U.S. Department of the Interior
Bureau of Land Management
Colorado River Valley Field Office
2300 River Frontage Road
Silt, Colorado 81652

ENVIRONMENTAL ASSESSMENT

NUMBER

DOI-BLM-CO-N040-2012-0076-EA

CASEFILE NUMBER

Surface holes and bottom holes fall within Federal Lease COC01523.

PROJECT NAME

Proposal to Drill Up to Ten Federal Gas Wells from the Proposed PH21 Pad Located on Public Land in the South Parachute Area, Garfield County, Colorado.

PAD LOCATION

Township 7 South (T7S), Range 95 West (R95W), Section 21, SE¼NE¼, Sixth Principal Meridian.

APPLICANT

Encana Oil & Gas (USA) Inc. – Contact: Jevin Croteau, 370 Seventeenth Street, Suite 1700, Denver, Colorado 80202.

PROPOSED ACTION

Encana Oil & Gas (USA) Inc. (Encana) proposes to directionally drill ten Federal gas wells from the proposed PH21 pad located on public land approximately 3.5 miles southeast of Parachute, Colorado. Encana plans to construct the pad in November 2012 and begin drilling the wells in May 2013. The project would result in 15.26 acres of initial surface disturbance and 5.54 acres of long-term disturbance through the production phase (Table 1). Names and locations of the wells are presented in Table 2. Figures 1 through 5 show the project location, pad layout, production schematic, access road alignment, and pipeline alignment, respectively. The access road and pipelines would not be collocated. Impact acres would be reduced by interim reclamation of the pad and reclamation of temporarily disturbed areas along the road and pipelines.

Table 1. Initial and Long-term Disturbance of Project Components

Component	***Initial Disturbance***	***Long-term Disturbance***
Well Pad	5.29 acres	1.28 acres
Access Road	2.81 acres (0.58 mile x 40 feet)	1.4 acres (0.58 mile x 20 feet)
Pipeline	7.16 acres (0.54 mile x 75 feet)	2.86 acres (0.54 mile x 30 feet)
Total	**15.26 acres**	**5.54 acres**

Table 2. Surface and Bottomhole Locations of Proposed Federal Wells (Federal Lease COC01523)

Proposed Pad	***Proposed Wells***	***Surface Location***	***Bottomhole Location***
PH21	Federal 21-1	1575 feet FNL, 754 feet FEL SE¼NE¼, Section 21, T7S R95W	255 feet FNL, 831 feet FEL NE¼NE¼, Section 21, T7S R95W
	Federal 22-1B	1609 feet FNL, 777 feet FEL SE¼NE¼, Section 21, T7S R95W	569 feet FNL, 2199 feet FEL NW¼NE¼, Section 21, T7S R95W
	Federal 21-1C	1592 feet FNL, 766 feet FEL SE¼NE¼, Section 21, T7S R95W	1151 feet FNL, 976 feet FEL NE¼NE¼, Section 21, T7S R95W
	Federal 21-8	1559 feet FNL, 743 feet FEL SE¼NE¼, Section 21, T7S R95W	1856 feet FNL, 340 feet FEL SE¼NE¼, Section 21, T7S R95W
	Federal 21-8C	1626 feet FNL, 789 feet FEL SE¼NE¼, Section 21, T7S R95W	2435 feet FNL, 758 feet FEL SE¼NE¼, Section 21, T7S R95W
	Federal 21-9A	1622 feet FNL, 777 feet FEL SE¼NE¼, Section 21, T7S R95W	2254 feet FSL, 406 feet FEL NE¼SE¼, Section 21, T7S R95W
	Federal 22-11B	1554 feet FNL, 730 feet FEL SE¼NE¼, Section 21, T7S R95W	2126 feet FSL, 1174 feet FWL NE¼SW¼, Section 21, T7S R95W
	Federal 22-12A	1571 feet FNL, 742 feet FEL SE¼NE¼, Section 21, T7S R95W	2543 feet FSL, 296 feet FWL NW¼SW¼, Section 21, T7S R95W
	Federal 22-12D	1605 feet FNL, 765 feet FEL SE¼NE¼, Section 21, T7S R95W	1852 feet FSL, 557 feet FWL NW¼SW¼, Section 21, T7S R95W
	Federal 22-14	1588 feet FNL, 753 feet FEL SE¼NE¼, Section 21, T7S R95W	922 feet FSL, 1687 feet FWL SE¼SW¼, Section 21, T7S R95W

Cuttings generated from the well bores would be collected in a small bermed and lined mixing area constructed on the pad. The cuttings would be tested as required by the U.S. Department of Energy (DOE) and Colorado Oil and Gas Conservation Commission (COGCC) and then mixed with drying agents and stored at the cut slope. The Proposed Action, including drilling and completion, production of natural gas and associated liquid condensate, proper handling and disposal of produced water, and interim and final reclamation, would be implemented consistent with the Federal oil and gas lease, Federal regulations (43 CFR 3100), and operational measures included in the Applications for Permit to Drill (APDs). Appendix A lists Conditions of Approval (COAs) required by the BLM for this project. Encana would be responsible for continuous inspection and maintenance of all project components.

A new access road and pipeline (Figures 4 and 5) would serve the proposed PH21 pad and planned wells. The source of water for drilling and completion would be the High Mesa water facility. Water would be transported to the pad through an existing water line to the west and through a proposed temporary surface waterline from the existing "Presco" waterline. Encana would install two temporary 8-inch waterlines 30 days before operations are planned and would remove the waterlines 60 days after completions are finished. The temporary surface waterline would cross both BLM and fee lands. A buried gathering line would also be constructed. The line would tie into an existing line at the existing PF21 pad (Figure 5) and be operated by Grand River Gathering (GRG).

A closed-loop drill system would be used, and no reserve pit would be required. The recovered drilling fluid would be stored on location in steel tanks to allow reuse for drilling operations. Instead of a reserve pit a small, bermed and contained mixing area would be constructed. The drill cuttings would be collected in this area during drilling operations. As the area fills, the cuttings would be mixed with drying agents and stored at the cut slope. For a well with a total depth (TD) of 12,000 feet, the approximate volume of cuttings would be 255 cubic yards.

