most recent BLM-FFO raptor nest GIS data, no raptor nests are located within 1/3 of a mile (approximately 1,200 feet) of the project area. According to the BLM-FFO GIS database, the closest known historical or currently active raptor nest (American peregrine falcon) occurs approximately 7.6 miles to the north, northeast of the project area (BLM-FFO 2014). Seven golden eagle (Aquila chrysaetos) nests and one American peregrine falcon nest occur within a 15-mile radius of the proposed project area (BLM 2014). Excepting the one golden eagle sighting, no other sign of raptor use, such as whitewash or nests, were observed in the proposed project or action area. The closest known burrowing owl nest site is 12 miles to the northeast of the proposed project area.

The proposed project is within the BLM-FFO designated potential habitat area for Brack's hardwall cactus (*Sclerocactus cloveriae* var. *brackii*) and Aztec gilia (*Aliciella 59ormosa*) and the area vegetation and soils reflect typical associated habitat for these species. Brack's hardwall cacti were observed during the field surveys of both the Proposed Action (Alternative B) and Alternative C areas. Biological surveys covering 50 feet on either side of all proposed disturbance widths were conducted in the project area. During biological surveys of the proposed project areas and buffers, 626 individual Brack's hardwall cacti were identified and their GPS coordinates recorded (see Biological Survey Report). No Aztec gilia were located within the Proposed Action or Alternative C areas. However, survey results located the presence of habitats that may support both Brack's hardwall cactus and Aztec gilia within the project areas.

During these field surveys, 626 Brack's hardwall cacti were observed. All Brack's hardwall cacti observed were pin-flagged and GPS located (see Biological Survey Report for the proposed Chaco 23-08 3 Wells Project). No other BLM special management species were observed during the field surveys.

Table 3-13. BLM-FFO Special Management Species with Potential to Occur in the Analysis Area

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Analysis Area (Proposed Action, Alternative B and Alternative C)
	FFO	BLM		
Birds				
Golden Eagle (*Aquila chrysaetos*)	SMS[1]		In the West, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and trees.	The surrounding action area contains suitable habitat for foraging, but not nesting.
Ferruginous hawk *(Buteo regalis)*	SMS	S	Grasslands and semi-desert shrub; occasionally piñon-juniper edge habitat. Nest on rock spires in NW New Mexico.	Analysis area contains suitable piñon-juniper edge habitat for foraging.
Prairie falcon *(Falco mexicanus)*	SMS	S	Arid, open country, grasslands or desert scrub, rangeland; nests on cliff ledges, trees, power structures.	The surrounding analysis area contains suitable habitat for foraging.
Mountain plover *(Charadrius montanus)*	SMS		Semi desert, grasslands, open arid areas, bare fields, breeds in open plains or prairie.	Analysis area does contain flat, open grasslands for suitable habitat.
American peregrine falcon (*Falco peregrinus anatum*)	SMS	S	Open country near lakes or rivers with rocky cliffs and canyons. Tall city bridges and buildings also inhabited.	Analysis area does not contain rocky cliffs, canyons or large water features. However, the analysis area contains suitable habitat for foraging.
Bald eagle (*Haliaeetus leucocephalus)*	SMS	S	Near lakes, rivers and cottonwood galleries. Nests near surface water in large trees. May forage terrestrially in winter	Analysis area does not contain suitable habitat for nesting or foraging opportunities unlikely.
Pinyon jay (*Gymnorhinus cyanocephalus*)	SMS	S	Piñon-juniper woodlands. Occasionally areas dominated by ponderosa pine, sagebrush, or chaparral (NMPIF 2007).	Vegetation communities with limited piñon pine and oneseed juniper trees within the proposed project area could provide nesting and foraging habitat for this species..
Chestnut-collared longspur (*Calcarius ornatus*)	SMS	S	Sparse desert shrublands, degraded grasslands, and open woodlands with scattered shrubs. On the Colorado Plateau, open sagebrush shrublands with scattered junipers. Avoids riparian areas and arroyos with dense shrub cover	Vegetation communities within proposed project area could provide suitable foraging and nesting habitat for this species.
Bendire's thrasher (*Toxostoma bendirei*)		S	Sparse desert shrublands, degraded grasslands, and open woodlands with scattered shrubs. On the Colorado Plateau, open sagebrush shrublands with scattered junipers. Avoids riparian areas and arroyos with dense shrub cover	Sagebrush shrublands within proposed project area provide potential foraging and nesting habitat for this species.
Burrowing owl	SMS	S	Associated with prairie dog towns. In	Analysis area does contain

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Analysis Area (Proposed Action, Alternative B and Alternative C)
	FFO	BLM		
(Athene cunicularia)			dry, open, short-grass, treeless plains	suitable habitat for foraging and nesting. However, no associated prairie dog colonies occur within or near the Analysis area.
Mammals				
Gunnison's prairie dog (*Cynomys gunnisoni*)		S	Grasslands and shrublands. Often scattered junipers and pines.	There areno prairie dog colonies within and adjacent to proposed project area although habitat exist in analysis area.
Plants				
Brack's hardwall cactus (*Sclerocactus cloveriae* ssp. *Brackii*)	SMS	S	Sandy clay slopes of the Nacimiento Formation in sparse semi desert, piñon-juniper grasslands and open arid areas of badland habitat (5,000-6,000 ft).	Nacimiento Formation occurs; and the surface soils reflect those typical of other type localities. Brack's hardwall cactus found within the analysis area.
Aztec gilia (*Aliciella 61ormosa*)	SMS	S	Arid and sparsely vegetated Badland /Salt desert scrub communities in soils of the Nacimiento Formation (5,000-6,000 ft).	Nacimiento Formation occurs. Surface soils and vegetative growth patterns of the Analysis area do reflect typical associated habitat for this species.
Grama grass cactus (*Sclerocactus papyracanthus*)	SMS	S	Desert grasslands or open piñon-juniper woodlands.	WOULD NOT OCCUR: No piñon-juniper woodlands or desert grasslands within proposed project area.
Mancos saltbush (*Proatriplex pleiantha*)	SMS	S	Desert badlands. Saline clay soils of the Mancos and Fruitland Formations Elevation: 5,000 to 5,500 feet	No badlands within proposed project area.
San Juan milkweed (*Asclepias sanjuanensis*)	SMS	S	Juniper savannah or Great Basin desert scrub. Sandy loam soils. Usually in disturbed areas.	No juniper savannah or Great Basin desert scrub habitats within proposed project area.

SMS = FFO Special Management Species
S = BLM Sensitive Species

In addition to analyzing BLM-FFO SMS species, the Biological Survey Report for the proposed project details the 16 federally listed threatened, endangered or candidate species with potential to occur within

the proposed project area. No suitable habitat for any federally listed or candidate species occurs within the project area, and so federally listed species were observed during the field surveys.

3.9.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Direct impacts would include the disturbance to 17.16 acres of previously undisturbed habitat for the identified species. The analysis area provides potential foraging habitat for golden eagle, ferruginous hawk, American peregrine falcon and prairie falcon. No potential nesting habitat for these species would be removed or modified by the Proposed Action. No active or abandoned prairie dog burrows were observed within the project area, therefore no suitable western burrowing owl nesting habitat is present. The erection of power poles in the project area under the Proposed Action, would improve the availability of high raptor perches in the area. The poles and lines may also be used by songbirds for perching. The removal of about 123 juniper and piñon trees of various ages and sizes by the Proposed Action would result in a long term loss of potential perch sites. This loss of perch habitat is not expected to adversely affect the foraging abilities of these raptor species, given the abundance of suitable sites in the surrounding area. After reclamation, there would be a long term change in vegetation density and composition. This could affect the prey base for these raptors. Additional impacts may include avoidance of the analysis area by these raptor species during construction, drilling and operation phases due to habitat disturbance, human and vehicle presence, and associated noise.

The analysis area provides suitable foraging and nesting habitat for mountain plover, pinyon jay, and Bendire's thrasher. Impacts to these species are consistent with those identified for migratory birds; avoidance of the analysis area during project activities due to habitat disturbance, human and vehicle presence, and associated noise. After reclamation, there would be a long term change in vegetation density and composition. This would result in long-term alteration in these species occupation patterns.

Coordinates taken from the Brack's hardwall cactus surveys were entered into a GIS system and were analyzed in relation to areas of existing and proposed project disturbances (road and existing pipelines). The proposed Chaco 23-08 3 #1H well-tie pipeline and the proposed Chaco 23-08 3 power line were moved closer to existing and proposed disturbances, minimizing Brack's hardwall cacti and habitat impacts. As a result of the realignments, 237 Brack's hardwall cacti were identified within the Proposed Action area. One Brack's hardwall cactus was found on the well pad, 59 Brack's hardwall cacti were located on the access road, 83 Brack's hardwall cacti were located on the Chaco 23-08 3 #1H well-tie pipeline, and approximately 94 Brack's hardwall cacti are intersected by the proposed proposed project's power line. The remaining 389 Brack's hardwall cacti were located on the buffer areas. A total of up to 237 Brack's hardwall cacti would require transplanting under the Proposed Action.

The transplanted Brack's hardwall cactus would to be expected have mortality, although the percentage of transplant success is not known. Positively, scientific information may be gained by monitoring transplanted Brack's hardwall cactus populations. Impacts to Brack's hardwall cacti resulting from the Proposed Action would affect individuals and habitats, but are not expected to result in population-level impacts.

The exposed Nacimiento Formation soils in the analysis area provide potential habitat for the Aztec gilia. No Aztec gilia were observed during field surveys.

Cumulative Impacts

The spatial analysis area for cumulative impacts to the Brack's hardwall cactus and Aztec gilia includes the Nacimiento habitat area as identified by the BLM-FFO for the Brack's hardwall cactus. This area totals 557,113 acres. There are approximately 1,152 existing wells and about 10,576.19 acres of existing disturbances that occurs within the analysis area. This represents 0.19% of total disturbance from oil and gas well projects. It is unknown how many Aztec gilia or Brack's hardwall cacti were removed or transplanted as a result of these wells because a database of individual species located does not yet exist, only suitable habitat boundaries. A portion of the reasonable foreseeable future Mancos well

developments assessed by Engler et. al. (2014) would also occur within this analysis area. Other past, present, and reasonably foreseeable future actions such as other energy development projects, livestock grazing, commercial and residential development, wildfire, and vegetation management that may also occur across this area

The Proposed Action would be cumulative to these existing disturbances as well as planned disturbances and contribute 17.16 additional acres of total disturbance previously undisturbed suitable habitat and long term impacts to 237 Brack's hardwall cacti. These acres would be additive to the existing disturbance acres and would be a 0.16% increase when compared against oil and gas disturbances.

485 new wells targeting development of the Mancos Formation could be added to the existing wells within the analysis area (Engler et. al. 2014). These wells could occupy a total 6,589.65 acres resulting in additional disturbance within the analysis area, about 0.12% of the habitat area acres. The Proposed Action would represent about 0.26% of these disturbances.

Based on the BLM-FFO existing well data (2015) combined with potential new well data from Engler et. al. (2014), the analysis area could contain a total of 1,637 wells. These wells could disturb a total of 17,165.65 acres. The Proposed Action would represent 0.10% of these disturbances.

The spatial analysis area for cumulative impacts to special management wildlife species is the proposed project area and a 2 mile buffer corresponding to the wildlife analysis area (**SECTION 3.7.2**). As discussed above, habitat disturbance and fragmentation in the analysis area is primarily the result of oil and gas development (including well pads, access roads, and pipeline corridors) as well as the other identified reasonably foreseeable actions within the analysis area. Relative to the existing and likely future impacts to special status birds in the area, Proposed Action impacts would have a minimal additive effect to cumulative impacts.

3.9.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct impacts to Special Management Species habitat under Alternative C would be 7.78 acres. This is 15.02 acres less than under the Proposed Action. Other direct impacts, such as mortality, would also likely decrease relative to the Proposed Action because less disturbing activities would result. This would be particularly relevant to burrowing species and plants.

Under Alternative C, a total of 60 Brack's hardwall cactus would be directly impacted. Relative to the Proposed Action, this is a decrease in the number of Brack's hardwall cacti impacted by 177 cacti. Alternative C as compared to the Proposed Action would result in 9.38 acres of less disturbance to suitable Brack's hardwall cactus and Aztec gilia habitat.

All other potential direct and indirect Special Management Species impacts under Alternative C would be the same as detailed in Proposed Action **SECTION 3.9.2**

Cumulative Impacts

Cumulative impacts analysis for Alternative C is similar as that for the Proposed Action because the alternatives are in the same area, and are of similar scope. Similarly, Alternative C impacts analysis uses the same analysis areas. Existing energy development and potential future Mancos energy development for the analysis area is presented in **SECTION 3.9.2.**

Alternative C would contribute 7.78 additional acres of disturbance previously undisturbed suitable habitat and long term impacts to 60 Brack's hardwall cacti. This is 9.94 acres less and 177 fewer Brack's hardwall cacti impacted than under the proposed action. Alternative C would result in a 0.07% increase in the existing disturbances on the analysis area.

When compared against the proposed future wells outlined in Engler et. al (2014) for the analysis area, Alternative C would represent about 0.11% of these disturbances.

Compared with the existing and proposed future wells, Alternative C would represent 0.05% of the disturbances on the analysis area.

Cumulative impacts on special management wildlife species is the same as that performed for wildlife in **SECTION 3.7.3**. Resulting changes to the affected and unaffected polygons under Alternative C do not differ from the Proposed Action. No additional fragmentation over the existing environment would occur under Alternative C that that analyzed for the Proposed Action.

3.10. Cultural Resources

3.10.1. *Affected Environment*

The proposed project is located within the archaeologically rich San Juan Basin of northwest New Mexico. In general, the history of the San Juan Basin can be divided into five major periods: PaleoIndian (ca. 10000 B.C. to 5500 B.C.), Archaic (ca. 5500 B.C. to A.D. 400), Basketmaker II-III and Pueblo I-IV periods (aka Anasazi; A.D. 1-1540), and the historic (A.D. 1540 to present), which includes Native American as well as later Hispanic and Euro-American settlers. Detailed descriptions of these various periods are provided in the Bureau of Land Management Farmington Field Office Final Environmental Impact Statement (2003) and will not be reiterated here. Additional information can also be found in an associated documented, Cultural Resources Technical Report (CRTR; SAIC 2002).

BLM Manual 8100, The Foundations for Managing Cultural Resources (2004) defines a cultural resource as "a definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups. (cf. “traditional cultural property”). Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit described in this Manual series. They may be but are not necessarily eligible for the National Register (a.k.a. "historic property”).”

In the broadest sense cultural resources include sites, buildings, structures, objects, and districts/landscapes (NPS 1997). Cultural resources (prehistoric or historic) vary considerably, and can include but are not limited to simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails. Traditional Cultural Properties (TCPs) are cultural resources that are eligible for the National Register of Historic Places (NRHP) and have cultural values, sometimes sacred, that transcend for instance the values of scientific importance that are normally ascribed to cultural resources such as archaeological sites and may or may not coincide with archaeological sites (Parker and King 1998). Historically Native American communities are most likely to identify TCPs, although TCPs are not restricted to those associations. Some TCPs are well known while others may only be known to a small group or otherwise only vaguely known. Native American tribal perspectives on what is considered a TCP are not necessarily limited by a places National Register eligibility or lack thereof.

The National Register of Historic Places (NRHP; 36 CFR Part 60) is the basic benchmark by which the significance of cultural resources are evaluated by a federal agency when considering what effects its actions may have on those resources. To summarize, to be considered eligible for the NRHP a cultural resource must meet one or more of the following criteria: a) are associated with events that have significantly contributed to the broad patterns of our history; or b) are associated with the lives of persons significant in our past; or c) embody distinctive characteristics of the type, period, or method of construction, or represents the work of a master, or possesses high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; or d) have yielded, or may be likely to yield, information that is important in a pre-history or history. The resource, as applicable, must possess one or more of the following aspects of integrity; location, design, setting, materials, workmanship, feeling, and association. In the event a determination of eligibility cannot be made, the resource is treated as eligible (a historic property).

Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36 CFR Part 800) requires federal agencies to consider what effect their licensing, permitting, funding or otherwise authorizing an undertaking, such as an APD or R-O-W, may have on properties eligible for the National Register. Pursuant to 36 CFR 800.16 (i), “Effect means alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National Register.” Effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. Area of Potential Effect (APE) means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is typically defined as areas to be directly disturbed and areas in immediate close proximity. Cultural resources are identified and reported through a combination of literature review and pedestrian survey consistent with guidelines set forth in the Procedures for Performing Cultural Resources Fieldwork on Public Lands in the Area of New Mexico BLM Responsibilities (BLM 2005).

The entire Area of Potential Effect (APE) for the Proposed Action and Alternative C were archaeologically surveyed by Division of Conservation Archaeology (DCA) and Dykeman Roebuck Archaeology LLC (DRA) at a BLM Class III level (100%). Two reports were prepared and submitted to the BLM-.

DCA field inventoried 46.89 acres for the well pad, access road and pipelines, and located three previously recorded cultural sites. Two cultural sites are considered undetermined eligibility and one is not eligible for inclusion in the National Register of Historic Places (NRHP) (DCA 2014, DCA Report 14-DCA-058; BLM Report 2015(II) 008F).

DRA field inventoried 20.75 acres along the proposed power line, and located three previously recorded cultural sites. Two cultural sites are considered undetermined eligibility and one is not eligible for inclusion in the NRHP (Dykeman 2014; DRA 140012-1; BLM Report 2015(II) 008.1F).

3.10.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Cultural resources tend to degrade over time from natural forces; however, many survive for hundreds or thousands of years. Any land-disturbing activity can disturb, damage, or uncover cultural resources. Direct impacts normally include alterations to the physical integrity of a historic property. If a historic property is significant for other than its information potential, direct impacts may also include the introduction of audible, atmospheric, or visual elements that are out of character for the property. A potential indirect impact from the proposed action, particularly in undeveloped areas is the increase in human activity or access to the area with an increased potential of unauthorized damage to historic properties.