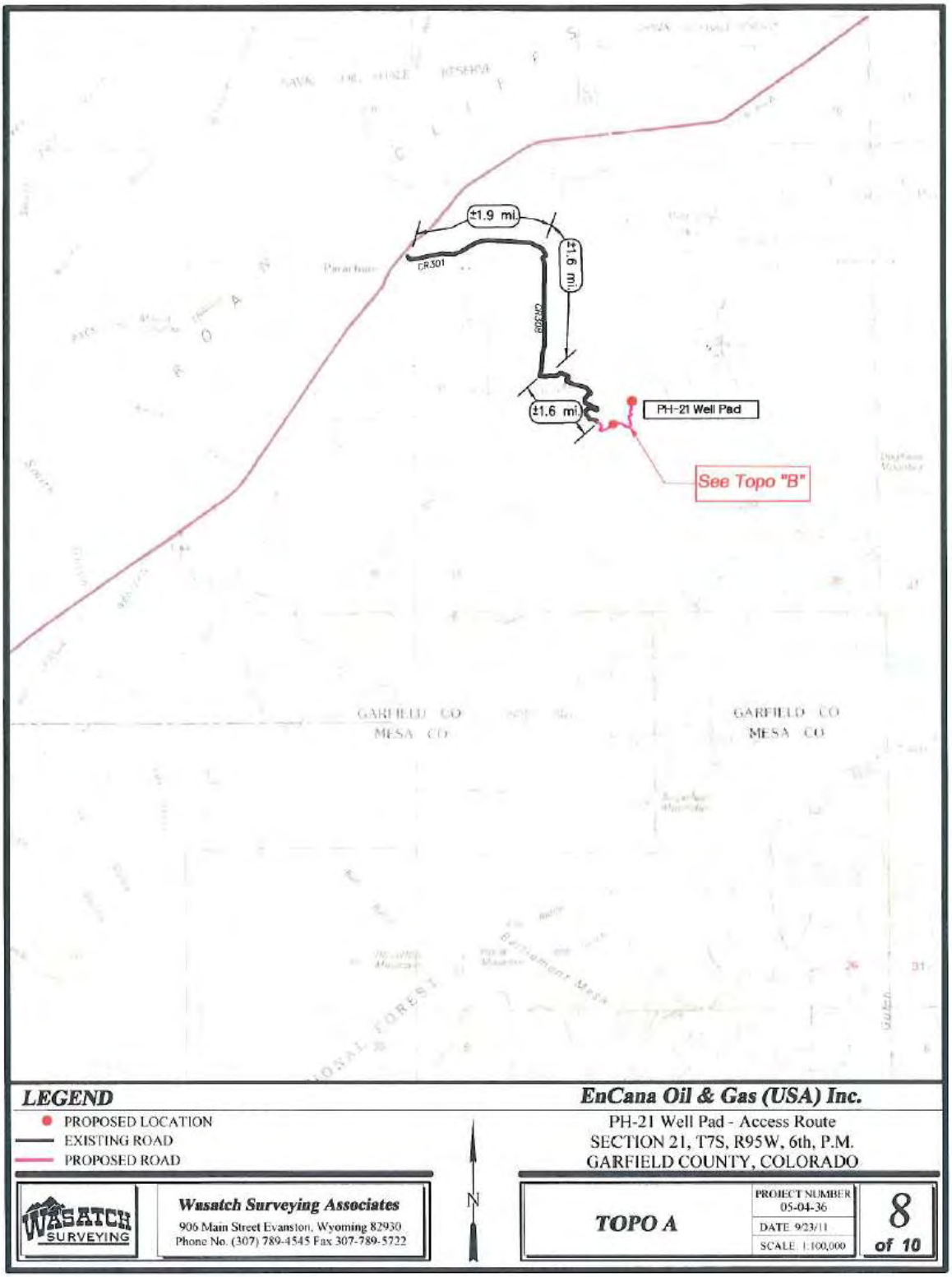


Figure 1. Project Location Map

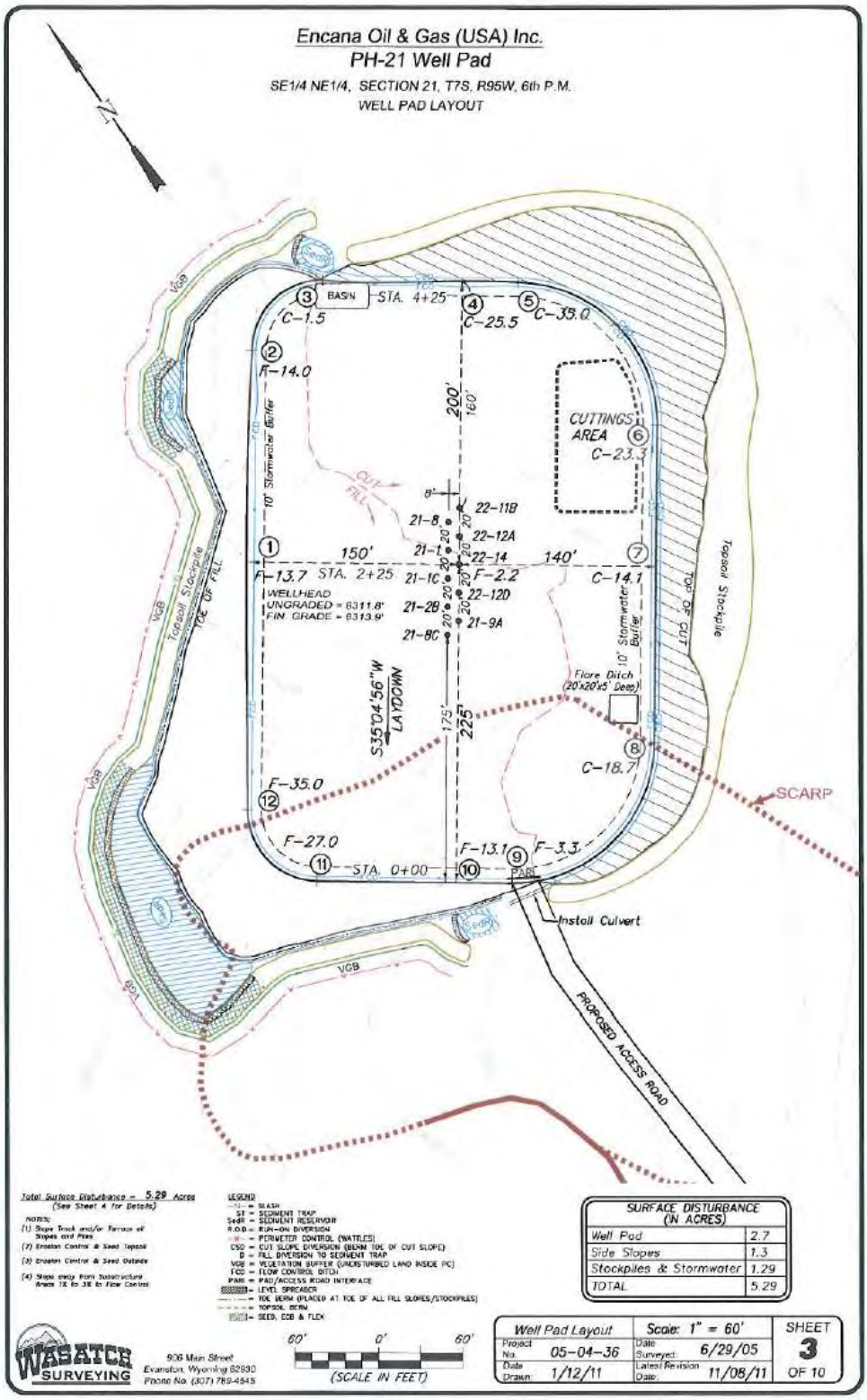


Figure 2. Well Pad Layout

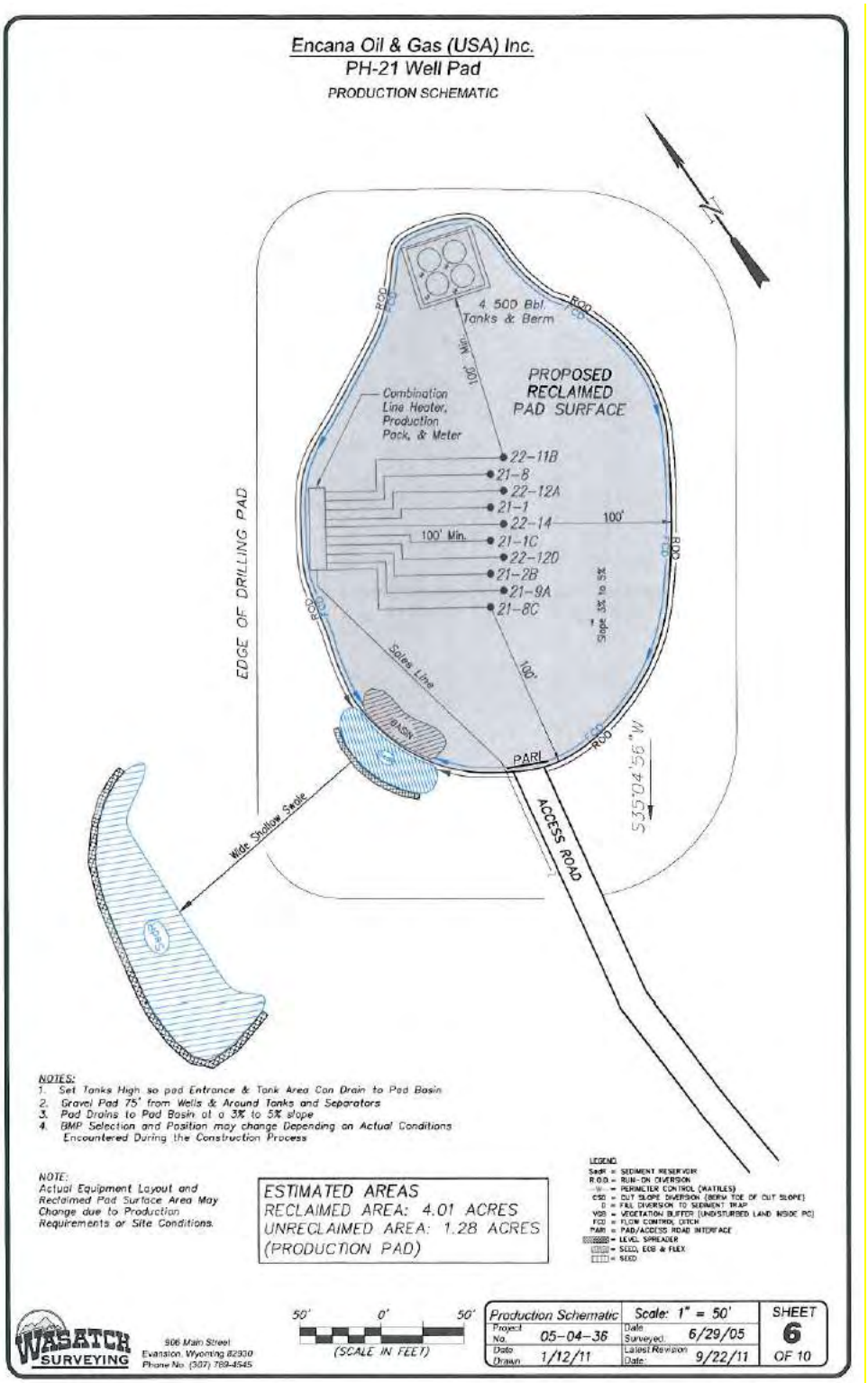


Figure 3. Production Schematic

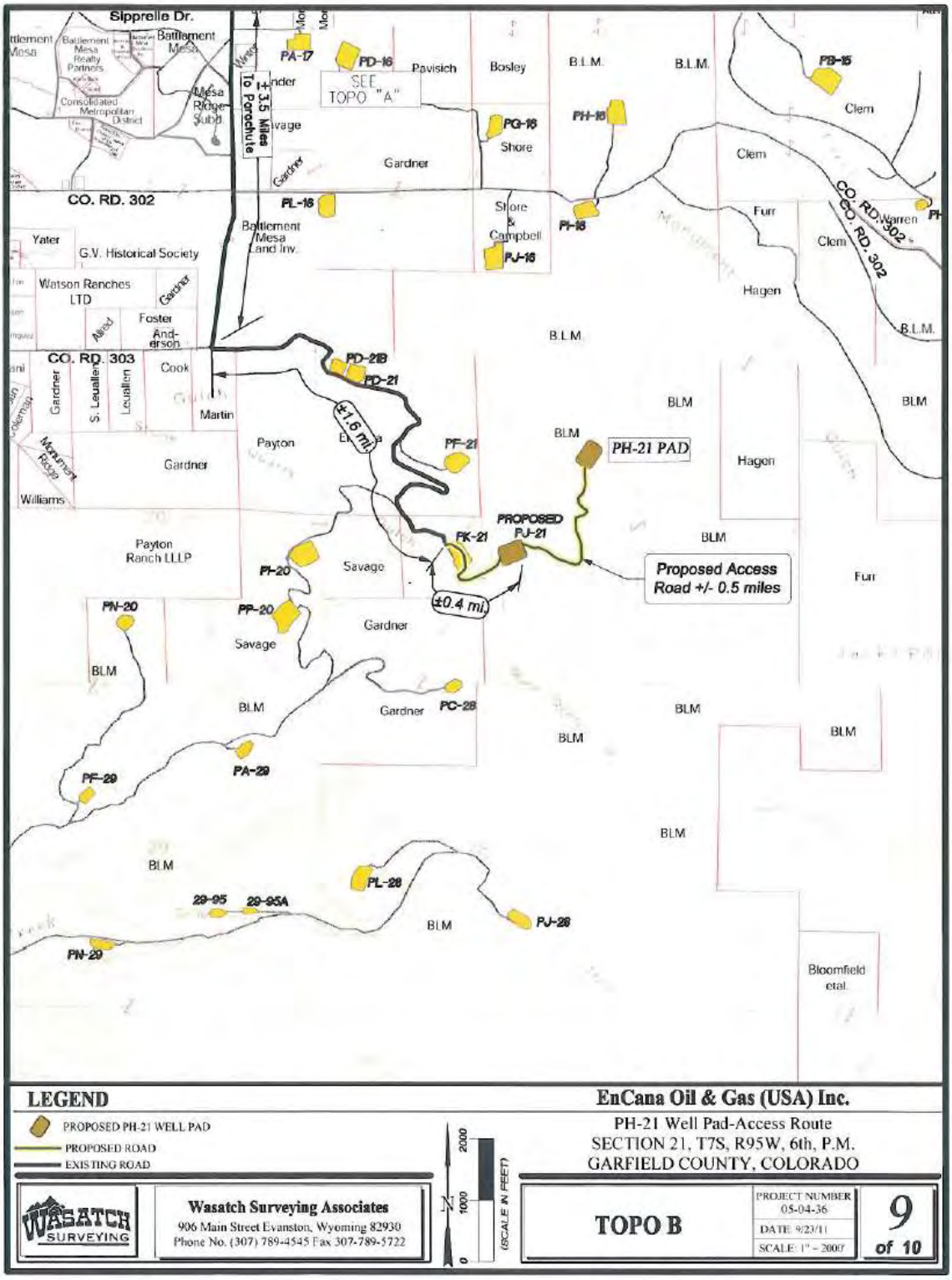


Figure 4. Proposed Access Road Alignment

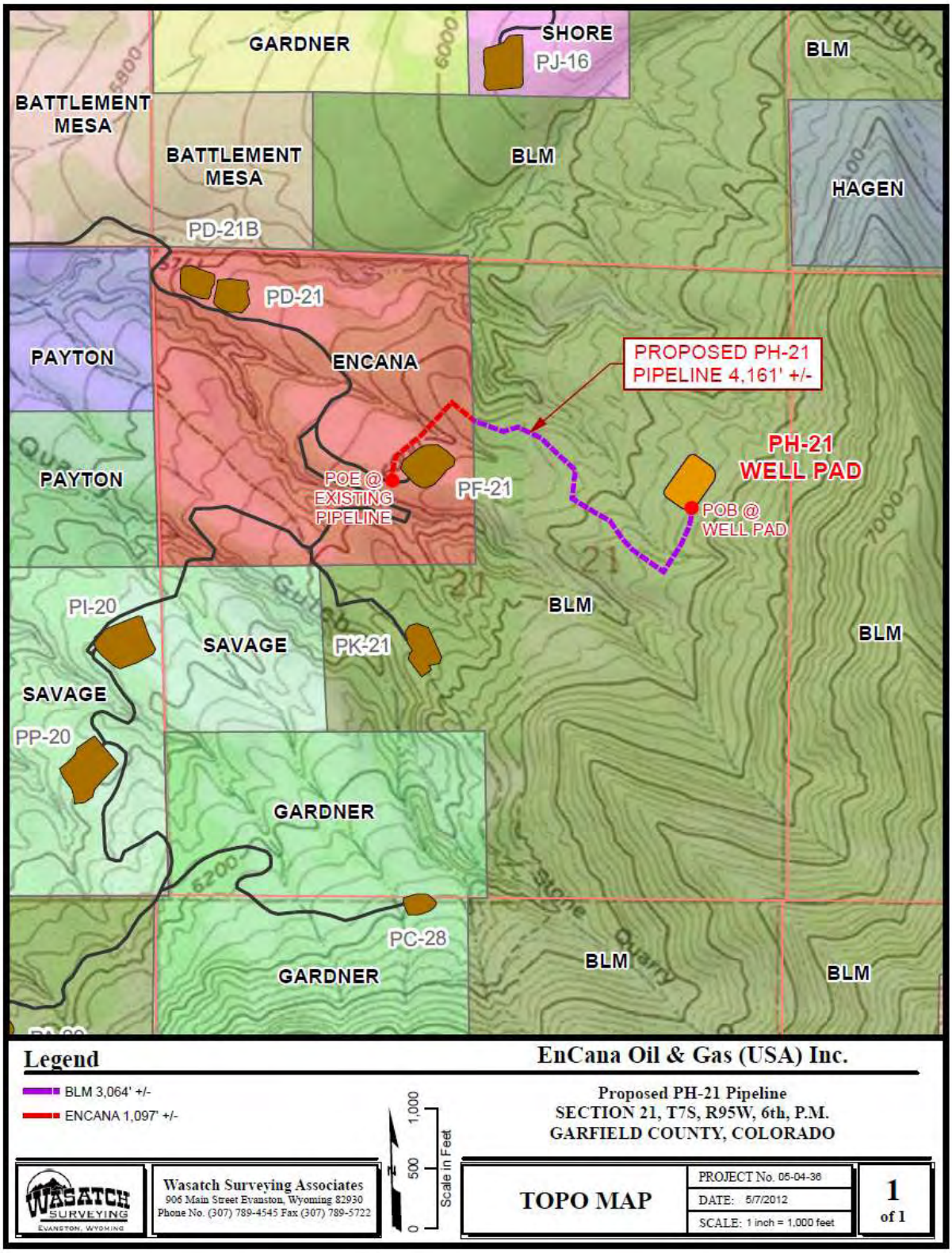


Figure 5. Proposed Pipeline Alignment

The process of collecting the cuttings, mixing with drying agents and storing at the cut slope would continue through drilling of all of the wells on the pad to Total Depth. After drilling and completion operations are finished, the cuttings would be spread on location as part of interim reclamation.

Several Class III cultural resource inventories of the proposed drill site, access roads, and other facilities on Federal lands have been conducted. A raptor survey and biological survey including any Federally listed, proposed, or candidate plant and wildlife species must be conducted before these APDs would be approved.

Federal lease COC01523 is applicable to the Proposed Action on the pad since the pad lies on public surface with underlying Federal minerals. Federal lease COC01523 has no special stipulations listed. However, as shown in the South Parachute Geographic Area Plan (SPGAP), Appendix E, COA#19 (Wildlife), a 60-day big game winter range timing limitation was instituted from January 1 through March 1 prohibiting construction, drilling, and completion activities. The Proposed Action would occur within the SPGAP boundaries.

NO ACTION ALTERNATIVE

The Proposed Action involves drilling ten Federal wells from BLM surface. Although the BLM cannot deny the right to drill and develop the Federal oil and gas lease, individual APDs can be denied to prevent unnecessary and undue degradation.

The No Action Alternative constitutes denial of the Federal APD(s) described in the Proposed Action. Consequently, none of the planned development activities outlined in the Proposed Action would occur. However, Encana would probably drill from a different location to avoid the BLM surface described in the Proposed Action.

PURPOSE AND NEED FOR THE ACTION

The purpose of the Proposed Action is to develop oil and gas resources on Federal lease COC01523 consistent with existing Federal lease rights. The action is needed to increase the development of oil and gas resources for commercial marketing to the public.

SUMMARY OF LEASE STIPULATIONS

The Federal wells would be directionally drilled from the proposed PH21 well pad located on public land. The bottomholes would occur within Federal lease COC01523. No specific stipulations are listed for this lease. However, site-specific COAs developed during the APD/Environmental Assessment (EA) review and onsite field consultation would apply to the pad and would be attached to the Federal APDs (Appendix A).

PLAN CONFORMANCE REVIEW

The Proposed Action and No Action Alternative are subject to and have been reviewed for conformance with the following plan (43 CFR 1610.5, BLM 1617.3):

Name of Plan: The current land use plan is the *Glenwood Springs Resource Management Plan* (RMP), approved in 1984 and revised in 1988 (BLM 1984). Relevant amendments include the *Oil and Gas Plan Amendment to the Glenwood Springs Resource Management Plan* (BLM 1991) and the *Oil &Gas Leasing & Development Record of Decision and Resource Management Plan Amendment (*BLM 1999a).

Decision Language: The 1991 Oil and Gas Plan Amendment (BLM 1991) included the following at page 3: "697,720 acres of BLM-administered mineral estate within the Glenwood Springs Resource Area are open to oil and gas leasing and development, subject to lease terms and (as applicable) lease stipulations" (BLM 1991, page 3). This decision was carried forward unchanged in the 1999 ROD and RMP amendment at page 15 (BLM 1999b): "In areas being actively developed, the operator must submit a Geographic Area Proposal (GAP) [currently referred to as a Master Development Plan, MDP] that describes a minimum of 2 to 3 years of activity for operator controlled leases within a reasonable geographic area."