Historic properties are being avoided with the implementation of design features such as but not limited to reduction of construction areas, temporary barriers, and site monitoring. These design features are detailed in the Cultural Resource Record of Review, attached to the COA in the APD/ROW/Sundry as the case may be. The proposed action is not known to physically threaten any TCP's, prevent access to sacred sites, prevent the possession of sacred objects, or interfere or otherwise hinder the performance of traditional ceremonies/rituals. The proposed action will have no direct or indirect impact on historic properties (no historic properties affected).

Cumulative Impacts

The United States is divided and sub-divided into successively smaller hydrologic units which are classified into six levels nested within each other, from the largest geographic area (region) to the smallest geographic area (subwatershed). The boundaries are distinguished by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters (USGS 2013, NRCS 2013). Hydrologic units can be viewed as a naturally defined landscape and impacts to cultural resources in one part of that landscape could, theoretically, affect a broader understanding of the interrelationships between sites in the landscape as a whole. The smallest

hydrologic unit area, typically from 10 to 40 K acres (15 to 62 mi²; HUC 12) or combination thereof are used as the CIAA.

The cumulative spatial analysis area (CIAA) for cultural resources is the proposed project area and the Crow Canyon-Blanco Wash and Headwaters Kimbeto Wash subwatersheds which total 65,474 acres. Based on New Mexico Cultural Resource Information System data (NMCRIS; February2015), within the subwatersheds there are 603 recorded sites and approximately 17% of the watersheds (11,368 ac) have been inventoried for cultural resources by 532 unique investigations since 1974. There are no properties listed on the National Register of Historic Places, New Mexico State Register of Cultural Properties, Chaco Protection Sites, World Heritage Sites, or National Historic Trails within the CIAA.

- What impacts would surface disturbance for the proposed action have on historic properties in the CIAA?

There will be no negative cumulative impact on known historic properties as they are being avoided by relocating the surface disturbing components of the proposed action away from the property. There will be no known negative cumulative impact on the landscape that would affect the seven aspects of integrity (location, design, setting, materials, workmanship, feeling, association) of known historic properties. A positive cumulative effect is the additional scientific information yielded by the archaeological survey both in terms of site specific information and the amount of the landscape inventoried for cultural resources.

- What impacts would the project have on unknown (buried, not visible) historic properties in the CIAA?

Risks of impacting unknown (i.e., buried) historic properties is normally negligible as cultural resources "discoveries" during surface disturbing components of a proposed action are infrequent in the FFO. Since FY2000, 28 discoveries have occurred in association with 21,290 actions, or 1:760. During that period 153,626 acres of land were inspected for cultural resources, with an average of 7.2 acres per action and one discovery per 5,472 acres. All authorizations (e.g., APDs, R-O-Ws) have stipulations, under penalty of law, requiring the reporting of and avoidance of further disturbing cultural discoveries during a proposed action. Where the risk of discoveries can be reasonably expected (e.g., ≤ 100' of a known historic property, or in environmental settings known or suspected to be conducive to buried sites), archaeological monitoring by a qualified and permitted archaeologist during initial disturbance (e.g., blading, trenching) is required. If buried historic properties are discovered, collaborative steps are taken to protect them in place or recover their important information.

3.10.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct and indirect impacts to cultural resources under Alternative C is the same as those analyzed under the Proposed Action.

Cumulative Impacts

Cumulative impacts to cultural resources under Alternative C is the same as those analyzed under the Proposed Action.

3.11. Paleontological Resources

3.11.1. *Affected Environment*

The proposed project is located within the paleontological rich area of the San Juan Basin of northwestern New Mexico. The BLM uses the Potential Fossil Yield Classification (PFYC) system to identify areas with a high potential to produce significant fossil resources. The BLM's PFYC system is a predictive modeling tool that was developed to provide baseline guidance for assessing and mitigating

paleontological resources. It is intended to be used at an intermediate point in analyses and to assist in determining the need for further mitigation assessment or actions.

Early Paleogene Nacimiento Formation outcrops designated as Class 5 in the Potential Fossil Yield Classification System (PFYC) occur in the proposed Chaco 2308 3 Wells Project area. The Nacimiento Formation has produced important vertebrate, invertebrate, and plant fossils (Williamson 1996, Williamson and Lucas 1992, Tsentas 1981, and Matthew 1937). The proposed project area crosses PFYC Class 5a and Class 5b.

"Class 5a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities. "

"Class 5b – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops from cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources."

Approximately 2,112.66 linear feet (1.94 acres) of the proposed Chaco 23-08 3 #1H well-tie pipeline is located within the Lybrook Fossil Area, a Specially Designated Area (USDI BLM 2003a). No proposed project components under Alternative C are located within the Lybrook Fossil Specially Designated Area. However, the Chaco 23-08 3 Wells Project area (for both the Proposed Action and Alternative C) is immediately to the north of the Lybrook Fossil Specially Designated Area. The entire project area is located within PFYC Classes 5a and 5b. All components of the proposed project will have a comprehensive paleontologic survey conducted by BLM permitted paleontological consultants. The BLM-FFO Paleontological Coordinator also conducted ground surveys of components for the proposed project.

Dr. John Burris and Mr. Ken Heil, BLM permitted paleontologists from San Juan College, Farmington, New Mexico conducted a paleontologic survey for the proposed project (well pad, access road, well-tie pipelines and power line) on November 08, 2014. An additional 50-foot wide buffer zone running parallel along all sides of the access road, well-tie in, and well pad construction zone were also surveyed on this date. All outcrops of potential fossil bearing strata located near the proposed project were also examined closely for vertebrate fossils, as were anthills located in the vicinity of potential fossil bearing outcrops. Dr. Burris and Mr. Heil survey report indicates that there were no discoveries of vertebrate fossils in all areas surveyed for the proposed project. Also, no fossils were discovered by the BLM-FFO Paleontological Coordinator for the proposed project. Due to the results of the surveys the BLM-FFO will not require paleontological monitoring of construction activities for the proposed project.

3.11.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

The Proposed Action would disturb approximately 22.87 acres. During excavation or disturbance, vertebrate fossils may be uncovered, at which point excavation or disturbance in a 50 foot radius of the discovery should halt until the BLM-FFO has been notified and a BLM-permitted paleontologist can examine the specimen to determine the appropriate next steps.

Cumulative Impacts

The cumulative spatial analysis area for paleontological resources is the proposed project area and immediately adjacent lands. Based on the paleontological surveys of the Proposed Action areas, current and future actions are not anticipated to negatively impact paleontological resources. Paleontological resources may be positively impacted by the collection of additional scientific data if a discovery and monitoring were to occur.

3.11.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Alternative C would disturb approximately 7.85 acres, 15.02 acres less than the Proposed Action. During excavation or disturbance, vertebrate fossils may be uncovered, at which point excavation or disturbance in a 50 foot radius of the discovery should halt until the BLM-FFO has been notified and a BLM-permitted paleontologist can examine the specimen to determine the appropriate next steps.

Cumulative Impacts

The cumulative spatial analysis area for paleontological resources under Alternative C is the proposed project area and immediately adjacent lands. Based on the paleontological surveys of Alternative C areas, current and future actions are not anticipated to negatively impact paleontological resources. Paleontological resources may be positively impacted by the collection of additional scientific data if a discovery and monitoring were to occur.

3.12. Grazing Livestock

3.12.1. *Affected Environment*

The BLM-FFO manages 208 grazing allotments with 390 grazing permittees. Authorized to graze on public lands within the FFO administrative area are cattle, sheep, goats and horses. Of the 390 grazing authorizations, 323 are permitted under Section 3 of the Taylor Grazing Act. Additional authorizations under Section 15 permit grazing on 30 allotments in the Lindrith, New Mexico area. The Proposed Action and Alternative C would be located within the boundary of the Largo Community (#5083) Grazing Allotment. This allotment is permitted for grazing by 145 head of cattle and 596 sheep year-round. Table 3-14 lists details of the grazing authorizations for this allotment.

Table 3-14. Details of the Largo Community Grazing Allotment Authorizations

BLM-FFO Allotment Number	Number of Livestock	Livestock Type	Grazing Period Begin Date	Grazing Period End Date	AUM[1]
5083	145	Cattle	March 1st	February 28th	1,676
5083	596	Sheep	March 1st	February 28th	1,370

[1]Animal Unit Month. Equal to one cow or one cow/calf pair for one month.
Source: BLM-FFO 2015.

During each field investigations trespass horses were observed grazing within the Proposed Action and Alternative C areas.

3.12.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Surface disturbance associated with construction of the Proposed Action would remove approximately 22.87 acres of vegetation, resulting in a reduction in forage and a change to the vegetation composition. Impacts to livestock grazing within the Largo Community Allotment would occur from the direct short term

loss of about 0.69 animal unit month (AUM), based on an estimated 25 acres per AUM. Reclaimed areas would be expected to re-vegetate within one to two years following reclamation. Following successful reclamation, there would be a long term loss of approximately 0.10 AUM. This would be as a result of the conversion of 2.53 acres to operational use for the well pad and access road. Seeding of disturbed areas with BLM-FFO Saltbush Shadscale/Winterfat Community Seed Mixture that is composed of grasses and palatable shrubs, may result in an increase in available livestock forage. However, this increase is not expected to be measurable.

During the construction of the Chaco 23-8 3 #1H well-tie pipeline, livestock could become trapped in an open pipeline trench. Long sections of the open trench could also present barriers to livestock movement. There would also be a potential for livestock collisions with equipment and vehicles working in the area. To mitigate these potential impacts, gaps would be made as needed in topsoil or subsoil stockpiles to allow for livestock trench crossing. To minimize potential direct impacts to livestock, pipeline trenches would be inspected for livestock prior to laying pipe and back filling. Trenches would not be left open for more than 24 hours.

During the drilling and production phase of the proposed project, livestock could come into contact with stored chemicals or fluids. Use of a closed-loop system would minimize potential impacts to livestock from exposure to chemicals and drilling fluids. All spills would be promptly cleaned up and reclaimed as per the operator's emergency response plan. Additionally, all chemicals or fluids stored for project use would be properly contained including secondary containments.

Cumulative Impacts

The spatial analysis area for cumulative impacts is the Largo Community Allotment. The Allotment contains 47,653 acres with existing disturbances from oil and gas development, residences and associated developments, San Juan County roads and U.S. Highway 550. Fiftyfive wells have been drilled within the allotment since 2012. Prior to 2012 there are 70 that are still active (not-inclusive of plugged and abandoned locations). Acres of disturbance associated with wells developed since 2012 is 275 acres (Assuming 5 acres per well project). Prior to 2012 there is 105 acres of existing disturbance (Assuming 1.5 acres of disturbance per well project) within the allotment. 1,018 acres of disturbance is attributed to existing roads across the allotment. Much of the existing previous disturbance, especially disturbance created prior to 1988 has been taken into account in the carrying capacity of the allotment. The Proposed Action would add 2.53 acres of long term disturbance, or 0.18% to the Largo Community Allotment existing disturbance.

Reasonably foreseeable activities that would impact livestock grazing within the Largo Community Allotment include additional energy developments, additional residences and associated developments, off-highway vehicle traffic, vegetation treatments, and permitted and non-permitted livestock grazing.

3.12.3. *Impacts from Alternative C*

Direct and Indirect

Direct impacts under Alternative C would occur to 7.85 acres. This is 15.02 acres less than under the Proposed Action. Because of the reduction in direct impacts, indirect impacts would also be reduced under Alternative C when compared to the Proposed Action. The types of direct and indirect impacts occurring as a result of Alternative C would remain the same as those under the Proposed Action.

Cumulative Impacts

Cumulative impacts analysis for Alternative C would be similar to that discussed under the Proposed Action as the alternatives are in the same area, and are of similar scope. Alternative C impacts analysis uses the same analysis area, the Largo Community Allotment. The Alternative C total and reclaimed disturbance differs from that analyzed under the Proposed Action and is reduced by 15.02 acres. However, Alternative C and the Proposed Action do not differ with respect to long term disturbances affecting the Largo Community Allotment (2.53 acres, 0.18% added to pre-existing) and the number of AUMs that would be removed (0.10 AUMs).

Other cumulative impacts to grazing livestock under Alternative C would be the same as depicted for the Proposed Action in **SECTION 3.12.2**.

3.13. Environmental Justice

3.13.1. *Affected Environment*

On February 11, 1994, the President issued Executive Order No. 12898 concerning Environmental Justice and impacts on minority and low-income populations. The purpose of the Order is to identify and address disproportionately high or adverse human health and environment effects of programs, policies, or activities on minority or low-income populations. In the region around the Proposed Action minority populations include, primarily, Native Americans and Hispanics. Some of these are low-income groups.

Minority population and poverty rate for the San Juan, Rio Arriba, and Sandoval counties, New Mexico is included in Table 3-15. While the individual poverty rate is comparable but slightly higher in San Juan and Rio Arriba counties than the state average, both counties also have a significantly higher portion of minority populations than the remainder of New Mexico. This can be attributed to the Native American Reservations (Navajo and Jicarilla Apache) located in San Juan and Rio Arriba counties. In San Juan County, more than half of the land area is located within the Navajo Reservation. Sandoval County has a lower poverty rate and a slightly higher minority population rate than the State of New Mexico. This fact is attributed to the close proximity of the city of Albuquerque to Sandoval County.

San Juan and Rio Arriba counties have produced oil and gas and other energy resources for over 50 years. The extractions of these resources are an income source to the local communities as well as the counties, the State of New Mexico and the federal government. Sandoval County has also had some oil and gas development over the years, but not to the extent of the other two counties. Many San Juan County and local contractors and their employees are employed in some aspect in the energy industry. The workforce for the local oil and gas industry is drawn largely from the populations of Rio Arriba and San Juan counties, so many minority and low-income families likely derive benefits from the energy sector's activities.

Table 3-15. Potential Affected Minority and/or Low-income Populations in New Mexico, and San Juan, Rio Arriba and Sandoval Counties, New Mexico

New Mexico County	Population (2010)	Percent Minority Population (2009)	Individual Poverty Rate (2009-2013)
New Mexico	**2,085,287**	**17.1%**	**20.4%**
San Juan County	126,503	43%	22.4%
Rio Arriba County	40,247	27.1%	21.2%
Sandoval	136,575	20.7%	14.2%
Source: U.S. Census 2015			

3.13.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

Potential direct adverse effects on populations could include exposure to noise, atmospheric contamination, toxic or hazardous materials, and increased traffic. Residential areas, including those of minority and low-income populations, are distant from the proposed project site and would therefore have a low risk of adverse impacts.

Local and regional companies may be contracted during construction, drilling, and production of the proposed wells and associated facilities. This employment may result in an economic benefit to the local populations as well as the regional community. The proposed project would positively affect local, San Juan County, the State of New Mexico, and federal government agencies and programs by contributions

to the energy and mineral impact assistance fund grants, severance taxes and mineral royalties. Local businesses in the project area may realize increased revenues for both the short and long term.

Under the Proposed Action, no disruptions or disproportionate negative impacts to any populations, communities, or groups are anticipated. A moderate short term increase in socio-economics is anticipated. The long term increase in socio-economics is expected to be low for the Proposed Action.

Cumulative Impacts

The Proposed Action would not cause any measurable or disproportionate impacts to minority or low-income populations. The BLM-FFO PRMP/FEIS (2003a) analyzed impacts to minority populations and determined that energy resources within the planning area are located with Rio Arriba and San Juan counties, both of which have disproportionately high minority populations. Resource development would provide jobs and therefore benefit these groups (USDI BLM 2003a, page 4-129). The Proposed Action would help maintain this positive effect.

3.13.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct and indirect impacts to environmental justice, minority and low-income populations, under Alternative C would not be altered as compared to the Proposed Action. Other specifics of the direct and indirect impacts to minority and low-income populations are detailed in **SECTION 3.13.2**.

Cumulative Impacts

Cumulative impacts to environmental justice, minority and low-income populations, under Alternative C would not be altered as compared to the Proposed Action. Specifics of the cumulative impacts to minority and low-income populations are detailed in **SECTION 3.13.2.**

3.14. Public Health and Safety

3.14.1. *Affected Environment*

The proposed Chaco 23-8 3 Wells Project would comply with the use and disposal of hazardous materials as regulated primarily under the Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC 6901, et seq.), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended (42 USC 9601, et seq.), and the Toxic Substances Control Act (TSCA) of 1976, as amended (15 USC 2601, et seq.). Most substances and wastes generated at oil and gas facilities and pipelines are exempt from hazardous materials regulations under the RCRA, although some materials associated with well construction and production, and pipeline activities are classified as hazardous and regulated by the U. S. Environmental Protection Agency (USEPA) and Department of Transportation (DOT).

No extremely hazardous substances (40 CFR 355) would be used during the Proposed Action. Hazardous substances that may be found at the site may include minimal quantities of materials that may be necessary for drilling, welding or gluing. Flammable or combustible substances such as fuels and acids/gels (corrosives) associated with vehicles and the drilling and welding processes may also be found at the site. These hazardous materials may include oil, fuel, hydraulic fluid, drilling fluids, and coolants. These chemicals are subject to reporting under the Emergency Planning and Right-to-Know Act of 1968 and may be used, produced, stored, transported or disposed of in association with the Chaco 23-08 3 Wells Project.

Non-hazardous solid waste generated at the proposed project area would be stored in appropriate containers and disposed of at an approved facility on an as-needed basis. Human solid and liquid wastes would be generated primarily during the drilling and construction phases of the project and would be contained within portable facilities at the site. No H_2S (hydrogen sulfide gas) is anticipated. Drilling and

completion fluids would be contained within a closed-loop system. Production fluids would be stored on site with secondary containment.