Discussion: The Proposed Action is in conformance with the 1991 and 1999 RMP amendments cited above because the Federal mineral estate proposed for development is open to oil and gas leasing and development. The 1999 RMP amendment requires multi-year development plans for lease development over a large geographic area. However, the 1999 RMP amendment also provides exceptions to that requirement for individual or small groups of exploratory wells drilled in relatively undrilled areas outside known high production areas. The Proposed Action is therefore in conformance with the exception to the requirement to require operators to submit MDPs, previously known as GAPs.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

During its internal scoping process for this Environmental Assessment (EA), pursuant to the National Environmental Policy Act (NEPA), BLM resource specialists identified the following elements of the natural and human environment as present in the project vicinity and potentially affected by the project:

- Access and Transportation
- Air Quality
- Cultural Resources
- Fossil Resources
- Geology and Minerals
- Invasive Non-Native Plants
- Migratory Birds
- Native American Religious Concerns
- Noise
- Socioeconomics
- Soils
- Special Status Species
- Vegetation
- Visual Resources
- Wastes, Hazardous and Solid
- Water Quality, Surface and Ground
- Wildlife, Terrestrial

Access and Transportation

Affected Environment

The project area would be located approximately 3.5 miles southeast of Parachute, Garfield County, Colorado. The primary vehicle access is as follows: From the Town of Parachute, Colorado travel southeasterly on County Road (CR) 308 approximately 3.5 miles to the intersection (and east end of CR303); turn left (easterly) onto the existing improved road and travel east and then southerly approximately 1.6 miles to the existing Encana PK21 well pad.

No public access exists to the site; a new access road would be constructed in order to access the proposed PH21 pad. The road would be approximately 0.58 mile long with a 40-foot-wide disturbance corridor.

Construction, maintenance, and reclamation would conform to guidelines established in the BLM Gold Book (USDI and USDA 2007). A road maintenance program would be required during the drilling,

completion, and production phases which includes, but is not limited to blading, ditching, culvert installation and cleanout, weed control, and gravel surfacing where excessive rutting or erosion may occur. The access road would be maintained in a safe and usable condition. Surface and subsoil materials within the proposed construction areas would be used. Gravel or pit lining material (if required) would be obtained from Federal or Fee lands in conformance with applicable regulations.

Environmental Consequences

Proposed Action

The Proposed Action would result in a substantial increase in truck traffic related to the development of the ten wells. The largest increase would be during rig-up, drilling, and completion activities. Data indicate that approximately 1,160 truck trips over a 30-day period would be required to support the drilling and completion of each well (Table 3). Once the wells are producing, traffic would decrease to occasional visits for monitoring or maintenance activities. Each well may have to be recompleted once per year, requiring three to five truck trips per day for approximately 7 days.

Table 3. Traffic Associated with Drilling and Completion Activities

Vehicle Class	***Number of trips per well***	***Percentage of total***
16-wheel tractor trailers	88	7.6%
10-wheel trucks	216	18.6%
6-wheel trucks	452	39.0%
Pickup trucks	404	34.8%
Total	1,160	100.0%

Source: BLM 2006. Note: Trips by different vehicle types are not necessarily distributed evenly during the drilling process. Drilling and completion period is approximately 30 days per well.

Degradation of field development roads may occur due to heavy equipment travel and fugitive dust and noise would be created. Mitigation measures (Appendix A) would be required as COAs to ensure adequate dust abatement and road maintenance occur.

Constructing the 0.58 mile of new access road with a 40-foot-wide disturbance corridor would create approximately 2.81 acres of new surface disturbance. After reclamation of the road cuts and fills, the long-term disturbance for the new road would total approximately 1.4 acres.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Air Quality

Affected Environment

Colorado Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based criteria for the maximum acceptable concentrations of air pollutants in areas of public use. Although specific air quality monitoring has not been conducted within the project area, regional air quality monitoring has been conducted in Rifle and elsewhere in Garfield County. Air pollutants measured in the region for which ambient air quality standards exist include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), particulate matter less than 10 microns (μ) in diameter (PM_{10}), and particulate matter less than 2.5 μ in diameter ($PM_{2.5}$).

The project area lies within Garfield County, which has been described as an attainment area under CAAQS and NAAQS. An attainment area is an area where ambient air pollution quantities are below (i.e., better than) NAAQS standards. Regional background values are well below established standards, and all areas within the cumulative study area are designated as attainment for all criteria pollutants. The Garfield County Quarterly Monitoring Report summarizing data collected at monitoring sites in Parachute, Silt, Battlement Mesa, and Rifle in January through March 2012 confirms continuing attainment of the CAAQS and NAAQS (Garfield County 2012). Federal air quality regulations are enforced by the CDPHE. The Prevention of Significant Deterioration (PSD) program within CDPHE is designed to limit incremental increases for specific air pollutant concentrations above a legally defined baseline level, as defined by an area's air quality classification. Incremental increases in PSD Class I areas are strictly limited.

Federal air quality regulations adopted and enforced by CDPHE limit incremental emissions increases to specific levels defined by the classification of air quality in an area. The PSD Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict.

The project area and surrounding areas are classified as PSD Class II, as is Dinosaur National Monument, located approximately 180 miles to the northwest. PSD Class I areas located within 100 miles of the project area are Flat Tops Wilderness (approximately 25 miles north), Maroon Bells – Snowmass Wilderness (approximately 35 miles south), West Elk Wilderness (approximately 60 miles southeast), Black Canyon of the Gunnison National Park (approximately 65 miles south), and Eagles Nest Wilderness (approximately 60 miles east).

Environmental Consequences

Proposed Action

The CDPHE, under delegated authority from the U.S. Environmental Protection Agency (EPA) and in conformance with Colorado's State Implementation Plan (SIP), is the agency with primary responsibility for air quality regulation and enforcement in conjunction with industrial developments and other air pollution sources in Colorado. Unlike the conceptual "reasonable but conservative" engineering designs used in NEPA analyses, any CDPHE air quality preconstruction permitting is based on site-specific, detailed engineering values, which are assessed in CDPHE's review of the permit application.

The Proposed Action includes constructing a new 0.5 mile access road, fluids and natural gas pipelines and constructing, drilling, completing, and operating up to ten new Federal wells. Individual wells would

require approximately 7 to 10 days to drill and approximately 5 to 15 days to complete. Air quality would decrease during construction of access roads, pads, and pipelines, and drilling and completing the wells.

Pollutants generated during construction activities would include combustion emissions and fugitive dust associated (PM_{10} and $PM_{2.5}$) with earthwork and construction equipment. Construction activities for the well pad, access road, and pipelines would occur between the hours of 7:00 a.m. and 6:00 p.m. each day. Once construction activities are complete, air quality impacts associated with construction would cease and impacts would transition to emissions associated with transportation of drilling and completions equipment. Fugitive dust and vehicle emissions from mobilization of equipment necessary for the drilling and completions phase, rigging up the drill rig would occur during the transitions between construction, drilling and completions phases. During drilling and completions work air quality impacts would be caused by emissions from generators and engines to run equipment, onsite and offsite vehicle traffic, and escaped and flared gasses during drilling and flowback phases. At the completion of these phases, emissions associated with drilling and completing the wells would also be greatly reduced to emissions associated with long-term natural gas and condensate production.

A regional air model addressing air quality impacts of current and future oil and gas activities within the CRVFO has recently been completed for the BLM by Tetra Tech, Inc. and its subcontractor, URS Corporation. The model addressed the cumulative impacts of incremental oil and gas development in the modeling domain by assuming a range of BLM wells and associated infrastructure and mitigation scenarios. A total of 2,664 wells were modeled in the "no action" scenario in which no additional mitigations above meeting CDPHE and EPA regulations and emissions standards were modeled. Within the range of alternatives a total of 4,198 new BLM wells and the associated facilities and infrastructure including were modeled requiring air quality mitigations in addition to the CDPHE and EPA regulations and emissions standards.

In all scenarios analyzed using the air quality model, results of the analysis indicate that impacts from the proposed BLM levels of development would be below NAAQS, CAAQS, PSD increments, and visibility and deposition thresholds. In addition, the cumulative impacts of all oil and gas development in conjunction with other major emissions sources were evaluated by assuming 15,664 future wells and a cumulative total of over 44,000 wells within the modeling domain over the next twenty years. The methods and results of that modeling are presented in the Air Resources Technical Support Document (ARTSD) prepared in conjunction with the modeling (BLM 2011).

The air quality model addressed impacts associated with emissions of greenhouse gases (GHGs), "criteria pollutants" (CO, NO_2, SO_2, ozone, PM_{10}, and $PM_{2.5}$), hazardous air pollutants (HAPs) including BTEX (benzene, ethylbenzene, toluene, and xylenes), formaldehyde, and n-hexane. The modeling also addressed potential impacts on visibility due to particulates and "photochemical smog" (caused by chemical reactions in the atmosphere) and on lake chemistry of selected pristine lakes due to modeled deposition rates of sulfur and resultant impacts on acid neutralizing capacity of the lake waters. The visibility analysis predicted a slight impact (one day per year with a reduction in visibility of 1deciview or greater) in the Flat Tops Wilderness and no days with 1 deciview or greater reduction in visibility at all other modeled Class I and II receptors. For the remaining pollutants analyzed, modeled levels of future oil and gas development within the CRVFO would have no or negligible long-term adverse impacts on air quality. Since the Proposed Action is within the scope of the future development modeled, no significant adverse impacts on air quality are anticipated.

The air quality model incorporated assumptions about various development and mitigation scenarios, many of which have been integrated into the Proposed Action or would be imposed by the BLM as COAs

(Appendix A). These include use of directional drilling to reduce the number of well pads, piping instead of trucking of fluids to a centralized collection facility, flaring instead of venting of natural gas during well completions, self-contained flare units to minimize emissions to the atmosphere, and use of closed-loop drilling. Closed-loop drilling minimizes emissions by recycling drilling muds and separating fluids and drill cuttings, thus eliminating open pits containing petroleum fluids. In addition to minimizing emissions associated with drilling and completion activities, these mitigation measures would also significantly reduce fugitive dust and vehicle tailpipe emissions by greatly reducing the volume of truck traffic required to support the operations.

Generation of fugitive dust as a result of construction activities and travel on unpaved access roads would be further reduced by BLM's requirement that the operator apply gravel to a compacted depth of 6 inches on the access road, apply water to the access road during the development phase, and apply a dust suppressant surfactant approved by the BLM throughout the long-term production phase (Appendix A).

Emissions of volatile organic compounds (VOCs) such as the BTEX constituents of condensate vary depending on the characteristics of the condensate, the volume produced, and tank operations. Operators are required to control emissions of VOCs from condensate tanks under CDPHE Regulation 7. If deemed necessary by the State, BBC may be required to install a vapor recovery or thermal destruction system to further reduce VOC concentrations.

Ongoing scientific research has identified the potential impacts of "greenhouse gases" (GHGs) and their effects on global atmospheric conditions. These GHGs include carbon dioxide, methane, nitrous oxide, water vapor, and several trace gases. Through complex interactions on a global scale, these GHG emissions are believed by many experts to cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the Earth back into space.

In 2001, the Intergovernmental Panel on Climate Change (IPCC) predicted that by the year 2100, global average surface temperatures would increase 1.4 to 5.8°C (2.5 to 10.4°F) above 1990 levels. The National Academy of Sciences (NAS) supports these predictions, but has acknowledged that there are uncertainties regarding how climate change may affect different regions. In 2007, the IPCC also concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations" (NAS 2007). Other theories about the effect of GHGs on global climate change exist.

The recent air modeling for the CRVFO inventoried and assessed GHG emissions associated with various scenarios of future oil and gas development. In all scenarios modeled, the GHG emissions would not increase the total U.S. natural gas sector emissions by more than 0.5%. The lack of scientific tools designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts of climate change on the specific area of the Proposed Action. While any oil and gas development project may contribute GHGs to the atmosphere, these contributions would not have a significant effect on a phenomenon occurring at the global scale believed by some to be due to more than a century of human activities.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Cultural Resources

Affected Environment

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take in to account the effects their actions will have on cultural resources. As a general policy, an agency must consider effects to cultural resources for any undertaking that involves Federal monies, Federal permitting/authorization, or Federal lands. Three Class III cultural resource inventories (CRVFO# 902, 14606-3 and 5412-2) each covered portions of the proposed PH21 well pad and the linear route for the cumulative complete coverage of the proposed well pad and access route. The cultural inventories and pre-field file searches of the Colorado SHPO database and BLM Colorado River Valley Field Office cultural records identified one cultural resource within the project area. This cultural resource consisted of a single prehistoric projectile point and is considered an "isolated find". Isolated finds are by definition are also not eligible to the NRHP. Eligible or potentially eligible sites are referred to in Section 106 of the National Historic Preservation Act as "historic properties."

Environmental Consequences

Proposed Action

No historic properties are located in the vicinity of the project area or will be affected by the construction of the proposed PJ-21 well pad and associated linear route. Therefore, the BLM made a determination of "**No Historic Properties Affected**." This determination was made in accordance with the 2001 revised regulations [36CFR 800.4(d)(1)] for Section 106 of the National Historic Preservation Act (16U.S.C 470f), the BLM/State Historic Preservation Officer (SHPO) Programmatic Agreement (2012) and Colorado Protocol (2012)]. As the BLM has determined that the Proposed Action would have no direct impacts to known "historic properties," no formal consultation was initiated with the SHPO.

A standard Education/Discovery COA for cultural resource protection will be attached to the Federal APDs. The importance of this COA would be stressed to the operator and its contractors, including informing them of their responsibilities to protect and report any cultural resources encountered during construction operations. Indirect long-term cumulative impacts from increased access and the presence of project personnel could result in a range of impacts to undiscovered cultural resources in the vicinity of the project location. These impacts could range from accidental damage or vandalism to illegal collection and excavation.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Fossil Resources

Affected Environment

The predominant bedrock formations present at or near the surface within the project area are the Wasatch Formation (including the Fort Union Formation or equivalent at its base) and the Anvil Points and Garden Gulch members of the Green River Formation. Both formations are overlain by areas of Quaternary

gravels and earthflow deposits. Occurring in varying thicknesses, these Quaternary sediments are considered Potential Fossil Yield Classification Class 2, defined as having a low probability of fossil occurrence. Class 2 geologic units are not likely to contain vertebrate or scientifically significant invertebrate fossils.

Both the Wasatch and Green River Formations are considered BLM Condition 4 formations, defined as an area that is known to contain vertebrate fossils or noteworthy occurrences of invertebrate fossils. These types of fossils are known to occur or have been documented, but may vary in occurrence and predictability. The Wasatch Formation is divided into the early Eocene Shire, and the Paleocene age Molina and Atwell Gulch members; while the Eocene aged Green River Formation is divided into the Parachute Creek, Garden Gulch, Douglas Arch, Cow Ridge, and Anvil Points members.

All members of the Wasatch Formation contain vertebrate fossils in varying abundances (Murphy and Daitch 2007). Rocks of the Wasatch Formation are lithologically very similar to one another throughout the Piceance Creek Basin as heterogeneous continental fluvial deposits with interfingering channel sandstone beds and overbank deposits consisting of variegated claystone, mudstone, and siltstone beds (Franczyk et al. 1990). Eocene mammals have been found in the lower part of the Shire member.

Fossils historically identified in the Wasatch are archaic mammals—including marsupials, representatives of two extinct orders of early mammals (pantodonts and creodonts), artiodactyls (deer-like even-toed ungulates), ancestral horses and other perissodactyls (odd-toed ungulates), carnivores, and primates—as well as birds, lizards, turtles, crocodilians, gars and other fishes, freshwater clams, gastropods (snails), and other invertebrates (BLM 1999a).

The Green River Formation consists of fine-grained lacustrine and fluvial-lacustrine rocks that were deposited in the Eocene Lake Uinta. The lake expanded early in its history, during the Long Point transgression (Johnson 1985), to cover much of the Piceance and Uinta Basins. The Green River Formation has yielded hundreds of invertebrate and plant fossils and more than 60 vertebrate taxa have been described from the formation, including crocodiles, boa constrictors, and birds.

Environmental Consequences

Proposed Action

Although mapped as the predominant surface formation of the project area, field inspection revealed the Wasatch exposed only in a few outcrops found on cliff faces and landslide exposures. The thickness of the Quaternary sediments cannot be accurately determined, but construction activities have the potential to adversely affect important fossils that may be present in the underlying Wasatch and Green Formations. The greatest potential for impacts is associated with excavation of shallow bedrock that may be unearthed during well pad and facilities (especially pipeline) construction. In general, alluvium, colluvium, and other unconsolidated sediments are much less likely than bedrock to contain well-preserved fossils.

An examination of the BLM paleontology database indicates that there are is one known fossil discovery site within a mile radius of the project area. The closest known site occurs in Section 29 approximately 4,900 feet southwest of the proposed pad. Areas covered with vegetation and soil cover do not usually yield fossil resources, but inspections should be conducted for proposed facilities that are located on or within 200 feet of Wasatch or Green River Formation bedrock surface exposures. In the event paleontological resources are encountered, a standard paleontological COA would be attached to the APDs (Appendix A).

No Action Alternative

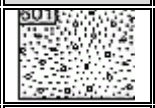
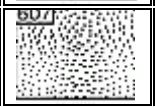
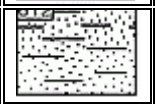
Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Geology and Minerals

Affected Environment

The project area is located near the eastern margin of the Colorado Plateau physiographic province (Fenneman 1946), a region characterized by dissected plateaus of strong relief. A broad, asymmetric, southeast-northwest trending structural basin, the Piceance Basin contains stratified sediments ranging in age from Cambrian through middle Tertiary up to 20,000 feet thick. The basin lies between the White River uplift to the northeast, the Gunnison uplift to the south, and the Uncompahgre swell to the west (George 1927, Weiner and Haun 1960). Table 4 lists the geologic formations within the project area.

Table 4. Geologic Formations within the Study Area

Map Symbol	***Lithologic Pattern***	***Formation Name***	***Age***	***Characteristics***	***Location***
Qes		Quaternary earthflow deposits	Holocene	Poorly sorted boulder, cobble and pebble gravel.	Mantles outcrops.
Tgg		Garden Gulch Member – Green River Formation.	Eocene	Light Grey marlstone to dark-brown and black shale	Outcrops and cliff faces.
Tga		Anvil Points Member – Green River Formation.	Eocene	Massive brown and buff fine to coarse grained sandstone	Outcrops and cliff faces.
Tws		Shire Member – Wasatch Formation	Eocene/ Paleocene	Variegated purple, lavender, red gray and brown claystone.	Steep slopes and outcrops.

Source: Donnell et al. 1989

Bedrock exposures within the proposed development project are the Tertiary Wasatch and Green River Formations. The Green River Formation consists of fine-grained lacustrine and fluvial-lacustrine rocks that were deposited in the Eocene Lake Uinta. In the Piceance Basin the early stages of the lake are marked by clay-rich oil shale zones referred to as the Garden Gulch Member, whereas the younger oil shale zones deposited in the lake are carbonate-rich and referred to as the Parachute Creek Member. These oil shale units grade marginward into marginal lacustrine rocks of the Douglas Creek and Anvil Points Members. The oldest member of the Green River Formation is the Cow Ridge Member, which intertongues with the variegated mudstones, sandstones, and siltstones of the underlying Wasatch Formation (USGS 2010).