Safety practices in accordance with state and federal laws, including the Occupational Safety and Health Act of 1970 (Public Law 91-596, as amended) would be followed at all times during the project. Standard safety procedures for drilling and completion of the Chaco 23-08 3 Wells Project would include pipeline markers, monitoring, and inspections that are required by federal and state regulations. The FFO BLM review the operator's drilling plans and geologic conditions before they approve an APD. These reviews consider the reservoir pressures that may be encountered, compare these pressures to the operator's proposed equipment ratings, casing design, and cement program. Wells would be drilled, cased and cemented as specified in the Eight-Point Drilling Plans of the Chaco 23-08 3 #1H and #2H APDs and as directed by the BLM-FFO. Monitoring in the field and the pre-field engineering and geologic reviews are performed by the BLM-FFO.

Energen maintains and implements a Spill Prevention Control and Countermeasures (SPCC) Plan. This plan contains measures designed to prevent spills and leaks during the production phase of each well. All wastes and products brought to the project site would be handled as specified by law and label directions. All substances would be properly contained, removed and disposed. Materials would be handled to minimize leaks and spills. Upon completion of the wells, all materials not needed for production would be removed from the site. Non-hazardous solid waste generated by the proposed project would be stored in appropriate containers and disposed of at an approved facility on an as-needed basis. Any spills would be cleaned up and disposed of in accordance with federal and State of New Mexico Oil Conservation Division regulations. Notification requirements under CERCLA and BLM Notice to Lessees (NTL) 3A would be followed.

Roads in the area are generally unimproved dirt surface and are used to access natural gas facilities. These roads may become hazardous or impassable during periods of inclement weather.

3.14.2. *Impacts from the Proposed Action (Alternative B)*

Direct and Indirect Impacts

The proposed project would be located within an existing oil and gas field currently experiencing concentrated development. Risks to public health and safety associated with the Proposed Action include increased traffic on public roads, wildfire, pipeline leakage, rupture, fire, explosion, and operation of construction equipment. Additional public health and safety risks include spills of wastes, chemicals, or hazardous materials.

Available at the project site at all times would be current Material Safety Data Sheets (MSDS) for all chemicals, compounds and/or substances which would be used during any phase of the Proposed Action. The notification of releases such as natural gas, natural gas liquids, produced water and petroleum, outside the facility site is required under the CERCLA and under the national BLM Notice to Lessees (NTL)-3A. Best management practices (BMPs) and "good housekeeping practices" including spill control measures would be followed, minimizing potential impacts from hazardous and non-hazardous wastes. Adherence to company safety policies and BLM-FFO COAs and ROW stipulations would mitigate public health and safety hazards. The hauling of project equipment and materials on public roads would comply with all Department of Transportation regulations. All equipment operation would be performed in compliance with appropriate Occupational Safety and Health Administration (OSHA) regulations.

Health and safety issues for construction workers include operation of heavy equipment, drilling, welding activities, and working in the vicinity of other utilities (primarily other oil and gas gathering pipelines and overhead power lines). Although unlikely, well explosions, blowouts and fire are considered possible risks. Energen maintains an emergency response plan. This plan includes the training of personnel to respond to emergencies. The Association of Mechanical Engineers (ASME) and American Petroleum Institute (API) issue standards for the design, construction, installation, and maintenance of pressure vessels, fittings, piping, and pipelines. Operators and their contractors would build, operate, and maintain

all equipment and pipelines according to these standards, which are intended to minimize the potential for explosions and failure of the equipment.

Material storage would only be within the proposed project well pad. Governmental agencies would be notified as required under the Emergency Planning and Community Right to Know Act (1986). The notification of releases such as natural gas, natural gas liquids, and petroleum outside the facility site is required under CERCLA and reporting of releases would be done in accordance with federal and State of New Mexico Oil Conservation Division regulations.

Cumulative Impacts

Cumulative impacts of the Proposed Action would be recognized in relation to the level of concentrated development that occurs in this area. Development activities as related to the Proposed Action (construction, pipelining, drilling and completion operations) would be added to existing development such as nearby highway activity, other infrastructure work, and other oil and gas activity. Additionally, the Proposed Action would be added to future activities that are reasonably certain to occur. Given the fact that the Proposed Action would be located within an existing oil and gas field, direct and indirect cumulative impacts to public health and safety as well as to worker safety would not be measurably different when compared to those from the past, present and reasonably predicted future activities.

3.14.3. *Impacts from Alternative C*

Direct and Indirect Impacts

Direct and indirect impacts to public health and safety under Alternative C would be reduced in the short term as a shorter pipeline would be installed under Alternative C. This shorter pipeline would mean fewer personnel, trucks, and equipment in the area associated with pipeline installation when compared to the Proposed Action. Other specifics of the direct and indirect impacts to public health and safety would remain as detailed in **SECTION 3.14.2**.

Cumulative Impacts

Cumulative impacts to public health and safety under Alternative C would be minimally lowered cumulatively for the short term when compared to the Proposed Action. Given the fact that the Alternative C would be located within an existing oil and gas field that is currently experiencing concentrated development and that all disturbance associated with Alternative C would be shorter, there would be a slight reduction in risk to public health and safety under Alternative C. Other specifics of the cumulative impacts to public health and safety are the same as detailed in **SECTION 3.14.2**.

4. SUPPORTING INFORMATION

4.1. Individuals, Organizations, or Agencies Consulted

This EA was prepared by Tegre Corporation in conformance with the standards of, and under the direction of, the BLM-FFO. The BLM-FFO web-site for scheduled on-sites can be found at, http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html. The BLM-FFO also notifies the appropriate tribes and individuals. Table 4- 1 contains a list of tribes, individuals, organizations, and agencies invited to attend the on-site for the project.

Table 4- 1. Tribes, Individuals, Organizations, and Agencies Invited to the On-Site

Name	Tribe, Organization or Agency	Attended On Site
Mike Eisendfeld	San Juan Citizens Alliance	No
Bruce Baizeal	San Juan Citizens Alliance	No
Don Schrieber	San Juan Citizens Alliance	No
Gary Graham	Western Resources	No
Lori Goodman	Western Resources	No
Melinda Ciarco	Navajo Historic Preservation Office	No
Samuel Sage	Counselor Chapter	No
Tweety Blancett	San Juan Citizens Alliance	No
Nageezi Chapter	Nageezi Chapter	No

The BLM fulfills its responsibilities under the National Historic Preservation Act (NHPA) through a number of agreements. The National Programmatic Agreement (NPA; 2012) between the BLM, Advisory Council on Historic Preservation (ACHP), and the National Council of State Historic Preservation Officers (NCSHPO) allows the agency to fulfill its NHPA responsibilities according to the provisions of the NPA in lieu of 36 CFR 800.3 through 800.7 regulations. The NPA, which applies to all BLM activities below specified thresholds, provides among other things, regulatory relief in many instances from the requirement for case-by-case review by State Historic Preservation Officers (SHPOs) and the ACHP, in exchange for managers' maintenance of appropriate staff capability and observance of internal BLM standards as set out in the 8100 Manual series.

The New Mexico BLM has a two-party protocol with the New Mexico SHPO (2014) specifically encouraged by the NPA. This protocol details how the New Mexico BLM and SHPO will regulate their relationship and consult. Specifically, this document outlines among other things, how and when consultation will be conducted between the BLM, SHPO, Tribes, and the public. The protocol also outlines when case-by-case SHPO consultation is or is not required for specific undertakings and the procedures for evaluating the effects of common types of undertakings and resolving adverse effects to historic properties. These common types of undertakings regularly include the common actions undertaken in the BLM-FFO.

4.2. List of Preparers

Jill Aragon	BLM-FFO Realty Specialist
Amanda Nisula	BLM-FFO NEPA Specialist
Peggy Deaton	BLM-FFO Natural Resource Specialist
Roger Herrera	BLM-FFO Environmental Protection Specialist
John Kendall	BLM-FFO Threatened and Endangered Species Biologist
Jeff Tafoya	BLM-FFO Supervisory Rangeland Specialist
James Copeland	BLM-FFO Lead Archaeologist
Sherri Landon	BLM-FFO Surface Protection Specialist/Paleontologist
Mark Kelly	BLM-FFO Environmental Protection Specialist
Craig Willems	BLM-FFO Environmental Protection Specialist

Marcella Martinez	BLM-FFO Planning and Environmental Specialist
Shelia Williams	BLM-State Botanist
J. Perter Jensen	Tegre Corporation, Sr. Biologist / President
Milton Williams	Tegre Corporation, GIS/CAD Analyst
Roberto Hinojosa	Tegre Corporation, PLS
Ilyse K. Gold	Tegre Corporation, Regulatory and Environmental Specialist

4.3. References

Allen, D., Pacsi, A., Sullivan, D., Araiza, D. Z., Harrison, M., Keen, K., et al. 2014. Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Pneumatic Controllers. *Environmental Science and Technology*, es5040156.

Allen, D., Sullivan, D., Araiza, D. Z., A.Pacsi, Harrison, M., Keen, K., et al. 2014a. Methane Emissions from Process Equipment at Natural Gas Production Sites in the United States: Liquid Unloadings. *Environmental Science and Technology*, es504015.

Allen. E., Undated document. Colorado Plateau Aquifers. http://www.stgeorgeutahrentals.com/zion-national-park.html.

American Petroleum Institute. 2013. Economic Impacts of Oil and Natural Gas Industry on the US Economy in 2011. Available at: http://www.api.org/news-and-media/news/newsitems/2013/aug-2013/~/media/Files/Policy/Jobs/Economic_Impacts_ONG_2011.pdf.

Animas Biological Studies. 2013. Golden Eagle Nest Monitoring in the Bureau of Land Management Farmington Resource Area Grant and Cooperative Agreement Number L08AC13284 Supplement Number 0004. In conjunction with San Juan Institute of Natural and Cultural Resources, Fort Lewis College, Durango Colorado.

Adrian Antal Borsa, D. C. Agnew, D. R. Cayan. 2014. Ongoing Drought-Induced Uplift in the Western United States. Published Online August 21 2014 Science 26 September 2014: Vol. 345 no. 6204 pp. 1587-1590.DOI: 10.1126/science.1260279. Available at: http://www.sciencemag.org/content/345/6204/1587.abstract?sid=6e6b14f2-e4c7-4189-b113-d477d1239475.

Belnap, J., Reynolds, R. L., Reheis, M. C., Phillips, S. L., Urban, F. E., and Goldstein, H. L., 2009, Sediment losses and gains across a gradient of livestock grazing and plant invasion in a cool, semi-arid grassland, Colorado Plateau, USA: Aeolian Research, v. 1, p. 27-43.

Bernstein, E. J., C. M. Albano, T. D. Sisk, T. E. Crews, S. Rosenstock. 2013. Establishing Cool-Season Grasses on a Degraded Arid Rangeland of the Colorado Plateau. In: Restoration Ecology. *Society for Ecological Restoration* doi: 10.1111/rec.12023.

BISON-M Database, New Mexico Natural Heritage Program. 2015. Available At: http://nmnhp.unm.edu/bisonm/bisonquery.php

Brooks, M. L. and Pyke, D.A. 2001. Invasive Plants and Fire in the Deserts of North America. Pages 1-14 in K.E.M. Galley and T.P Wilson (eds.). Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management. Miscellaneous Publication No. 11, Tall Timbers Research Station, Tallahassee, FL.

Brugge, D. M. 1993. An Investigation of AIRFA Concerns Relating to the Fruitland Coal Gas Development Area. Office of Contract Archaeology, University of New Mexico. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

Burris, John and .K. D. Heil. 2014. A Paleontological Resource Survey for the Energen Resources Corporation Chaco 23-8 3 Wells #1H and #2H, Access Road, Pipeline and Power Line. Sections 3, 4 and 9, T23N, R8W. San Juan County, New Mexico. Prepared for the Bureau of Land Management, Farmington Field Office (BLM/FFO).

Division of Conservation Archaeology (DCA). 2015. The Cultural Resources Inventory of Energen Resources Corporation's Proposed Chaco 23-08-3 No. 1H and 2H Twinned Well Pad and Access Road and Williams Four Corner's Well Tie Pipeline, San Juan County, New Mexico. NMCRIS No. 132381. DCA Report 14-DCA-058.

Dykeman, D., P. Roebuck, and K. Langenfeld. 2015. Chaco 23-8 3 Power Line Cultural Survey for Energen Resources Corporation, San Juan County, New Mexico. NMCRIS Project No. 132530. DRA Report DRA140012-1.

Engler, Thomas, W., Shari Kelly and Martha Cather. 2014. Reasonable Foreseeable Development (RFD) for Northern New Mexico. Final Report October 2014. New Mexico Institute of Mining and Technology, Socorro, New Mexico.

Eveling, D.W., and A. Bataille. 1984. The Effect of Deposits of Small Particles on the resistance of Leaves and Petals to Water Loss. Environmental Pollution 36:229-238.

Federal Register. December 24, 2014. Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews A Notice by the Council on Environmental Quality on 12/24/2014

Gruver, J.C. and D.A. Keinath. 2006. Townsend's Big-eared Bat (*Corynorhinus townsendii*): a Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region. [http://www.fs.fed.us/r2/projects/scp/assessments/townsendsbigearedbat.pdf].

Hirano, T., M. Kiyota, and I. Aiga. 1995. Physical Effects of Dust on Leaf Physiology of Cucumber and Kidney Bean Plants. Environmental Pollution 89:255–261.

Heil, Kenneth, D., O'Kane, S., Reeves, M., Clifford, A. 2013. Flora of the Four Corners Region. Vascular Plants of the San Juan River Drainage Arizona, Colorado, New Mexico, and Utah. Missouri Botanical Garden. 1098 pp.

Holmes, A.L. and A.V. King. 2006. Vital Rates of Sagebrush Obligate Songbirds in Relation to Natural Gas Development and Weather. Poster presentation before the IV North American Ornithological Conference. October 6, 2006. Veracruz, Mexico.

Holmes, J.A. and M.J. Johnson. 2005a. Sage Sparrow (*Amphispiza belli*): A Technical Conservation Assessment. USFS, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/sagesparrow.pdf.

Holmes, J.A. and M.J. Johnson. 2005b. Brewer's Sparrow (*Spizella breweri*): A Technical Conservation Assessment. USFS, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/brewerssparrow.pdf

Howarth, R., Santoro, R., & A.Ingraffea. 2011. Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations. Climate Change. 679-690.

Intergovernmental Panel on Climate Change. 2013. *Climate Change 2013: The Physical Science Basis.* Cambridge: Cambridge University Press.

Kelly, K., R. Martin, R. Begay, T. Neff, and C. Werito. 2006. “We Will Help You With What We Know”: Diné Traditional Cultural Places In Dinétah. Museum of Northern Arizona Environmental Solutions, Inc., Flagstaff. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

Kort, E., Frankenberg, C., Costigan, K., Lindenmaier, R., Dubey, M., and Wunch, D. 2014. Four Corners: Largest US Methane Anomaly Viewed from Space (The). *Geophysical Research Letters*, 6898-6903.

Lutz, D. W., J. R. Heffelfinger, S. A. Tessmann, R. S. Gamo, and S. Siegel. 2011. Energy Development Guidelines for Mule Deer. Mule Deer Working Group, Western Association of Fish and Wildlife Agencies, USA.

New Mexico Environment Department. 2010. Inventory of New Mexico Greenhouse Gas Emissions: 2000-2007. Santa Fe: New Mexico.

New Mexico State, Engineers Office—Water Administration and Technical Engineering Resource System Database 2014 Dataset. Accessed January 2015. *www.ose.**state.nm**.us/**waters_db**_index.html*.

New Mexico Oil and Gas Association. 2015. State and Local Revenue form Oil and Gas. Available at: http://www.nmoga.org/state-and-local-revenue-from-oil-and-gas.

Matthew, W. D., 1937, Paleocene Faunas of the San Juan Basin, New Mexico; Transactions of the American Philosophical Society, Volume 30, 510p.

Olivier, J. G.-M. 2012. *Trends in Global CO2 Emissions.* The Hague: PBL Netherlands Environmental Assessment Agency.

Rahmstorf. S., G. Foster, A. Cazenave. 2012. Comparing Climate Projections to Observations up to 2011. 2012 IOP Publishing Ltd. Available at: http://iopscience.iop.org/1748-9326/7/4/044035/article.

Robson, S.G., and E.R. Banta, 1995. Watershed Condition Assessment for the Jicarilla Ranger District, Carson National Forest. http://capp.water.usgs.gov/gwa/ch_c/C-text8.html.

Romme, W., C. D. Allen, J. D. Bailey, W. L. Baker, B. T. Bestelmeyer, P. M. Brown, K. S. Eisenhart, L. Floyd, D. W. Huffmand, B. F. Jacobs, R. F. Miller, E. H. Muldavin, T. W. Swetnam, R. J. Tausch, and P. J. Weisberg. 2009. Historical and modern disturbance regimes, stand structures, and landscape dynamics in pinon-juniper vegetation of the western United States. *Rangeland Ecology & Management* 62:203-222.

Sawyer, H., M. J. Kauffman, and R. M. Nielson. 2009. Influence of well pad activity on winter habitat selection patterns of mule deer. Journal of Wildlife Management 73(7):1052–1061.

Sawyer, H., R. M. Nielson, F. G. Lindzey, and L. L. McDonald. 2006. Winter habitat selection of mule deer before and during development of a natural gas field. Journal of Wildlife Management 70:396–403.

Schwinning, S., J. Belnap, D. R. Bowling, and J. R. Ehleringer. 2008. Sensitivity of the Colorado Plateau to change: climate, ecosystems, and society. *Ecology and Society* **13**(2): 28. [online] URL: http://www.ecologyandsociety.org/vol13/iss2/art28/.

Science Applications International Corporation (SAIC). 2002. *Cultural Resources Technical Report: Background Information on Cultural Resources for the Farmington Draft RMP/EIS*. On file, Bureau of Land Management, Farmington, New Mexico.

Science Applications International Corporation. 2003. Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah. WWW URL: http://www.fs.fed.us/r3/carson/engineering/watershed_jic_step3_current_conditions.pdf. page 20.