The Wasatch Formation consists of variegated siltstone, claystone, and sandstones and ranges from 1,000 to 2,500 feet thick. The Wasatch Formation is underlain unconformably by the Mesaverde Group. The

Mesaverde Group is composed of mudstones and sandstones with interlayered coal beds and ranges in thickness from about 3,000 to over 7,000 feet. The Mesaverde Group has also been referred to as the Mesaverde Formation, which includes informal subdivisions based on gas productivity characteristics.

In the proposed development area, the Wasatch and Green River Formations are mantled by unconsolidated sedimentary surface deposits of Quaternary age in the form of earthflow deposits. The thickness of these unconsolidated sediments is uncertain, but the depth to the underlying Wasatch Formation may be determined during construction excavation.

The Iles Formation of the Mesaverde Group is the target zone of the proposed drilling program. Comprised of the Williams Fork and Iles Formations, sediments of the Mesaverde Group are marine sandstones transitional to non-marine beds of coal, shale, and sandstone. These sediments were deposited marginal to the great Cretaceous seaway. The oscillating shoreline of this sea, due to the rise and fall of sea level, left behind a complex of transgressive and regressive sedimentary sequences of nearshore and offshore sediments that define the Mesaverde Group.

Production is derived from three reservoir intervals, which include the Wasatch, Williams Fork, and Iles Formations. The latter two make up the Upper Cretaceous Mesaverde Group. The proposed drilling program would target the sandstone sequences of the Upper Williams Fork Formation, which provide most of the natural gas production volumes (Lorenz 1989). The upper portions of the Williams Fork include fluvial point bar, floodplain, and swamp deposits. The Lower Williams Fork Formation includes delta front, distributary channel, strandplain, lacustrine and swamp environments (Hemborg 2000), while the sandstones and coalbeds of the Iles Formation were deposited in a wave-dominated coastal setting (Johnson 1989, Lorenz, 1989). The source rocks are interbedded and thermally mature gas-prone shales, mudstones, siltstones, and coals. The reservoir rocks are the fine to medium-grained Williams Fork sandstones, varying in thickness from less than 10 feet to more than 50 feet (Spencer and Wilson 1988), creating an interbedded relationship between source and reservoir. The trapping mechanism of the gas is both stratigraphic and diagenetic.

No commercial deposits of coal, oil shale, uranium, precious metals, limestone, sand and gravel, gypsum, or other leasable, locatable, or salable minerals are believed to occur within or beneath the project area.

Environmental Consequences

Proposed Action

If the proposed wells are proven feasible, initial production rates would be expected to be highest during the first few years of production, then decline during the remainder of the economic lives of the wells. Substantial reserves have been known to be trapped within the tight sands of these reservoirs since the late 1950s, but only within the last decade, and particularly within the last few years, has the integrated application of new technologies turned the tight gas sands of the Mesaverde Group into a profitable play (Kuuskraa 1997). Natural fracture detection, advanced log analysis, more rigorous well completions and recompletions, and denser spacing have increased the amount of recoverable gas within these reservoirs.

Natural gas production from the proposed wells would contribute to the draining of hydrocarbon-bearing reservoirs within the Mesaverde Group in this area, an action that would be consistent with BLM objectives for mineral production. Hydraulic fracturing would be utilized to create fractures within the formation to allow gas production from the wells. In recent years, public concern has been voiced regard potential impacts of hydraulic fracturing from “micro-earthquakes” and from contamination of freshwater aquifers.

Potential Impacts of Hydraulic Fracturing During Oil and Gas Well Completions

For decades, oil and gas companies and independent geophysicists have used state of the art equipment to monitor microseismic activity—defined as a "faint" or "very slight" tremor—during hydraulic fracturing to optimize well completions and to gather information about fracture dimensions and propagation (Warpinksi 2009). These data give an indication about the magnitude of seismic activity associated with hydraulic fracturing, dimensions of resultant fractures in geologic formations, and probability for induced fractures to extend into nearby aquifers, if present. Research indicates that microseismic activity created by hydraulic fracturing occurs at Richter magnitude 1 or less (Warpinski and Zimmer 2012). In comparison, a magnitude 3 earthquake is the threshold that can be felt at the ground surface. The Richter magnitude scale is base-10 logarithmic, meaning that a magnitude 1 tremor is 1/100th the amplitude of a magnitude 3 tremor. The National Academy of Sciences reviewed more than 100,000 oil and gas wells and waste water disposal wells around the world and concluded that "incidences of felt induced seismicity appear to be very rare," with only one such documented occurrence (National Academy of Sciences 2012).

The dimensions of induced fractures have been measured with field monitoring equipment (including microseismic "listeners") and in laboratory tests and have been compared to three-dimensional (3D) hydraulic fracture models. Researchers have successfully validated these models for fracturing in "tight gas" reservoirs including those in the Piceance Basin. Results of the analyses show that fractures resulting from completions of oil and gas wells can be predicted (Zhai and Sharma 2005, Green et al. 2009, Palisch et al. 2012) and that the length of fractures in relation to depth of the well can be estimated.

Hydraulically induced fracture orientation in relation to the wellbore depends upon the downhole environment (i.e., rock mechanics, minimum and maximum principle stress directions, rock physical properties, etc.) and the wellbore trajectory. In vertical or normal directional wells such as in the Mesaverde formation—the predominant hydrocarbon-producing formation in the CRVFO area—fracture growth is primarily lateral or outward from the wellbore, with minimal secondary fractures extending at some angle away from the lateral fractures. In horizontal wells such as being used to develop deep marine shales, fracture growth from the wellbore is mainly determined by the orientation of the wellbore in relation to the principal stresses of the rock. Fracture growth toward the surface is limited by barriers such as variations in stress and lithology, as is also the case in vertical and normal directional wells. In some horizontal wells, fracture growth is similar to that in vertical or normal directional wells due to wellbore trajectory along the maximum principal stress direction. Analysis of data from thousands of wells indicates fracture extent (length) of less than 350 feet in the vast majority of cases, with outliers of 1,000 to 2,000 feet (Maxwell 2011, Davies et al. 2012). The extreme outlier lengths are associated with fractures in thick deposits of lithologically uniform marine shales.

The potential height of hydraulically induced fractures in horizontal drilling is reduced in layered sediments in which a propagating fracture encounters a change in rock type or a bedding plane within a formation or a contact between formations. When these features are encountered, the fracture either terminates or to a lesser extent reorients along the generally horizontal bedding plane or formation contact instead of continuing upward across it. In the CRVFO area, natural gas production is primarily from vertically stacked, lenticular tight sands of the Mesaverde formation using vertical and directional wells. These tight-sand lenses are a few tens of feet thick or less. More recently, advances in horizontal drilling technology have allowed enhanced development of deeper marine shales such as the Niobrara formation. These tight-shale deposits are a few hundreds to thousands of feet thick in the CRVFO area compared to many hundreds or thousands of feet in some other gas-producing regions. The thickness of

hydrocarbon-bearing strata in this area limits the vertical growth of primary and secondary fractures resulting from hydraulic stimulation.

Based on a review of available information on microseismic monitoring and fracture dimensions, Fisher and Warpinski (2011) concluded that fractures from deep horizontal wells are not a threat to propagate across the long distances (thousands of feet) needed to reach fresh-water aquifers much closer to the surface. This conclusion applies to the CRVFO area, and is also applicable to much shallower potable groundwater sources consisting of unconsolidated alluvium (streambed deposits) associated with the Colorado River and major tributaries. In general, alluvial water wells in the CRVFO extend to depths of less than 200 feet, with few in the range of 400 feet. Typical water levels in these wells range from 50 to 100 feet deep. Impacts to water quality of these shallow fresh-water wells is highly improbable as a result of hydraulic fracturing, which occurs at depths of 5,000 to 11,000 feet below ground surface.

In addition to vertical separation of several thousand feet between the upper extent of fractures and fresh-water aquifers are requirements by the BLM and COGCC for proper casing and cementing of wellbores to isolate the aquifers penetrated by a wellbore. BLM requires that surface casing be set from 800 to 1,500 feet deep, based on a geological review of the formations, aquifers, and groundwater. Cement is then pumped into the space between the casing and surrounding rock to prevent fluids from moving up the wellbore and casing annulus and coming in contact with shallow rock layers, including fresh-water aquifers. BLM petroleum engineers review well and cement design and final drilling and cementing logs to ensure that the cement has been properly placed. When penetration of groundwater and freshwater aquifers is anticipated, BLM inspectors may witness the cementing of surface casing and subsequent pressure testing to ensure that the annular space between the casing and borehole wall is properly sealed.

No single list of chemicals currently used in hydraulic fracturing exists for western Colorado, and the exact combinations and ratios used by operators are considered proprietary. However, the general types of compounds and relative amounts used are well known and relatively consistent (Table 5). Since fracture jobs are tailored to the downhole environment and companies are aware of the concerns involving hydraulic fracturing, the chemicals listed in Table 5 may or may not be used, and the information is provided solely as general information. Although a variety of chemicals additives are used in hydraulic fracturing—the examples in Table 1 being drawn from a total of 59 listed on the FracFocus website—the vast bulk of fluid injected into the formation during the process is water mixed with sand, representing 99.51% of the total by volume in the typical mixture shown in Table 5. The sand is as a proppant, or propping agent, to help keep the newly formed fractures from closing.

Following completion of fracturing activities, the pressure differential between the formation—a result of several thousand feet of overlying bedrock—and the borehole that connects with the surface causes most of the injected fluids to flow toward the borehole and then upward to the surface along with the hydrocarbon fluids released from the formation. The composition of this mixture, called flowback water, gradually shifts over a period of several days to a few months as injected fluids that have not yet migrated back to the wellbore or reacted with the native rock are carried out of the formation.

In 2011, the COGCC published an analysis of hydraulic fracturing technology use in the state and potential risks to human health and the environment. The introduction to that report included the following paragraph: "*Hydraulic fracturing has occurred in Colorado since 1947. Nearly all active wells in Colorado have been hydraulically fractured. The COGCC serves as first responder to incidents and complaints concerning oil and gas wells, including those related to hydraulic fracturing. To date, the COGCC has not verified any instances of groundwater contaminated by hydraulic fracturing.*" Based on the information summarized above, the CRVFO has concluded that properly implemented hydraulic

fracturing of oil and gas wells drilled within its boundaries for the purpose of accessing Federal fluid minerals or for accessing private fluid minerals from BLM surface lands does not represent a significant adverse impact to human health and the environment.

Table 5. Constituents of Typical Hydraulic Fracturing Operation in Tight Gas Formations

Additive Type*	Typical Example*	Percent by Volume**	Function*	Common Use of Example Compound
Acid	Hydrochloric acid	0.123	Dissolves mineral cement in rocks and initiates cracks	Swimming pool chemical and cleaner
Biocide	Glutaraldehyde	0.001	Eliminates bacteria in the water that produce corrosive or poisonous by-products	Disinfectant; sterilizer for medical and dental equipment
Breaker	Ammonium persulfate	0.010	Allows delayed breakdown of the gel	Used in hair coloring, as a disinfectant, and in manufacture of household plastics
Clay stabilizer	Potassium chloride	0.060	Creates a brine carrier fluid that prohibits fluid interaction with formation clays	Used in low-sodium table salt substitutes, medicines, and IV fluids
Corrosion inhibitor	Formic acid	0.002	Prevents corrosion of the well casing	Used as preservative in livestock feed; used as lime remover in toilet bowl cleaners
Crosslinker	Borate salts	0.007	Maintains fluid viscosity as temperature increases	Used in laundry detergents, hand soaps, and cosmetics
Friction reducer	Polyacrylamide	0.088	"Slicks" the water to minimize friction	Used as a flocculant in water treatment and manufacture of paper
Gelling agent	Guar gum	0.056	Thickens the water to help suspend the sand propping agent	Used as a thickener, binder, or stabilizer in foods
Iron control	Citric acid	0.004	Prevents precipitation of metal oxides	Used as flavoring agent or preservative in foods
Surfactant	Lauryl sulfate	0.085	Increases the viscosity of the fluid	Used in soaps, shampoos, detergents, and as foaming agents
pH adjusting agent	Sodium hydroxide, acetic acid	0.011	Adjusts pH of fluid to maintain the effectiveness of other components	Sodium hydroxide used in soaps, drain cleaners; acetic acid used as chemical reagent, main ingredient of vinegar
Scale inhibitor	Sodium polycarboxylate	0.043	Prevents scale deposits in the pipe	Used in dishwashing liquids and other cleaners
Winterizing agent	Ethanol, isopropyl alcohol, methanol	--	Added as necessary as stabilizer, drier, and anti-freezing agent	Various cosmetic, medicinal, and industrial uses
Total Additives		**0.49**		
Total Water and Sand		**99.51**		

*FracFocus Chemical Disclosure Registry, fracfocus.org/chemical-use/what-chemicals-are-used
**DOE 2009

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the

proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Invasive Non-Native Plants

Affected Environment

The project area is located within Utah juniper (*Juniperus osteosperma*) and sagebrush habitat, some of which has burned and been replaced with grass dominated vegetation. The burned areas were seeded post-fire with perennial non-native grasses including smooth brome (*Bromus inermis*) and crested wheatgrass (*Agropyron cristatum*), which remain well-established. One Colorado List B noxious weed species (the biennial forb musk thistle, *Carduus nutans*) and one List C species (cheatgrass, *Anisantha tectorum*) are scattered throughout the burned areas. One stand of the List B noxious weed species known as tamarisk or salt-cedar (*Tamarix* sp.), a tall shrub or small tree, occurs just downhill from the proposed access road alignment.

Environmental Consequences

Proposed Action

Under the Proposed Action, approximately 15.26 acres of new ground disturbance would occur, creating conditions conducive to establishment and spread of noxious weeds and other non-native invasive plants. This increased weed risk would be mitigated by the implementation of standard COAs for weed management and revegetation, as described in Appendix A.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Migratory Birds

Affected Environment

The Migratory Bird Treaty Act (MBTA) includes native passerines (flycatchers and songbirds) as well as birds of prey, migratory waterbirds (waterfowl, wading birds, and shorebirds), and other species such as doves, hummingbirds, swifts, and woodpeckers. Within the context of the MBTA, "migratory" birds include non-migratory "resident" species as well as true migrants, essentially encompassing virtually all native bird species. For most migrant and resident species, nesting habitat is of special importance because it is critical for supporting reproduction in terms of both nesting sites and food. In addition, because birds are generally territorial during the nesting season, their ability to access and utilize sufficient food is limited by the quality of the territory occupied. During non-breeding seasons, birds are generally non-territorial and able to feed across a larger area and wider range of habitats.

Several migratory bird species occupy, or have the potential to occupy, the project area. Migratory bird species that are Federally listed under the Endangered Species Act of 1973, as amended, or classified by the BLM as sensitive species, are addressed under the section on Special Status Species. The current section addresses migratory birds that may inhabit the proposed project area. Emphasizing the need to

conserve declining species, the U.S. Fish and Wildlife Service (USFWS) has published a list of Birds of Conservation concern (BCC) that deserve prompt conservation attention to stabilize or increase populations or to secure threatened habitats. This section also addresses species within the project area that listed as BCC species (USFWS 2008). This analysis focuses on BCC species, non-BCC species that are Neotropical migrants, and raptors—three groups highly vulnerable to habitat loss or modification on their breeding grounds.

Sagebrush shrublands in the project area provide potential habitat for one BCC species, Brewer's sparrow (*Spizella breweri*). Other migratory birds associated with sagebrush shrublands but not BCC species include the western meadowlark (*Sturnella neglecta*), vesper sparrow (*Pooecetes gramineus*), and lark sparrow (*Chondestes grammacus*).

Stands or scattered individuals of juniper provide some habitat for three pinyon-juniper obligate species on the BCC list: the pinyon jay (*Gymnorhinus cyanocephalus*), juniper titmouse (*Baeolophus ridgwayi*), and gray vireo (*Vireo vicinior*). Of these, the last species is unlikely to occur because of the location of the project area outside the known nesting range, located farther to the west. Other migrants potentially occurring in the limited pinyon-juniper include -gray gnatcatcher (*Polioptila caerulea*), and black-throated gray warbler (*Setophaga nigrescens*). During winter, three additional species—Clark's nutcracker (*Nucifraga columbiana)*, Townsend's solitaire (*Myadestes townsendi*), and cedar waxwing (*Bombycilla cedrorum*)—may congregate in pinyon-juniper habitats in search of pine nuts (the nutcracker) or juniper berries (the solitaire and waxwing). Other migrants expected in sagebrush shrubland habitats include the western kingbird (*Tyrannus vociferus*), western meadowlark (*Sturnella neglecta*), vesper sparrow, and lark sparrow.

Raptors use the project area for nesting and hunting activities. Species most likely to nest within or near the project area and/or use the project vicinity for foraging include two BCC species—the golden eagle (*Aquila chrysaetos*) and prairie falcon (*Falco mexicanus*)—and, more commonly, non-BCC species such as the American kestrel (*Falco sparverius*), Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*A. striatus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), great horned owl (*Bubo virginiana*), and long-eared owl (*Asio otus*). Another BCC species, the peregrine falcon (*Falco peregrinus*), nests on the Roan Cliffs of the CRVFO area but hunts primarily along major rivers and reservoirs or across the broad, rolling upland atop the Roan Plateau.

Environmental Consequences

Proposed Action

Under the Proposed Action, removal of 15.26 acres of pinyon-junipers and sagebrush would result in loss of existing and potential nesting sites for perching birds. While habitat loss and fragmentation may affect individual birds, it is not expected to adversely impact a species as a whole. If construction, drilling, or completion activities occur during the nesting season, visual and noise disturbance near active nests could cause nest abandonment and failure, reducing the productivity of affected species. Construction activity during the nesting season could also result in the destruction of clutches and/or mortality of nestlings.

A Timing Limitation (TL) applied as a COA (Appendix A) would prohibit vegetation removal during the period May 1 to July 1 to reduce adverse impacts to migratory birds such as BCC species. A raptor nesting TL, also described in Appendix A, would preclude construction, drilling, or completion activities during the period May 1 to July 1 to minimize disturbance to nesting raptors. In addition to these restrictions, the operator is subject to the MBTA, administered by the USFWS, which precludes the "take" of any raptor or most other native species. Under the Act, the term "take" means to harass, harm,

pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The USFWS interprets "harm" and "kill" to include loss of eggs or nestlings due to abandonment or reduced attentiveness by one or both adults as a result of disturbance by human activity, as well as physical destruction of an occupied nest. Adherence to the 60-day TL period does not ensure compliance with the MBTA.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Native American Religious Concerns

Affected Environment

The Proposed Action is located within an area identified by the Ute Tribes as part of their ancestral homeland. Several Class III cultural resource inventories (see the section on Cultural Resources) were conducted in the Proposed Action's vicinity to determine if any areas were known to be culturally sensitive to Native Americans. No sensitive areas were identified or are currently known in the proposed project area.