Schneising, O., J. P. Burrows, R. R. Dickerson, M. Buchwitz, M. Reuter, and H. Bovensmann. 2014. Remote sensing of fugitive methane emissions from oil and gas production in North American tight geologic formations. *Earth's Future*, 548-558.

Shaun A. Marcott, J. D. Shakun, P. U. Clark, A. C. Mix. 2013. A Reconstruction of Regional and Global Temperature for the Past 11,300 Years. Science 8 March 2013: Vol. 339 no. 6124 pp. 1198-1201 DOI: 10.1126/science.1228026.

Stone, W. J., Lyford, F. P., Frenzel, P. F., Mizell, N. H., and Padgett, E. T., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: Socorro, New Mexico Bureau of Mines and Mineral Resources Hydrologic Report 6, 70 p.

Thompson, J.R., P.W. Mueller, W. Flückiger, and A.J. Rutter. 1984. The Effect of Dust on Photosynthesis and its Significance for Roadside Plants. *Environmental Pollution* (Series A) 34(1984):171–190.

Tsentas, C., 1981, Mammalian biostratigraphy of the Middle Paleocene (Torrejonian) strata of the San Juan Basin: Notes on Torreon Wash and the status of *Pantolambda* and *Deltatherium* faunal "zones"; *in* Lucas, Rigby, Kues, eds., Advances in San Juan Basin Paleontology, University of New Mexico Press, p. 264 – 292.

U.S. Department of Agriculture Forest Service. 2011. *Emissions Reductions Techniques for Oil and Gas Activities.* U.S. Forest Service.

U.S. Department of Agriculture. Natural Resource Conservation Service. Undated Publication. Rapid Watershed Assessment Chaco Watershed. 34pp.

U.S. Department of Agriculture. Natural Resource Conservation Service. Web Soil Survey. Accessed January 2015. At: http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm
U.S. Department of Agriculture, Forest Service. 2000. "Mexican Spotted Owl Survey Data for 1990 through 2000." Jicarilla Range District. Bloomfield, New Mexico

U.S. Department of Agriculture and U.S. Department of Interior. 2007. Surface and Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO/ST-06/021+0371/REV 07. Denver, Colorado. 84 pp.

U.S. Geological Survey. 2015. Energy Resources Program. Retrieved January 2015. http://energy.usgs.gov/OilGas/UnconventionalOilGas/HydraulicFracturing.aspx.

U.S. Government Accountability Office. 2010. *Report to Congressional Requestors: Federal Oil and Gas Leases; Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases.* Washington, D.C.: U.S. Government Accountability Office.

U.S. Department of Interior Bureau of Land Management. 2014a. **MANCOS-GALLUP RESOURCE PLAN AMENDMENT AND ENVIRONMENTAL IMPACT STATEMENT. BIOLOGICAL BASELINE REPORT**. Farmington Field Office, Farmington, New Mexico.

U.S. Department of Interior Bureau of Land Management. 2014b. **AIR RESOURCES TECHNICAL REPORT FOR OIL AND GAS DEVELOPMENT**. Santa Fe.

U.S. Department of Interior Bureau of Land Management. 2013a. Farmington Field Office Bare Soil Reclamation Procedures. Farmington District. Farmington Field Office. 6251 N. College Blvd., Ste. A Farmington, NM 87402.

U.S. Department of Interior Bureau of Land Management. 2013b. Farmington Field Office. Climate Data.

U.S. Department of Interior Bureau of Land Management. 2013c. Farmington Field Office. Saltbush Shadscale/Winterfat Vegetation Community in the BLM-FFO Administrative Area.

U.S. Department of Interior Bureau of Land Management. 2007. Potential Fossil Yield Classification (PFYC) System. Obtained from the Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

U.S. Department of Interior Bureau of Land Management. 2003a. Farmington Proposed Resource Management Plan and Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

U.S. Department of Interior Bureau of Land Management. 2003b. Farmington Resource Management Plan Record of Decision. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

U.S. Department of the Interior, Bureau of Land Management. 2002. Biological Assessment: Impacts to Threatened and Endangered Species Related to the Resource Management Plan. U.S. Department of the Interior, Bureau of Land Management, Farmington Field Office, Farmington, New Mexico.

U.S. Department of Interior. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. Division of Migratory Bird Management, Arlington, Virginia. 85 pp. Online version available at http://www.fws.gov/migratorybirds/.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 2002. Migratory Bird Mortality. Available online: http://www.fws.gov/birds/mortality-fact-sheet.pdf

U.S. Energy Information Administration 2012. Annual Energy Outlook 2012. DOE/EIA-0383(2012). Available on line at: http://www.eia.gov/forecasts/aeo/pdf/0383(2012).pdf.

U.S. Environmental Protection Agency. 2014a. *Natural Gas Star Program*. Retrieved February 11, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/gasstar/.

U.S. Environmental Protection Agency. 2014b, February 7. *Air Trends: Design Values*. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airtrends/values.html.

U.S. Environmental Protection Agency. 2014c. *The 2011 National Emissions Inventory*. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/ttn/chief/net/2011inventory.html.

U.S. Environmental Protection Agency. 2014d. Hydraulic Fracturing Background Information. Available at: http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydrowhat.cfm.

U.S. Environmental Protection Agency. 2013a, November 15. *Air Quality Index Report*. Retrieved March 12, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airdata/ad_rep_aqi.html

U.S. Environmental Protection Agency. 2013b, December 5. *The Green Book Nonattainment Areas for Criteria Pollutants*. Retrieved February 25, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/airquality/greenbook/.

U.S. Environmental Protection Agency. 2013c. *Air Data: Reports*. Retrieved December 27, 2013, from U.S. Environmental Protection Agency: http://www.epa.gov/airdata/ad_reports.html.

U.S. Environmental Protection Agency. 2013d. *National Air Toxics Assessments*. Retrieved February 11, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/nata/.

U.S. Environmental Protection Agency. 2013e. *The 2011 National Emissions Inventory*. Retrieved December 27, 2013, from U.S. Environmental Protection Agency: http://www.epa.gov/ttn/chief/net/2011inventory.html.

U.S. Environmental Protection Agency. 2013f. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011.* Washington, DC.

U.S. Environmental Protection Agency. 2013g. Level III Ecoregions of the Continental United States. National Health and Environmental Effects Research Laboratory. Revised April 2013.

U.S. Environmental Protection Agency. 2012a. *National Ambient Air Quality Standards (NAAQS)*. Retrieved December 31, 2012, from U.S. Environmental Protection Agency: http://www.epa.gov/air/criteria.html.

U.S. Environmental Protection Agency. 2012b, May 21. *2005 National-Scale Air Toxics Assessment*. Retrieved February 27, 2014, from U.S. Environmental Protection Agency: http://www.epa.gov/ttn/atw/nata2005/.

U.S. Environmental Protection Agency. 2004. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study; National Study Final Report. http://www.epa.gov/safewater/uic/cbmstudy.html.

Van Valkenburgh, R. F. 1974. Navajo Sacred Places and Short History of the Navajo People. Garland American Indian Ethnohistory Series, Navajo Indians, 3 vols. Garland Publishing, Inc., New York and London.

Van Valkenburgh, Richard F. Van. 1941. Diné Bikeyah. Department of the Interior, Office of Indian Affairs, Navajo Services, Window Rock. Ms. on file, Bureau of Land Management, Farmington, New Mexico.

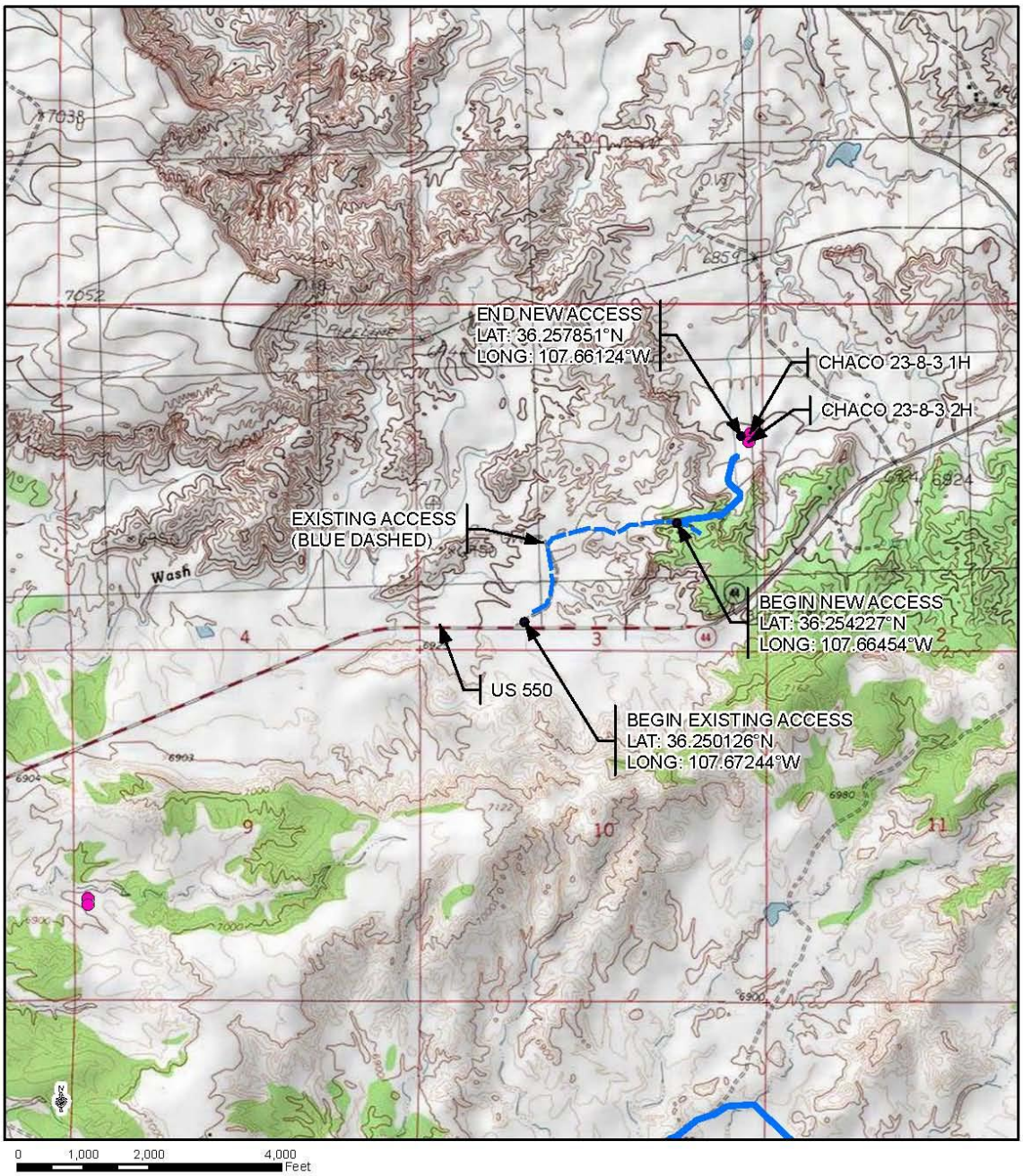
White House Updates Draft Guidance on Climate Change Considerations in NEPA Review By Latham & Watkins LLP on December 29, 2014 Posted in Environmental and approvals By Joshua T. Bledsoe and Stacey L. VanBelleghem.

Weber, William A., Ronald C. Wittmann. 2012. Colorado Flora: Western Slope. University Press of Colorado. Boulder, Colorado. 532 pp.

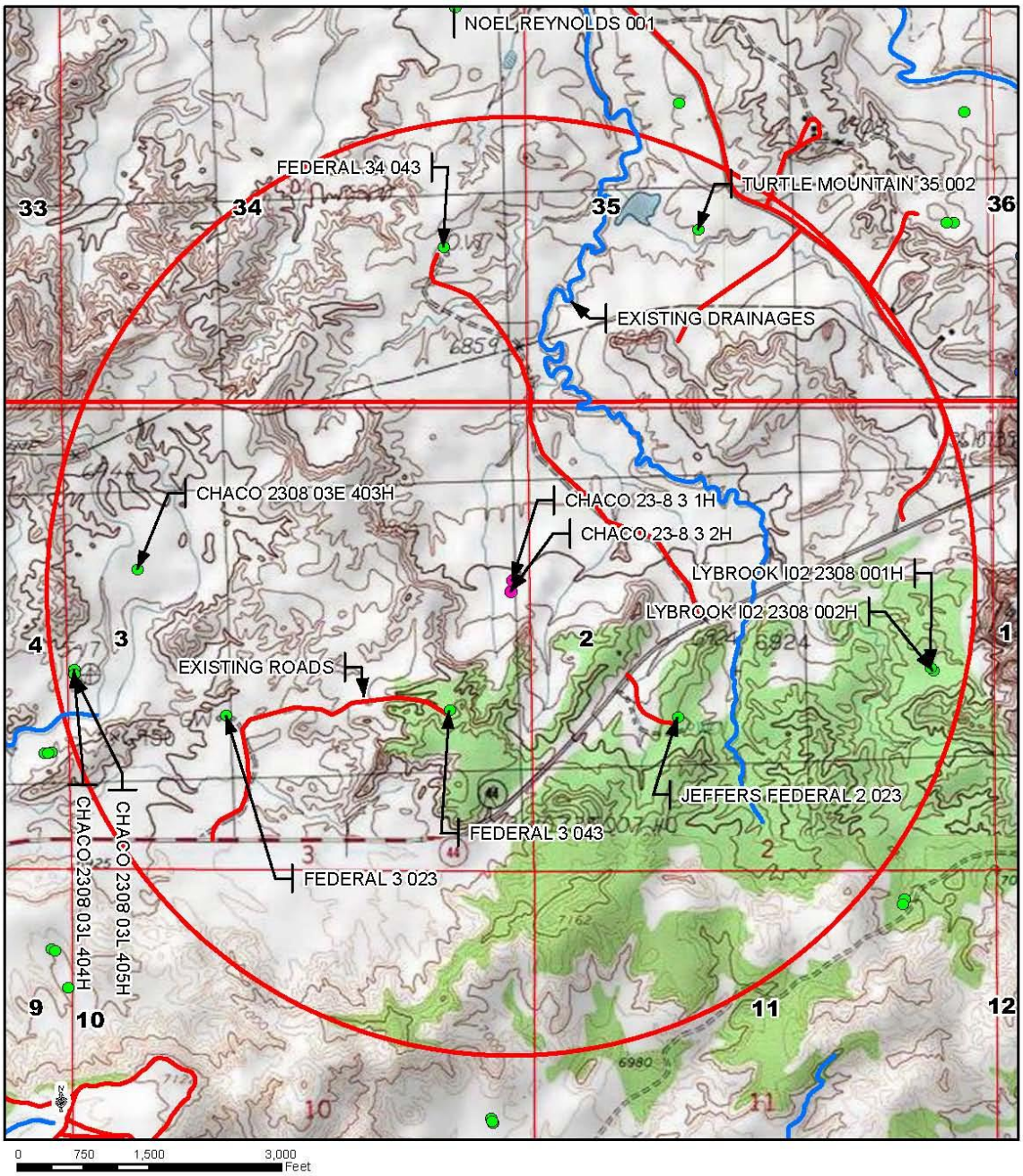
Western Association of Fish and Wildlife Agencies. 2011. Energy Development Guidelines from the Western Association of Fish and Wildlife Agencies. A Product of the Mule Deer Working Group. Sponsored by the Western Association of Fish and Wildlife Agencies.

Williamson, T. E. 1996. The Beginning of the Age of Mammals in the San Juan Basin, New Mexico: Biostratigraphy and Evolution of Paleocene Mammals of the Nacimiento Formation., New Mexico Museum of Natural History and Science, Bulletin 8, 141 pages.

Appendix A. **MAPS**



Chaco 23-08 3 1H & 2H	**FIGURE 1** **VICINITY MAP &** **ACCESS TO PROPOSED PROJECT** **Chaco 23-08 3 1H & 2H**
Cartography By: MW	
Checked by: JS	
Date: 5/12/2015 Time: 1:59:52 AM	



Chaco 23-08 3 1H & 2H	**FIGURE 2** **EXISTING WELLS & WATER FEATURES** **1 MILE RADIUS MAP** **Chaco 23-08 3 1H & 2H**
Cartography By: MW	
Checked by: JS	
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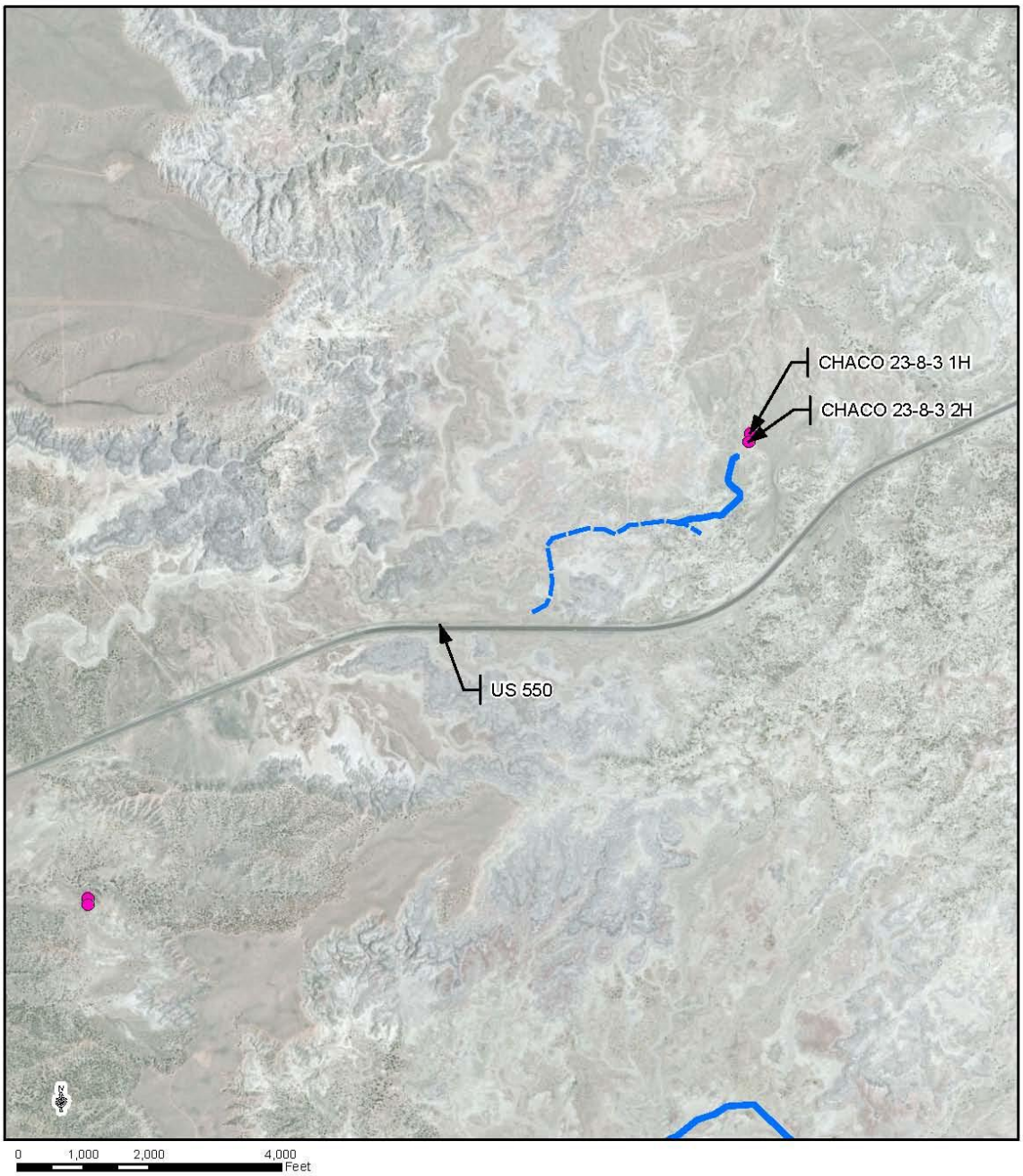


tegre integrity - respect - responsibility	Chaco 23-08 3 1H & 2H	**FIGURE 3** **Chaco 23-08 3 1H & 2H**
	Cartography By: MW	
	Checked by: JS	
	Date: 5/12/2015 Time: 2:02:30 AM	

Appendix B. **PLATS**

B.1. Well Pad Plats

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
Phone: (505) 334-6178 Fax: (505) 334-6170
DISTRICT IV
1220 S. St. Francis Dr., Santa Fe, NM 87505
Phone: (505) 476-3460 Fax: (505) 476-3462

State of New Mexico
Energy, Minerals & Natural Resources Department

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-102
Revised August 1, 2011

Submit one copy to appropriate District Office

☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	97232	BASIN MANCOS GAS

[4] Property Code	[5] Property Name	[6] Well Number
	CHACO 23-8 3	1H

[7] OGRID No.	[8] Operator Name	[9] Elevation
162928	ENERGEN RESOURCES CORPORATION	6910.5'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	WEST/West line	County
H	3	23N	8W		1994'	NORTH	187'	EAST	SAN JUAN

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	WEST/West line	County
D	3	23N	8W	4	380'	NORTH	380'	WEST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
PROJECT AREA 160.00 ACRES N/2 N/2 SEC. 3			

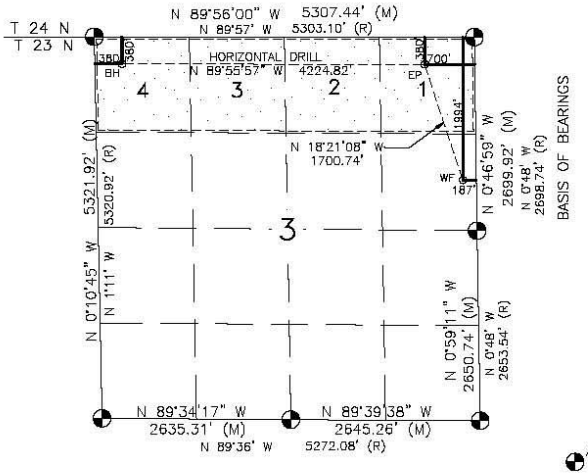
NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16

BOTTOM HOLE
LAT. 36.262526° N (NAD83)
LONG. 107.676925° W (NAD83)
LAT. 36.262513° N (NAD27)
LONG. 107.676314° W (NAD27)

ENTRY POINT
LAT. 36.265512° N (NAD83)
LONG. 107.662600° W (NAD83)
LAT. 36.265499° N (NAD27)
LONG. 107.661989° W (NAD27)

WELL FLAG
LAT. 36.258079° N (NAD83)
LONG. 107.660785° W (NAD83)
LAT. 36.258066° N (NAD27)
LONG. 107.660174° W (NAD27)



18

[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

JULY 31, 2014

Date of Survey

Signature and Seal of Professional Surveyor:

DAVID B. RUSSELL NEW MEXICO 10201 REGISTERED PROFESSIONAL LAND SURVEYOR

DAVID RUSSELL

Certificate Number 10201

DISTRICT I
1625 N. French Dr., Hobbs, N.M. 88240
Phone: (575) 393-6161 Fax: (575) 393-0720
DISTRICT II
811 S. First St., Artesia, N.M. 88210
Phone: (575) 748-1283 Fax: (575) 748-9720
DISTRICT III
1000 Rio Brazos Rd., Aztec, N.M. 87410
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1220 S. St. Francis Dr., Santa Fe, NM 87505
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☐ AMENDED REPORT

WELL LOCATION AND ACREAGE DEDICATION PLAT

[1] API Number	[2] Pool Code	[3] Pool Name
	97232	BASIN MANCOS GAS

[4] Property Code	[5] Property Name	[6] Well Number
	CHACO 23-8 3	2H

[7] OGRID No.	[8] Operator Name	[9] Elevation
162928	ENERGEN RESOURCES CORPORATION	6910.5'

[10] Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	WEST/West line	County
H	3	23N	8W		2119'	NORTH	213'	EAST	SAN JUAN

[11] Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	WEST/West line	County
E	3	23N	8W		2260'	NORTH	380'	WEST	SAN JUAN

[12] Dedicated Acres	[13] Joint or Infill	[14] Consolidation Code	[15] Order No.
PROJECT AREA 160.00 ACRES S/2 N/2 SEC. 3			

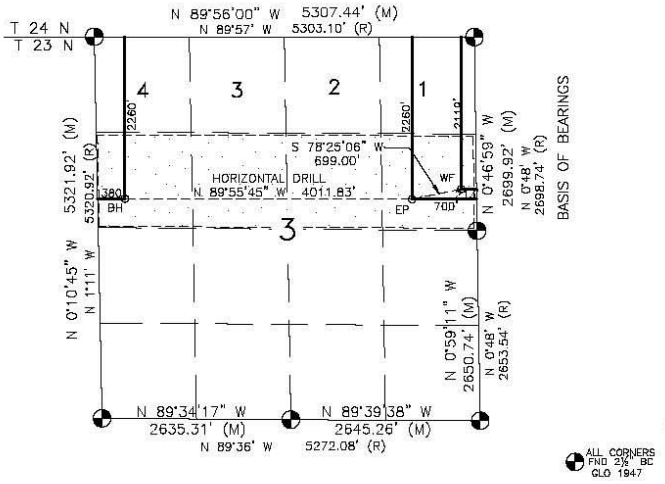
NO ALLOWABLE WILL BE ASSIGNED TO THIS COMPLETION UNTIL ALL INTERESTS HAVE BEEN CONSOLIDATED OR A NON-STANDARD UNIT HAS BEEN APPROVED BY THE DIVISION

16

BOTTOM HOLE
LAT. 36.257364° N (NAD83)
LONG. 107.676793° W (NAD83)
LAT. 36.257351° N (NAD27)
LONG. 107.676182° W (NAD27)

ENTRY POINT
LAT. 36.257350° N (NAD83)
LONG. 107.663191° W (NAD83)
LAT. 36.257337° N (NAD27)
LONG. 107.662580° W (NAD27)

WELL FLAG
LAT. 36.257736° N (NAD83)
LONG. 107.660870° W (NAD83)
LAT. 36.257723° N (NAD27)
LONG. 107.660259° W (NAD27)



18

[17] OPERATOR CERTIFICATION

I hereby certify that the information contained herein is true and complete to the best of my knowledge and belief, and that this organization either owns a working interest or unleased mineral interest in the land including the proposed bottom hole location or has a right to drill this well at this location pursuant to a contract with an owner of such a mineral or working interest, or to a voluntary pooling agreement or a compulsory pooling order heretofore entered by the division.

Signature Date

Printed Name

E-mail Address

SURVEYOR CERTIFICATION

I hereby certify that the well location shown on this plat was plotted from field notes of actual surveys made by me or under my supervision, and that the same is true and correct to the best of my belief.

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Date of Survey

Signature and Seal of Professional Surveyor:

DAVID B. RUSSELL
NEW MEXICO
10201
REGISTERED PROFESSIONAL LAND SURVEYOR

DAVID RUSSELL

Certificate Number 10201

WELL FLAG
LATITUDE: 36.258079° N
LONGITUDE: 107.660785° W
DATUM: NAD83

ENERGEN RESOURCES CORPORATION

CHACO 23-8 3 #1H
1994' FNL & 187' FEL
LOCATED IN THE SE/4 NE/4 OF SECTION 3,
T23N, R8W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6908', NAVD 88
FINISHED PAD ELEVATION: 6910.5', NAVD 88

MN 9.43° E
TN
50' 0 50' 100'
SCALE = 100'

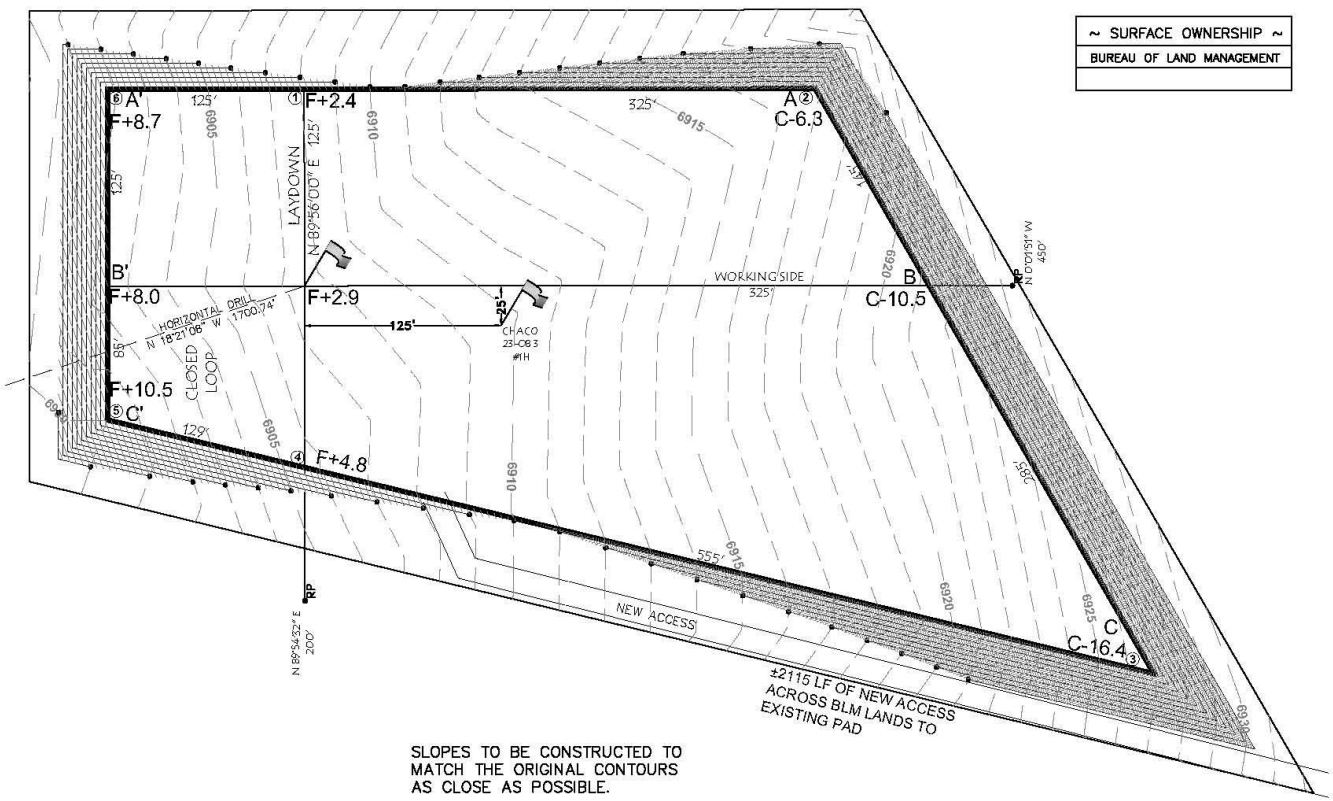
NOTES:

1.) BASIS OF BEARING: BETWEEN FOUND MONUMENTS AT THE NORTHEAST CORNER AND THE EAST QUARTER CORNER OF SECTION 3, TOWNSHIP 23 NORTH, RANGE 8 WEST, N.M.P.M. SAN JUAN COUNTY, NEW MEXICO.
LINE BEARS: N 0°46'59" W A DISTANCE OF 2699.92 FEET AS MEASURED BY G.P.S.

2.) LATITUDE, LONGITUDE AND ELLIPSOIDAL HEIGHT BASED ON AZTEC CORS L1 PHASE CENTER.
DISTANCES SHOWN ARE GROUND DISTANCES USING A TRAVERSE MERCATOR PROJECTION FROM A WGS84 ELLIPSOID, CONVERTED TO NAD83.
NAVD88 ELEVATIONS AS PREDICTED BY GEOID03.

3.) LOCATION OF UNDERGROUND UTILITIES DEPICTED ARE APPROXIMATE. PRIOR TO EXCAVATION UNDERGROUND UTILITIES SHOULD BE FIELD VERIFIED. ALL CONSTRUCTION ACTIVITIES SHOULD BE FIELD VERIFIED WITH NEW MEXICO ONE-CALL AUTHORITIES AT LWEST 48 HOURS PRIOR TO CONSTRUCTION.

~ SURFACE OWNERSHIP ~
BUREAU OF LAND MANAGEMENT



±2115 LF OF NEW ACCESS ACROSS BLM LANDS TO EXISTING PAD

SLOPES TO BE CONSTRUCTED TO MATCH THE ORIGINAL CONTOURS AS CLOSE AS POSSIBLE.

TOTAL PERMITTED AREA
MULTIPLE DIMENSION = 5.83 ACRES
SCALE: 1" = 100'
JOB No.: ERG327
DATE: 08/26/2014
DRAWN BY: TWT

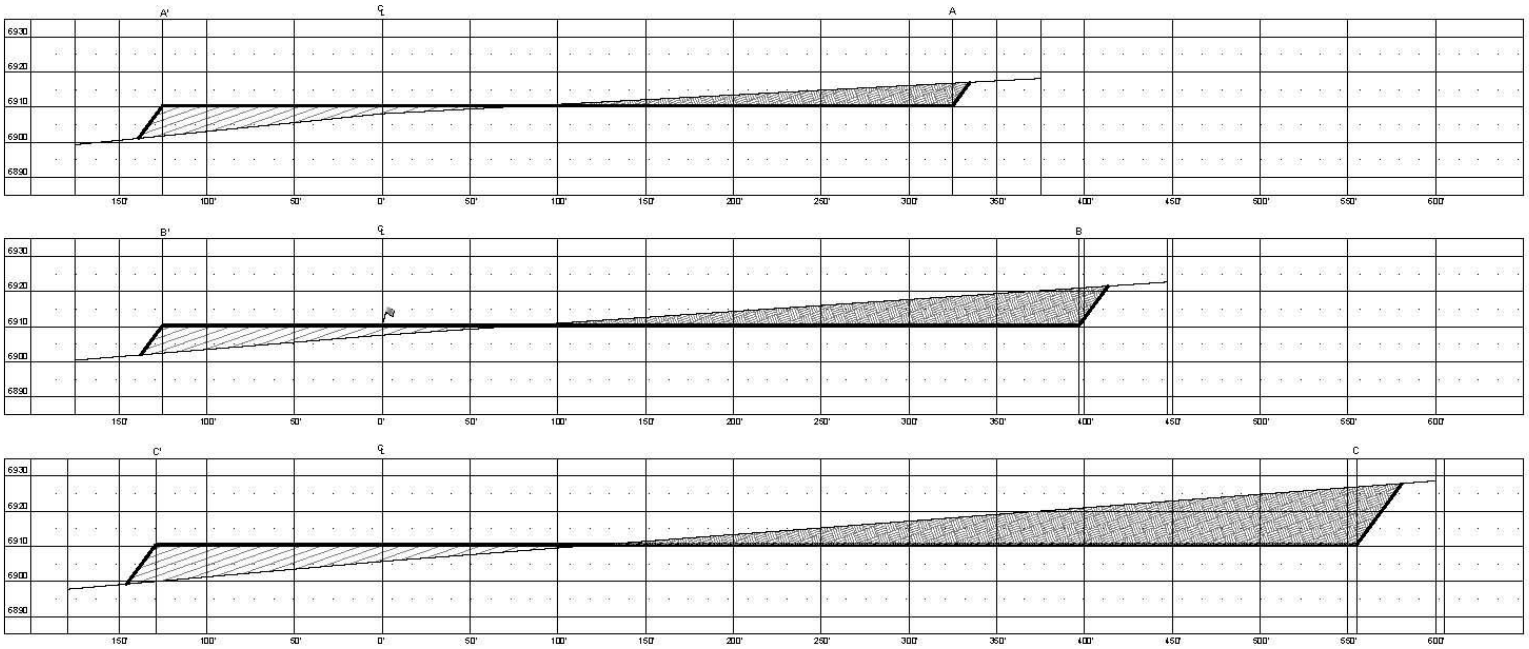
NOTE:
SCORPION SURVEY & CONSULTING, L.L.C. IS NOT LIABLE FOR UNDERGROUND UTILITIES OR PIPELINES. CONTRACTOR SHOULD CALL ONE-CALL FOR LOCATION OF ANY MARKED OR UNMARKED, BURIED PIPELINES OR CABLES ON WELL PAD, IN CONSTRUCTION ZONE AND/OR ACCESS ROAD AT LWEST TWO (2) WORKING DAYS PRIOR TO CONSTRUCTION.

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

LATITUDE: 36.258079° N
LONGITUDE: 107.660785° W
DATUM: NAD 83

ENERGEN RESOURCES CORPORATION

CHACO 23-8 3 #1H
1994' FNL & 187' FEL
LOCATED IN THE SE/4 NE/4 OF SECTION 3, T23N, R8W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6908', NAVD 88
FINISHED PAD ELEVATION: 6910.5', NAVD 88



VERT. SCALE: 1" = 45'
HORZ. SCALE: 1" = 90'
JOB No.: ERG327
DATE: 01/20/2014

THIS DIAGRAM IS AN ESTIMATE OF DIRT BALANCE AND IS NOT INTENDED TO BE AN EXACT MEASURE OF VOLUME

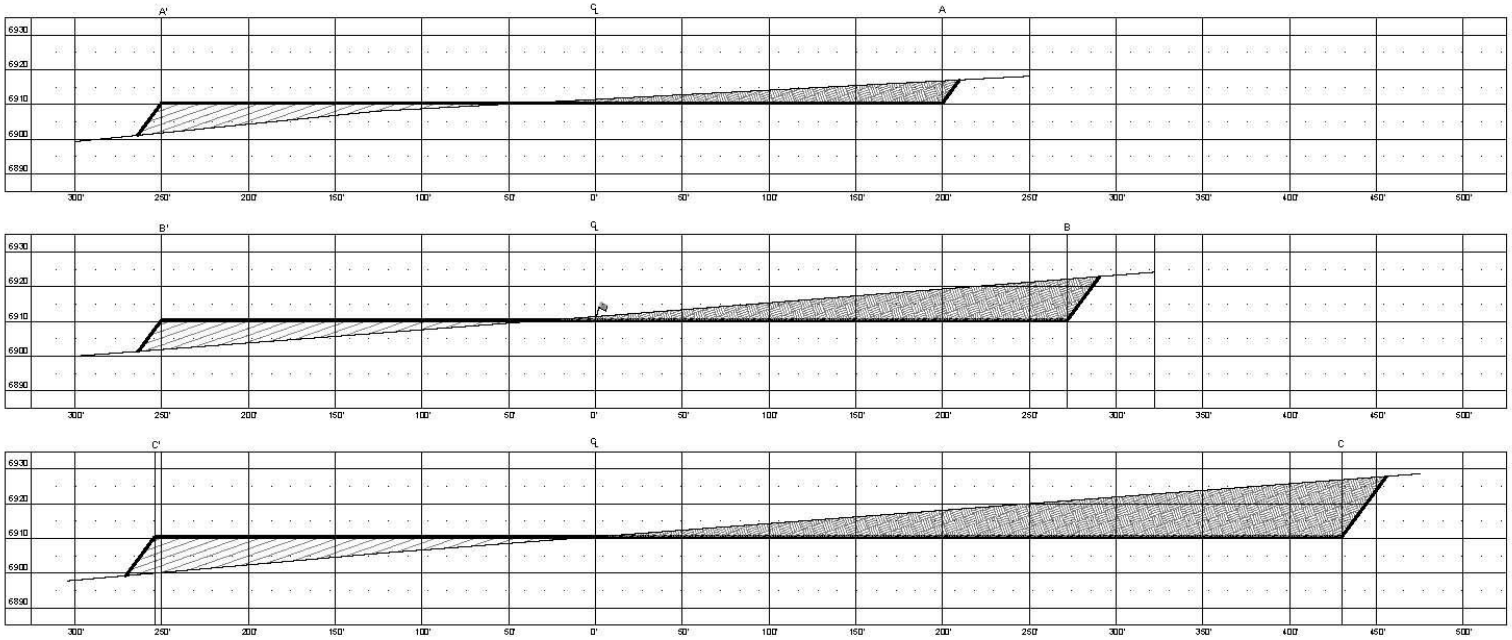
FILL CUT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

LATITUDE: 36.257736° N
LONGITUDE: 107.660870° W
DATUM: NAD 83

ENERGEN RESOURCES CORPORATION

CHACO 23-8 3 #2H
2119' FNL & 213' FEL
LOCATED IN THE SE/4 NE/4 OF SECTION 3, T23N, R8W, N.M.P.M.,
SAN JUAN COUNTY, NEW MEXICO
GROUND ELEVATION: 6910', NAVD 88
FINISHED PAD ELEVATION: 6910.5', NAVD 88



VERT. SCALE: 1" = 45'
HORZ. SCALE: 1" = 90'
JOB No.: ERG328
DATE: 01/20/2014

THIS DIAGRAM IS AN ESTIMATE OF DIRT BALANCE AND IS NOT INTENDED TO BE AN EXACT MEASURE OF VOLUME

FILL CUT

Scorpion Survey & Consulting, L.L.C.
302 S. Ash
Aztec, New Mexico 87410
(505) 334-4007

B.2. Access Road Plats

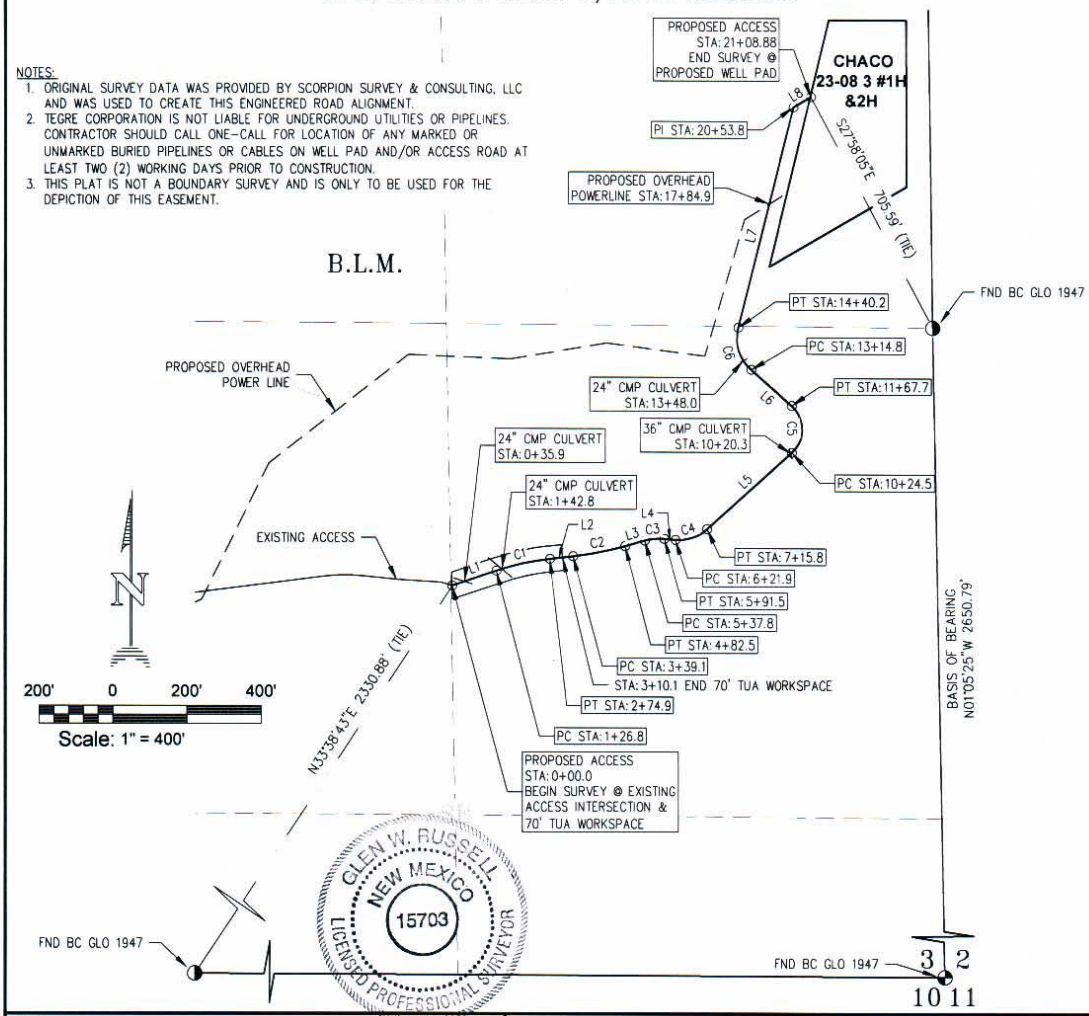
ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H

2108.9' PROPOSED 40' WIDE ACCESS

LOCATED IN NE/4 SE/4 & SE/4 NE/4 SEC. 3, T-23-N, R-8-W, N.M.P.M.

SAN JUAN COUNTY, NEW MEXICO

NOTES:
1. ORIGINAL SURVEY DATA WAS PROVIDED BY SCORPION SURVEY & CONSULTING, LLC AND WAS USED TO CREATE THIS ENGINEERED ROAD ALIGNMENT.
2. TEGRE CORPORATION IS NOT LIABLE FOR UNDERGROUND UTILITIES OR PIPELINES. CONTRACTOR SHOULD CALL ONE-CALL FOR LOCATION OF ANY MARKED OR UNMARKED BURIED PIPELINES OR CABLES ON WELL PAD AND/OR ACCESS ROAD AT LEAST TWO (2) WORKING DAYS PRIOR TO CONSTRUCTION.
3. THIS PLAT IS NOT A BOUNDARY SURVEY AND IS ONLY TO BE USED FOR THE DEPICTION OF THIS EASEMENT.



BASIS OF BEARING:
BETWEEN FOUND MONUMENTS AT THE SOUTHEAST CORNER AND THE EAST QUARTER CORNER OF SECTION 3, TOWNSHIP 23 NORTH, RANGE 8 WEST, N.M.P.M. SAN JUAN COUNTY, NEW MEXICO.

LINE BEARS: N01°05'25"W A DISTANCE OF 2650.79 FEET AS MEASURED BY G.P.S. STATE PLANE NAD83, ZONE NEW MEXICO WEST 3003.

OWNERSHIP

LOCATION	OWNER	STATION	FT./RODS
E1/2, SEC.3, T23N, R8W	BLM	E.S. 0+00.00 TO E.S. 21+08.9	2108.9/127.8

I, GLEN W. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR, FOR AND ON BEHALF OF TEGRE CORPORATION, CERTIFY THAT I CONDUCTED OR SUPERVISED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

Glen W. Russell DATE 1-26-15

GLEN W. RUSSELL, PLS
NEW MEXICO L.S. #15703

tegre
1199 MAIN AVENUE SUITE 101 DURANGO, COLORADO 81301 (970)828-4732

ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H
2108.9' PROPOSED 40' WIDE ACCESS

PROJ. NO	CLIENT	DRAWING NO.	SHEET
3050914		ENERGEN	1 OF 2
DRAWN BY LJB DATE 01/26/15	CHECKED BY GWR DATE 01/26/15		

ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H

2108.9' PROPOSED 40' WIDE ACCESS

LOCATED IN NE/4 SE/4 & SE/4 NE/4 SEC. 3, T-23-N, R-8-W, N.M.P.M.

SAN JUAN COUNTY, NEW MEXICO

LINE TABLE		
LINE NO.	LENGTH	DIRECTION
L1	126.8	N71°22'51"E
L2	64.2	N83°30'01"E
L3	55.3	N74°21'58"E
L4	30.4	S85°07'39"E
L5	308.7	N48°05'56"E
L6	147.1	N48°26'12"W
L7	613.6	N14°02'18"E
L8	55.1	N59°11'35"E

CURVE TABLE					
CURVE NO.	RADIUS	ARC LENGTH	Δ ANGLE	CHORD DIST.	CHORD DIRECTION
C1	700.0'	148.1'	12°07'11"	147.8'	N77°26'26"E
C2	900.0'	143.5'	9°08'04"	143.3'	N78°56'00"E
C3	150.0'	53.7'	20°30'23"	53.4'	N84°37'09"E
C4	115.0'	93.9'	46°46'25"	91.3'	N71°29'08"E
C5	85.0'	143.2'	96°32'08"	126.9'	N0°10'08"W
C6	115.0'	125.4'	62°28'30"	119.3'	N17°11'57"W

PERMANENT EASEMENT		
STATION	WIDTH	ACREAGE
0+00 TO 21+08.88	40.00'	1.94AC

TUA WIDTH TABLE		
STATION	WIDTH	TUA ONLY ACREAGE
0+00 TO 3+10.1	70'-40'=30'	0.21AC

GLEN W. RUSSELL NEW MEXICO 15703 LICENSED SURVEYOR

I, GLEN W. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR, FOR AND ON BEHALF OF TEGRE CORPORATION, CERTIFY THAT I CONDUCTED OR SUPERVISED AND AM RESPONSIBLE FOR THIS SURVEY, THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

Glen W Russell DATE 1-26-15

GLEN W. RUSSELL, PLS
NEW MEXICO L.S. #15703

tegre

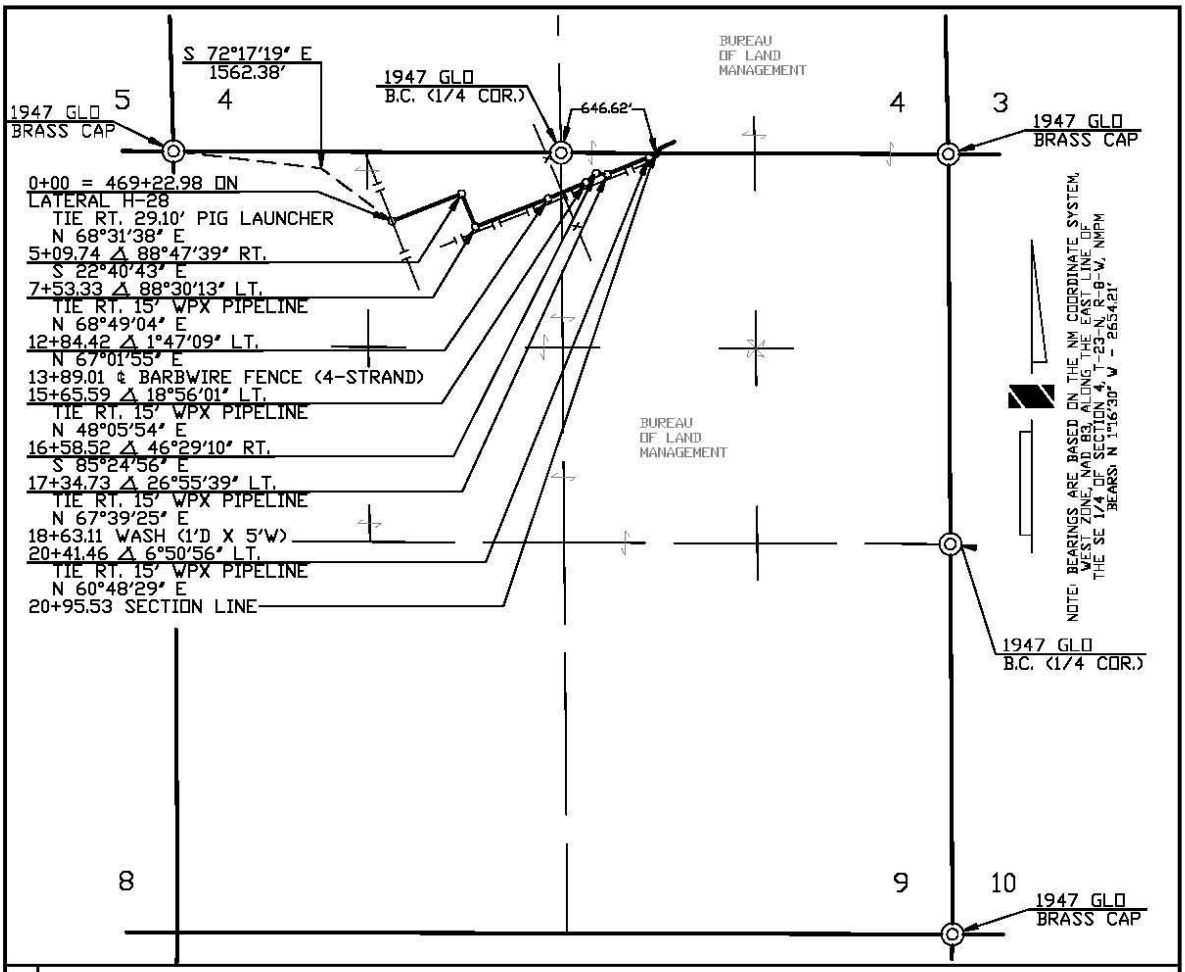
1199 MAIN AVENUE
SUITE 101
DURANGO, COLORADO 81301
(970)828-4732

ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H
2108.9' PROPOSED 40' WIDE ACCESS

PROJ. NO	CLIENT	DRAWING NO.	SHEET
3050914		ENERGEN	2 OF 2

DRAWN BY	DATE	CHECKED BY	DATE
LJB	01/26/15	GWR	01/26/15

B.3. Pipeline Plats



PIPE DATA

PRELIMINARY DRAWING

OWNERSHIP

SUBDIVISION	OWNER	FEET	MILES	ACRES	RODS	R.O.W. WIDTH
0+00 TO 20+95.53	BUREAU OF LAND MANAGEMENT	2095.53	0.397	1.924	127.002	40'

REVISION

NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.	NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.
2	12/10/14	VC	LINE CHANGE (11-04-14)	WDC1168637	MW								
1	09/26/14	HJ	ISSUED FOR REVIEW	WDC1168637	MW		3	01/07/15	MW	LINE CHANGE	WDC1168637	MW	

INFO		DRAFTING	BY	DATE
R/W #:	148103	DRAWN BY	HJ	09/26/14
NWC #:		CHECKED BY	MW	09/26/14
METER #:		APPROVED BY		
SURVEYED:	09/09/14	**ENGINEER**	**BY**	**DATE**
		DESIGNED BY		
		PROJ. APPROVED		

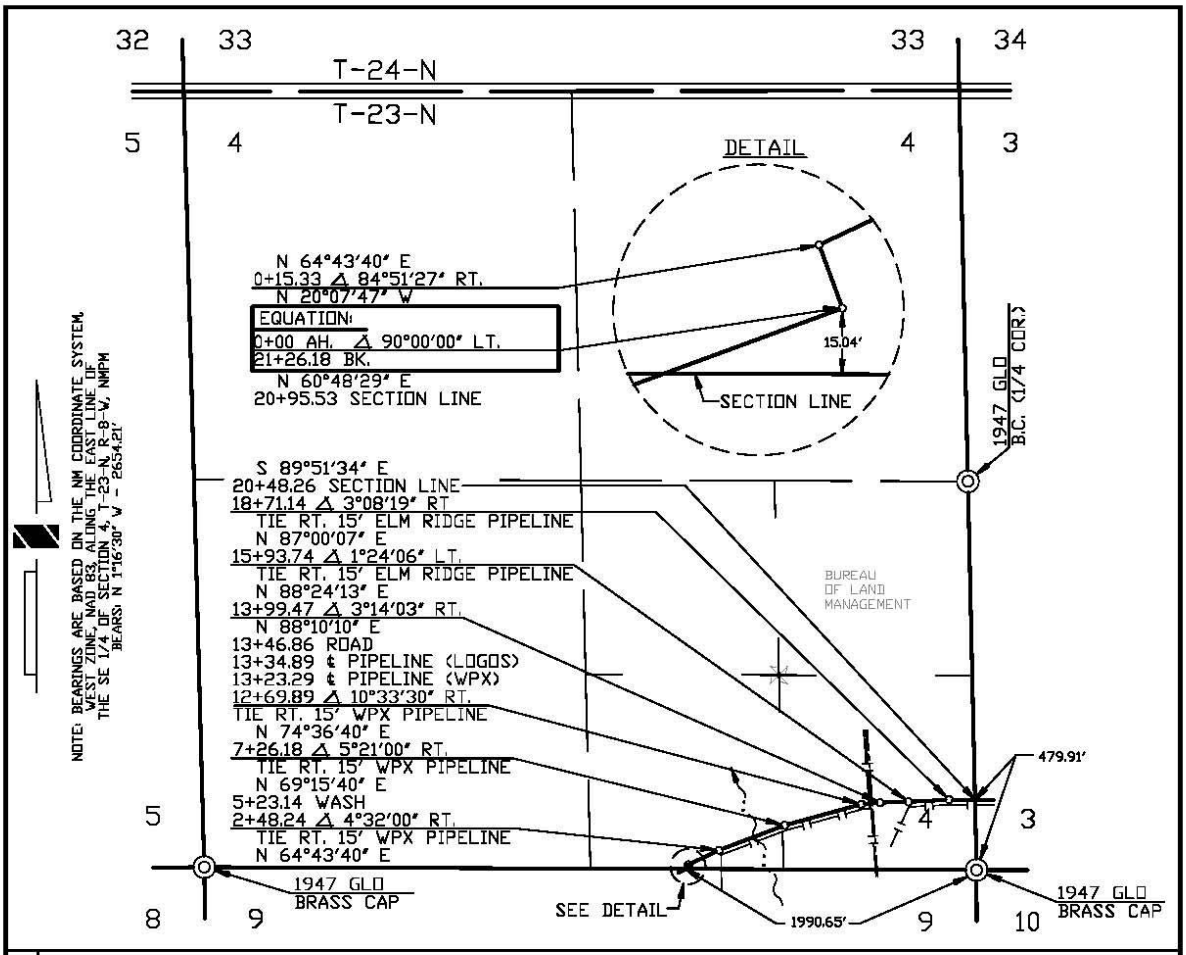
STATE: NEW MEXICO
COUNTY: SAN JUAN

WILLIAMS FOUR CORNERS, LLC Williams
ONE OF THE WILLIAMS COMPANIES

SAN JUAN GATHERING SYSTEM
ENERGEN RESOURCES - CHACO 23-08-3 #1H
(REF DWG. 28H765.0-1)
SEC. 9, T-23-N, R-8-W, NMPM
0+00 = 469+22.98 ON LATERAL H-28

SCALE: 1" = 1000'
W.O. NO: WDC1168637
DWG NO. 28H765.0-6-1
SHEET 1 OF 3
REV 3

T:\DS\MAPPING\DRAWINGS\SANJUAN\765\00\28H7650-6-1_R03.DWG 1/07/2015 3:00PM MARYW



PIPE DATA

PRELIMINARY DRAWING

OWNERSHIP

SUBDIVISION	OWNER	FEET	MILES	ACRES	RODS	R.O.W. WIDTH
20+95.53 TO 20+48.26	BUREAU OF LAND MANAGEMENT	2078.91	0.394	1.909	125.995	40'

REVISION

NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.	NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.
2	12/10/14	VC	LINE CHANGE (11-04-14)	WOC1168637	MW								
1	09/26/14	HJ	ISSUED FOR REVIEW	WOC1168637	MW		3	01/07/15	MW	LINE CHANGE	WOC1168637	MW	

INFO	
R/W #:	148103
NWC #:	
METER #:	
SURVEYED:	09/09/14

DRAFTING	BY	DATE
DRAWN BY	HJ	09/26/14
CHECKED BY	MW	09/26/14
APPROVED BY		
ENGINEER	**BY**	**DATE**
DESIGNED BY		
PROJ. APPROVED		

STATE: NEW MEXICO
COUNTY: SAN JUAN

WILLIAMS FOUR CORNERS, LLC Williams
ONE OF THE WILLIAMS COMPANIES

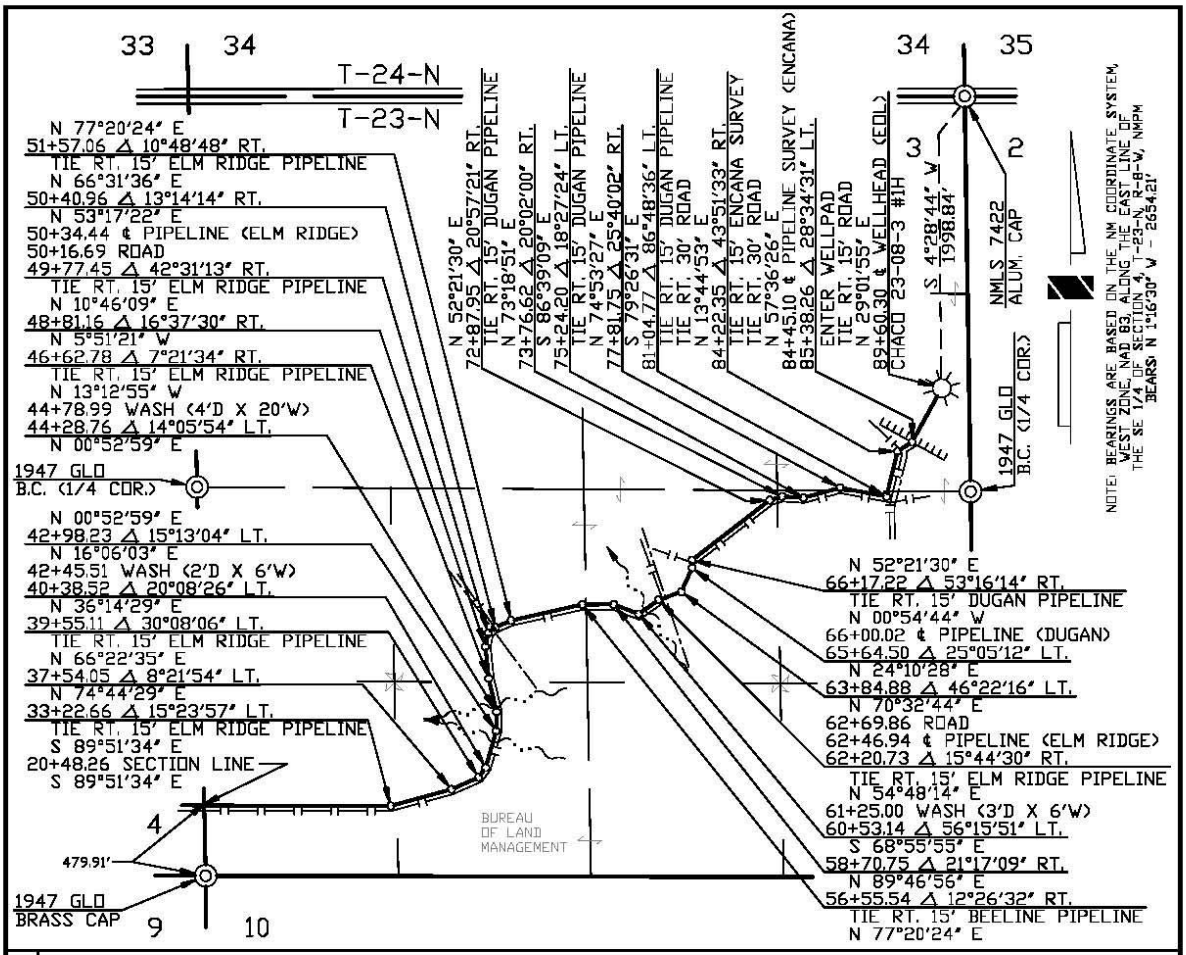
SAN JUAN GATHERING SYSTEM
ENERGEN RESOURCES - CHACO 23-08-3 #1H
(REF DWG. 28H765.0-1)
SEC. 4, T-23-N, R-8-W, NMPM
0+00 = 469+22.98 ON LATERAL H-28

SCALE: 1" = 1000'
W.O. NO. WOC1168637

DWG NO. 28H765.0-6-2

SHEET 2 OF 3 | REV 3

T:\DS\MAPPING\DRAWINGS\SANJUAN\765\00\28H7650-6-2_R03.DWG 01/06/2015 3:00PM MARYW



PIPE DATA

PRELIMINARY DRAWING

OWNERSHIP

SUBDIVISION	OWNER	FEET	MILES	ACRES	RODS	R.O.W. WIDTH
20+48.26 TO 89+60.30	BUREAU OF LAND MANAGEMENT	6912.04	1.309	6.347	418.912	40'

REVISION

NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.	NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.
2	12/10/14	VC	LINE CHANGE (11-04-14)	WOC1168637	MW								
1	09/26/14	HJ	ISSUED FOR REVIEW	WOC1168637	MW		3	01/07/15	MW	LINE CHANGE	WOC1168637	MW	

INFO	
R/W #:	148103
NWC #:	
METER #:	
SURVEYED:	09/09/14

DRAFTING	BY	DATE
DRAWN BY	HJ	09/26/14
CHECKED BY	MW	09/26/14
APPROVED BY		
ENGINEER	**BY**	**DATE**
DESIGNED BY		
PROJ. APPROVED		

STATE: NEW MEXICO
COUNTY: SAN JUAN

WILLIAMS FOUR CORNERS, LLC Williams
ONE OF THE WILLIAMS COMPANIES

SAN JUAN GATHERING SYSTEM
ENERGEN RESOURCES - CHACO 23-08-3 #1H
(REF DWG. 28H765.0-1)
SEC. 3, T-23-N, R-8-W, NMPM
0+00 = 469+22.98 ON LATERAL H-28

SCALE: 1" = 1000'
W.O. NO. WOC1168637

DWG NO. 28H765.0-6-3

SHEET 3 OF 3 REV 3

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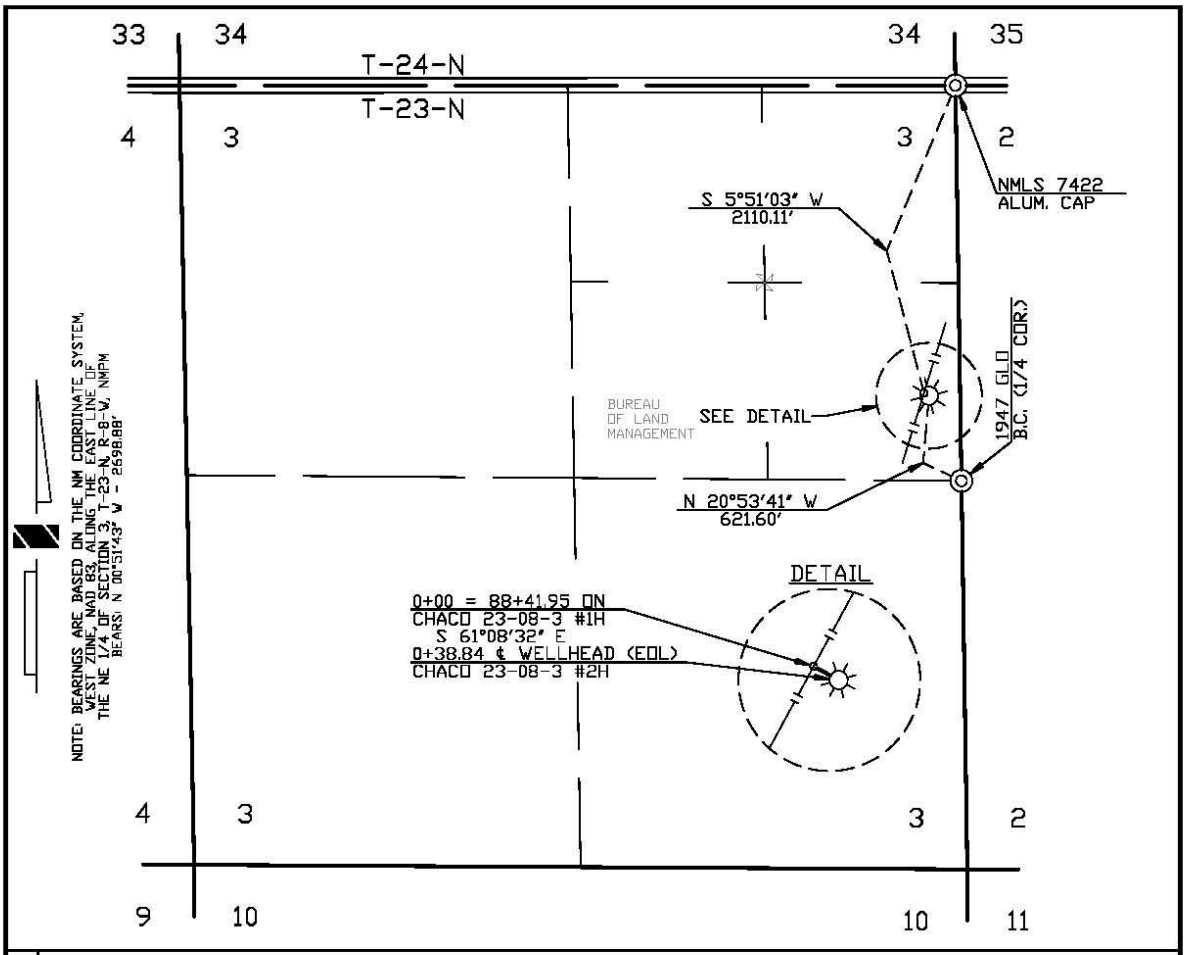

PIPE DATA

PRELIMINARY DRAWING

OWNERSHIP

SUBDIVISION	OWNER	FEET	MILES	ACRES	RODS	R.O.W. WIDTH
0+00 TO 0+38.84	BUREAU OF LAND MANAGEMENT	38.84	0.007	0.036	2.354	40'

REVISION

NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.	NO.	DATE	BY	DESCRIPTION	W.O.NO.	CHK.	APP.
2	01/07/15	MW	LINE CHANGE	WOC1168647	MW								
1	09/19/14	HJ	ISSUED FOR REVIEW	WOC1168647	MW								

INFO	
R/W #:	148104
NWC #:	
METER #:	
SURVEYED:	09/12/14

DRAFTING	BY	DATE
DRAWN BY	HJ	09/19/14
CHECKED BY	MW	09/19/14
APPROVED BY		
ENGINEER	**BY**	**DATE**
DESIGNED BY		
PROJ. APPROVED		

STATE: NEW MEXICO
COUNTY: SAN JUAN

WILLIAMS FOUR CORNERS, LLC Williams
ONE OF THE WILLIAMS COMPANIES

SAN JUAN GATHERING SYSTEM
ENERGEN RESOURCES - CHACO 23-08-3 #2H
(REF DWG. 28H765.0-6-1)
SEC. 3, T-23-N, R-8-W, NMPM
0+00 = 88+41.95 ON CHACO 23-08-3 #1H

SCALE: 1" = 1000'
W.O. NO. WOC1168647

DWG NO. 28H765.0-7-1

SHEET 1 OF 1 | REV 2

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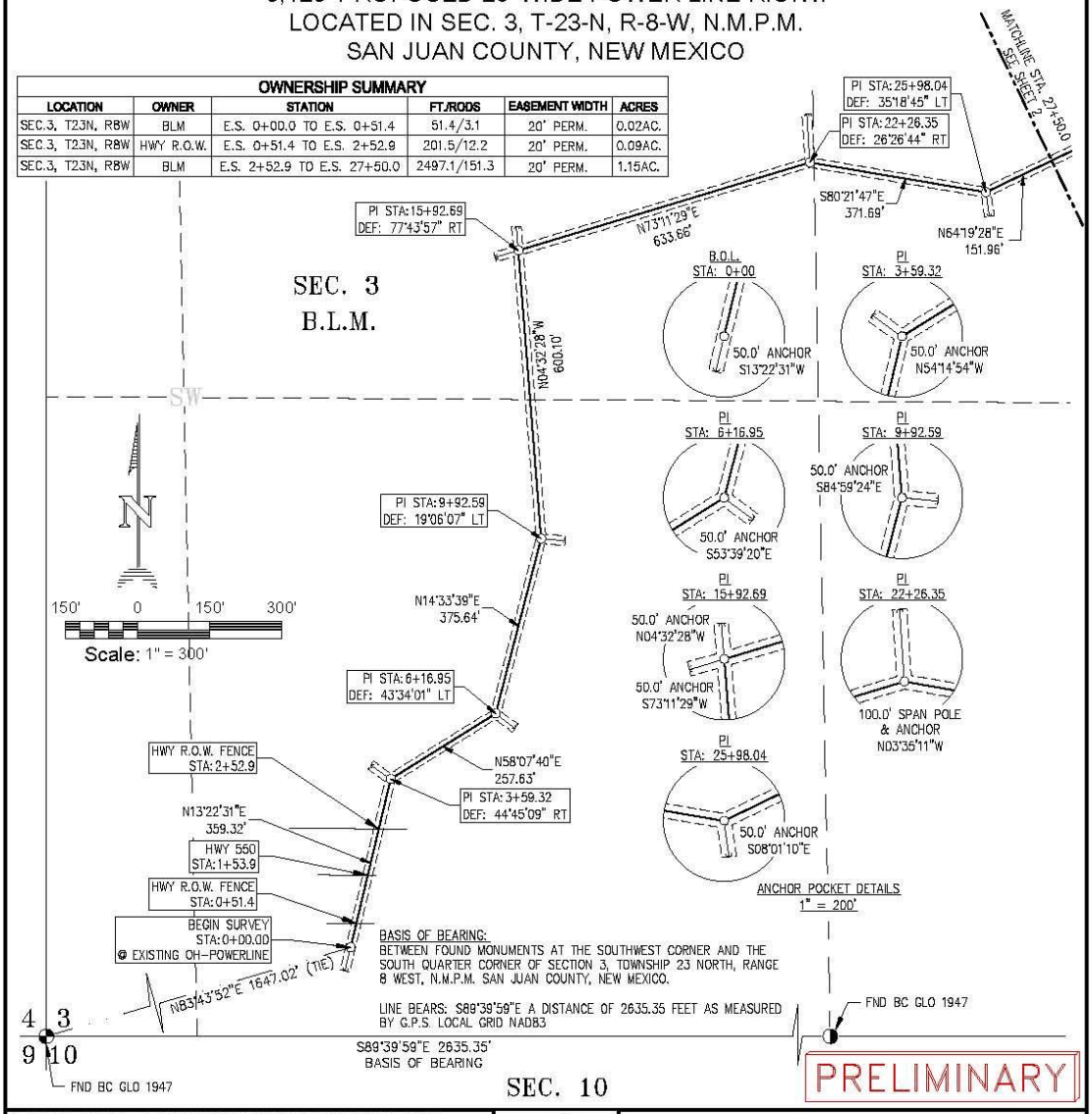
B.4. Power Line Plats

ENERGEN RESOURCES CORPORATION
PROPOSED POWERLINE
CHACO 23-08 3 #1H & CHACO 23-08 3 #2H
JEMEZ MOUNTAINS ELECTRIC COOPERATIVE, INC.

5,125' PROPOSED 20' WIDE POWER LINE R.O.W.
LOCATED IN SEC. 3, T-23-N, R-8-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO

OWNERSHIP SUMMARY

LOCATION	OWNER	STATION	FT./RODS	EASEMENT WIDTH	ACRES
SEC.3, T23N, R8W	BLM	E.S. 0+00.0 TO E.S. 0+51.4	51.4/3.1	20' PERM.	0.02AC.
SEC.3, T23N, R8W	HWY R.O.W.	E.S. 0+51.4 TO E.S. 2+52.9	201.5/12.2	20' PERM.	0.09AC.
SEC.3, T23N, R8W	BLM	E.S. 2+52.9 TO E.S. 27+50.0	2497.1/151.3	20' PERM.	1.15AC.



I, GLEN W. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR, FOR AND ON BEHALF OF TEGRE CORPORATION, CERTIFY THAT I CONDUCTED OR SUPERVISED AND AM RESPONSIBLE FOR THIS SURVEY. THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

DATE _____

GLEN W. RUSSELL, PLS
NEW MEXICO L.S. #15703

tegre
integrity - respect - responsibility
1196 MAIN AVENUE
SUITE 101
DURANGO, COLORADO 81301
(970)259-4732

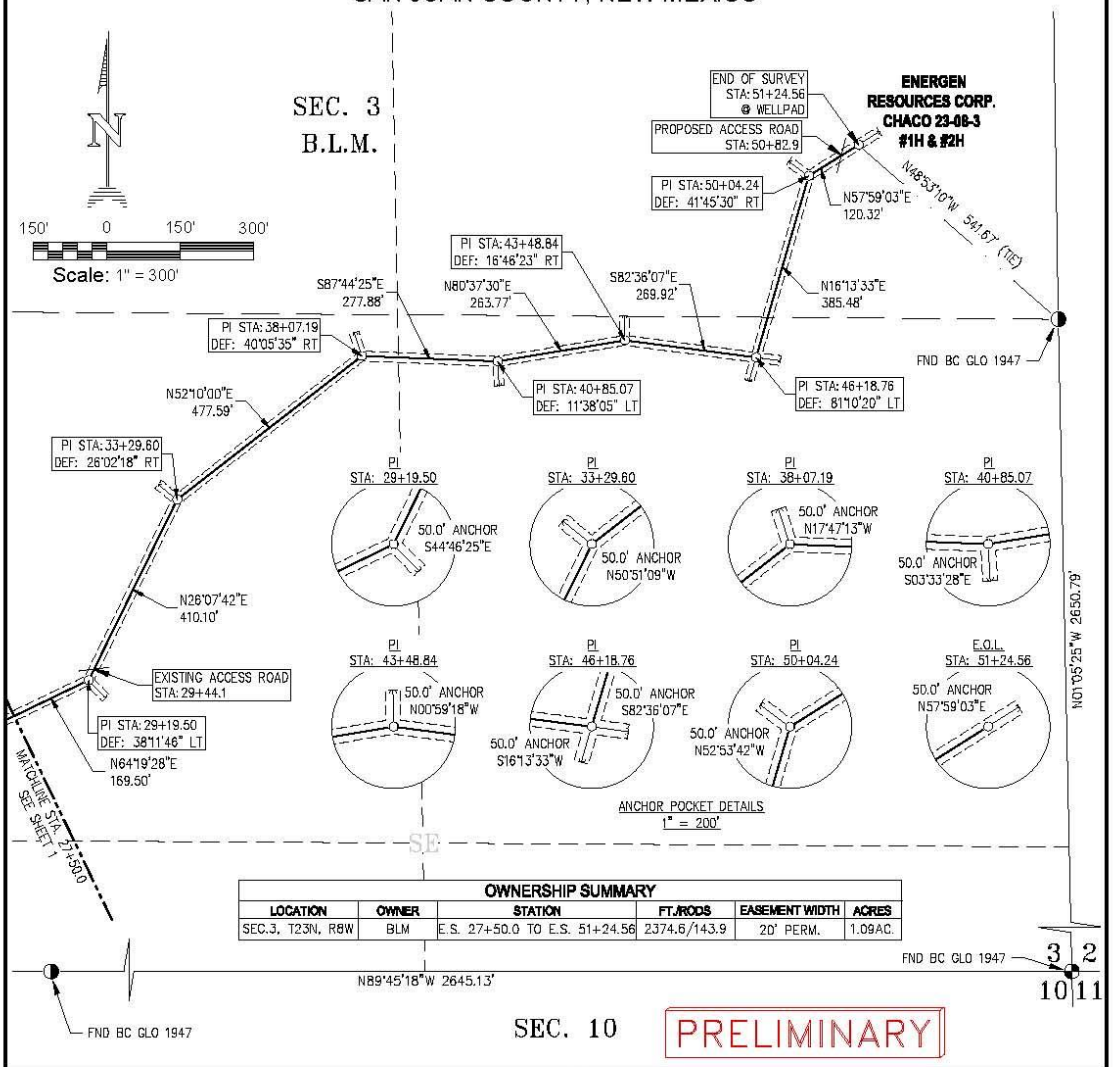
ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H
5,125' PROPOSED 20' WIDE POWER LINE R.O.W.

PROJ. NO	CLIENT	DRAWING NO.	SHEET
3050914		ENERGEN	1 OF 3

DRAWN BY	DATE	CHECKED BY	DATE
LJB	07/17/15	GWR	07/17/15

ENERGEN RESOURCES CORPORATION
PROPOSED POWERLINE
CHACO 23-08 3 #1H & CHACO 23-08 3 #2H
JEMEZ MOUNTAINS ELECTRIC COOPERATIVE, INC.

5,125' PROPOSED 20' WIDE POWER LINE R.O.W.
LOCATED IN SEC. 3, T-23-N, R-8-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO



OWNERSHIP SUMMARY					
LOCATION	OWNER	STATION	FT./RODS	EASEMENT WIDTH	ACRES
SEC.3, T23N, R8W	BLM	E.S. 27+50.0 TO E.S. 51+24.56	2374.6/143.9	20' PERM.	1.09AC.

I, GLEN W. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR, FOR AND ON BEHALF OF TEGRE CORPORATION, CERTIFY THAT I CONDUCTED OR SUPERVISED AND AM RESPONSIBLE FOR THIS SURVEY. THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

DATE

GLEN W. RUSSELL, PLS
NEW MEXICO L.S. #15703

tegre
integrity - respect - responsibility
1196 MAIN AVENUE
SUITE 101
DURANGO, COLORADO 81301
(970)626-4732

ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H
5,125' PROPOSED 20' WIDE POWER LINE R.O.W.

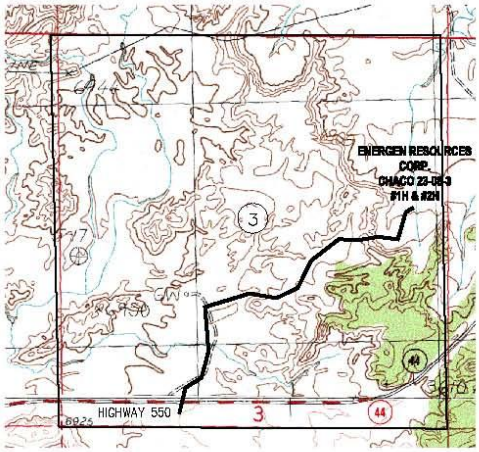
PROJ. NO	CLIENT	DRAWING NO.	SHEET
3050914			2 OF 3

DRAWN BY	DATE	CHECKED BY	DATE
LJB	07/17/15	GWR	07/17/15

ENERGEN

ENERGEN RESOURCES CORPORATION
PROPOSED POWERLINE
CHACO 23-08 3 #1H & CHACO 23-08 3 #2H
JEMEZ MOUNTAINS ELECTRIC COOPERATIVE, INC.

5,125' PROPOSED 20' WIDE POWER LINE R.O.W.
LOCATED IN SEC. 3, T-23-N, R-8-W, N.M.P.M.
SAN JUAN COUNTY, NEW MEXICO



MAIN LINE PERMANENT EASEMENT

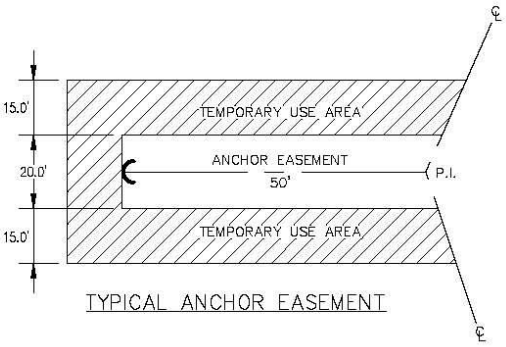
TOTAL MAIN LINE FOOTAGE: 5,125'
TOTAL ACREAGE: 2.35 ACRES

ANCHOR EASEMENTS

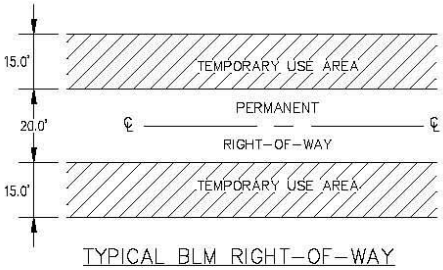
TOTAL LINEAR FOOTAGE: 900'
TOTAL ACREAGE: 0.35 ACRES

TEMPORARY USE AREA

TOTAL ACREAGE 4.10 ACRES



TYPICAL ANCHOR EASEMENT



TYPICAL BLM RIGHT-OF-WAY

PRELIMINARY

I, GLEN W. RUSSELL, A NEW MEXICO REGISTERED PROFESSIONAL LAND SURVEYOR, FOR AND ON BEHALF OF TEGRE CORPORATION, CERTIFY THAT I CONDUCTED OR SUPERVISED AND AM RESPONSIBLE FOR THIS SURVEY. THAT THIS SURVEY IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF, AND THAT THIS SURVEY AND PLAT MEET THE MINIMUM STANDARDS FOR SURVEYING IN NEW MEXICO.

_____ DATE _____

GLEN W. RUSSELL, PLS
NEW MEXICO L.S. #15703

tegre
integrity - respect - responsibility

1196 MAIN AVENUE
SUITE 101
DURANGO, COLORADO 81301
(970)259-4732

ENERGEN RESOURCES CORPORATION
CHACO 23-08 3 #1H & #2H
5,125' PROPOSED 20' WIDE POWER LINE R.O.W.

PROJ. NO		CLIENT		DRAWING NO.	SHEET
3050914				ENERGEN	3 OF 3
DRAWN BY	DATE	CHECKED BY	DATE		
LJB	07/17/15	GWR	07/17/15		

Appendix C. **PHOTOGRAPHS OF THE PROPOSED ACTION AREA**

Chaco 23-08 3 #1H and #2H Wells Project Proposed Well Pad
Looking to the South, Southwest

Chaco 23-08 3 #1H and #2H Wells Project Proposed Well Pad
Looking to the North

Chaco 23-08 3 #1H and #2H Wells Project Proposed Well Pad
Looking to the North, Northeast

Chaco 23-08 3 #1H and #2H Wells Project Existing Access Road to be Up-Graded
Latitude 36.266 Longitude 107.637

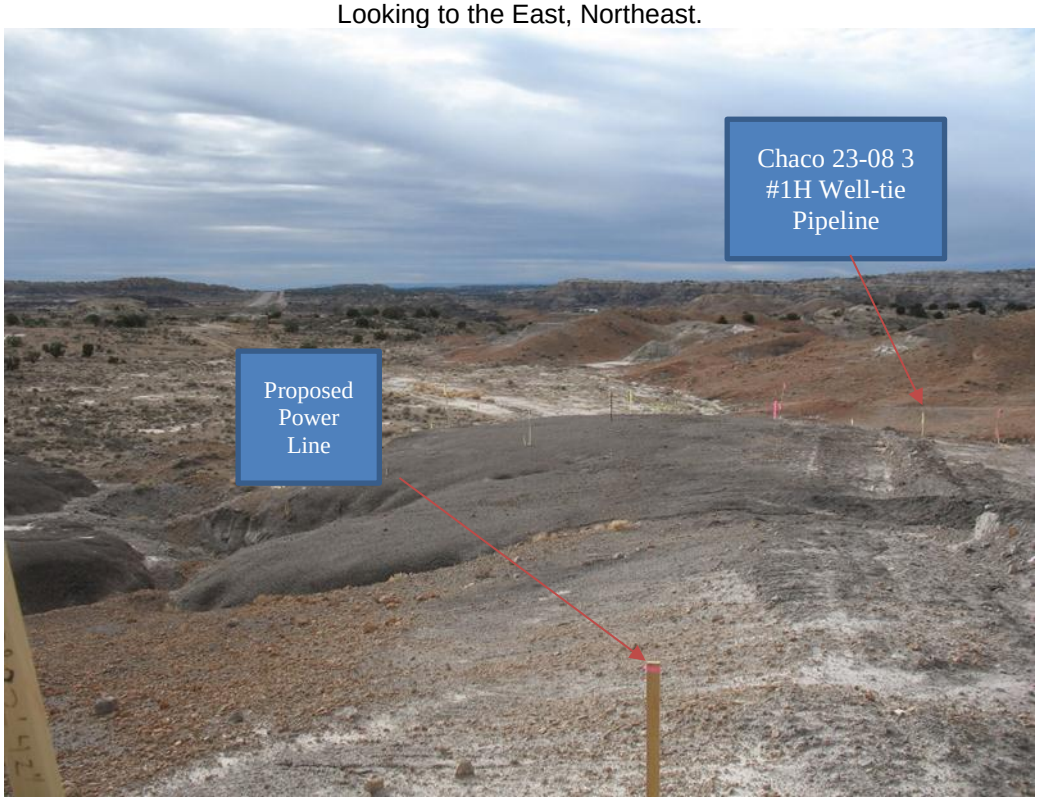
Chaco 23-08 3 #1H and #2H Wells Project Existing Access Road to be Up-Graded
Latitude 36.254 Longitude 107.666

Chaco 23-08 3 #1H and #2H Wells Project Existing Access Road to be Up-Graded

Latitude 36.251 Longitude 107.651

Chaco 23-08 3 #1H and #2H Wells Project Proposed Access Road. Center Line of Road Stake
Latitude 36.255 Longitude 107.662

Chaco 23-08 3 #1H and #2H Wells Project
Proposed Chaco 23-08 3 #1H Pipeline and Power Line Route. Adjacent to an Existing Pipeline.
Looking to the East, Northeast.



Chaco 23-08 3 #1H and #2H Wells Project
Proposed Chaco 23-08 3 #1H Pipeline and Power Line Route. Adjacent to an Existing Pipeline.
Looking to the Southwest.