Environmental Consequences

Proposed Action

At present, no Native American concerns are known within the project area and none were identified during the inventories. The Ute Tribe of the Uintah and Ouray Bands, the primary Native American tribe in this area of the CRVFO, have indicated that they do not wish to be consulted for small projects or projects where no Native American areas of concern have been identified either through survey or past consultations. Therefore, formal consultation with Native American Tribes was not undertaken for the current project. If new data are disclosed, new terms and conditions may have to be negotiated to accommodate their concerns.

Although the Proposed Action would have no direct impacts on Native American religious concerns, increased access and personnel in the vicinity of the proposed project could have indirect adverse impacts on unknown Native American resources due to causes such as inadvertent damage, illegal collection, and vandalism resulting from increased human presence and activity in the area .

The National Historic Preservation Act (NHPA) requires that if newly discovered cultural resources are identified during project implementation, work in that area must stop and the agency Authorized Officer notified immediately (36 CFR 800.13). The Native American Graves Protection and Repatriation Act (NAGPRA), requires that if inadvertent discovery of Native American Remains or Objects occurs, activity must cease in the area of discovery, a reasonable effort made to protect the item(s) discovered, and immediate notice made to the agency Authorized Officer, as well as the appropriate Native American group(s) (IV.C.2). Notice may be followed by a 30-day delay (NAGPRA Section 3(d)). Further actions also require compliance under the provisions of NHPA and the Archaeological Resource Protection Act. Encana Oil & Gas (USA) Inc. will notify its staff and contractors of the requirement under the NHPA, that work must cease if cultural resources are found during project operations. A standard

Education/Discovery COA for the protection of Native American values would be attached to the Federal APDs (Appendix A). The importance of these COAs should be stressed to the operator and its contractors, including informing them of their responsibilities to protect and report any cultural resources encountered. The proponent and contractors should also be aware of requirements under the NAGPRA.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Noise

Affected Environment

The Proposed Action would lie within a rural setting approximately 3.5 miles southeast of Parachute, Colorado and Interstate 70 (I-70). The project area is rural, and noise levels are presently created traffic on the county roads and oil and gas development. Noise is generally described as unwanted sound, weighted and noise intensity (or loudness) is measured as sound pressure in decibels (dBAs). The decibel scale is logarithmic, not linear, because the range of sound that can be detected by the human ear is so great that it is convenient to compress the scale to encompass all the sounds that need to be measured. Each 20-unit increase in the decibel scale increases the sound loudness by a factor of 10.

Sound levels have been calculated for areas that exhibit typical land uses and population densities. In rural recreational areas, ambient sound levels are expected to be approximately 30 to 40 dBA (EPA 1974, Harris 1991). As a basis for comparison, the noise level during normal conversation of two people 5 feet apart is 60 dBA.

Environmental Consequences

Proposed Action

The project would result in increased levels of noise during the construction, drilling, and completion phases. The noise would be most noticeable along the roads used to haul equipment and at the pad location. Drilling activities are subject to noise abatement procedures as defined in the COGCC Rules and Regulations (Aesthetic & Noise Control Regulations). Operations involving pipeline or gas facility installation or maintenance, the use of a drilling rig, completion rig, workover rig, or stimulation are subject to the maximum permissible noise levels for industrial zones. The 2006 revised COGCC noise control rules call for noise levels from oil and gas operations at any well site and/or gas facility to comply with the maximum permissible levels (Table 6) at a distance of 350 feet.

Table 6. Noise Standards for Light industrial, Residential/Agriculture/Rural

Zone	***7:00 A.M. to 7:00 P.M***	***7:00 P.M. to 7:00 A.M***
Light Industrial	70 dBA	65 dBA
Residential/Agricultural/Rural	55 dBA	50 dBA

Given the remote locations of the proposed project activities, with no reasonably close occupied structure or designated recreational area, the light industrial standard is applicable. The allowable noise level for periodic impulsive or shrill noises is reduced by 5 dBA from the levels shown (COGCC 2008). Short-term (7- to 14-day) increases in nearby noise levels would characterize road and well pad construction while the existing cuttings pit is re-opened. Based on the Inverse Square Law of Noise Propagation (Harris 1991) and an typical noise level for construction sites of 65 dBA at 500 feet (Table 7), project-related noise levels would be approximately 59 dBA at a distance of 1,000 feet, approximating active commercial areas (EPA 1974).

Traffic noise would also be elevated as a consequence of the Proposed Action. The greatest increase would be along access roads during the drilling and completion phases. Based on the La Plata County data presented in Table 7 approximately 68 dBA of noise (at 500 feet) would be created by each fuel and water truck that travels these roads. Less noise would be created by smaller trucks and passenger vehicles such as pickup trucks and sport utility vehicles. Although the duration of increased noise from this source would be short, it would occur repeatedly during the drilling and completion phases.

Table 7. Noise Levels at Typical Construction Sites and along Access Roads

Equipment	***Noise Level (dBA)***		
	50 feet	***500 feet***	***1,000 feet***
Air Compressor, Concrete Pump	82	62	56
Backhoe	85	65	59
Bulldozer	89	69	63
Crane	88	68	62
Front End Loader	83	63	57
Heavy Truck	88	68	62
Motor Grader	85	65	59
Road Scraper	87	67	61
Tractor, Vibrator/Roller	80	60	54
Sources: BLM (1999a), La Plata County (2002)			

Noise impacts would decrease during the production phase but would remain background noise levels. During maintenance and well workover operations, noise levels would temporarily increase above those associated with routine well production. These increased noise levels would be in addition to levels of noise that are already above background levels due to current oil and gas developments in the area. As stated above, the nearest residence is less than 0.25 mile away. While exposure to these noise levels is unlikely to be harmful, it may be annoying to residents.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Therefore, although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Socioeconomics

Affected Environment

The project area is located within Garfield County, Colorado. The population of Garfield County grew by 28.8% from 2000 to 2010, representing an increase from 43,791 to 56,389 residents (DOLA 2010). Population growth in Garfield County is expected to more than double over a 20-year period from approximately 50,000 in 2005 to approximately 106,500 in 2025 (DOLA 2010).

In 2009, industry groups in Garfield County with the highest percentage of total employment were construction 15%, tourism 12%, retail trade 13%, and education and health 20% (Colorado Department of Labor and Employment 2010). An estimated 13% of the population was retired in 2000 and did not earn wages (Garfield County 2000). Employment in agriculture, forestry, hunting, and mining accounted for 8% of total employment (Colorado Department of Labor and Employment 2010).

Personal income in Garfield County has also risen, from $504 million in 1990 to $2.2 billion in 2008 (USDOC 2011). Annual per capita income has grown in the same period; from about $19,354 to $40,166 (USDOC 2011), and the average earnings per job in 2005 was approximately $37,500 (Garfield County 2007). The communities of Parachute, Silt, and Rifle are the most affordable for housing, while the communities of Battlement Mesa, New Castle, and Glenwood Springs are the least affordable, with the cost to rent or own similar housing higher by 50% or more (BLM 2006).

Activities on public land in the vicinity of the project area are primarily ranching/farming, hunting, OHV travel, and the development of oil and gas resources. Hunters contribute to the economy because many require lodging, restaurants, sporting goods, guides and outfitting services, food, fuel, and other associated supplies. Big-game hunting, in particular, is viewed as critical to Garfield County, and especially the local community economies that depend on BLM and U.S. Forest Service (USFS) public lands where most hunting occurs (BLM 2006). Expenditures by hunters in the Roan Plateau Planning Area alone have been estimated to be as much as $1 million annually, with perhaps an additional $1 million annually of indirect and local expenditures (CPW 1995, cited in BLM 2006).

The growth of the oil and gas industry in the past 10 years has been increasingly important to local economies (BLM 2006). Production of natural gas in Garfield County increased dramatically during recent years, from approximately 70 bcf in 2000 to 576 bcf in 2009 (COGCC 2010). In addition, Garfield County is experiencing the fastest increase in oil and gas development in Colorado, with over 2,000 drilling permits currently approved between July 2009 and September 2010 (COGCC 2010). While the number of workers employed in the mining and extraction industry in Garfield County has been shown to be only 1.7%, this number is considered misleading because some oil and gas employment has been incorporated as part of the construction sector statistics instead (BLM 2006). For example, in 2005, an estimated 4,000 persons were directly employed by gas development companies and their subcontractors in Garfield County (Garfield County 2009).

The Federal government makes “Payments in Lieu of Taxes” (PILT) to county governments to help offset property tax revenue lost for nontaxable Federal lands within the county (BLM 2006). Payments are based on Federal acreage in the county for all land management agencies, including BLM, USFS, USFWS, and National Park Service. The amount may also be adjusted based on population and as appropriated by Congress. By formula, payments are decreased as other funds, such as mineral royalty payments, increase. Approximate PILT received by Garfield County in recent years has been as follows: $0.8 million in 2005; $1.1 million in 2006, 2007, and 2008; and $1.9 million in 2009 (USDI 2010).

Property tax revenue from oil and gas development has become the largest source of public revenue in Garfield County (BLM 2006), with an assessed valuation in Garfield County of approximately $3.8 billion, or 74% of the total. Total tax revenues from property taxes and special district levies were $130 million. Tax dollar distributions in 2009 were Schools – 30.4%, County – 32.3%, Special Districts – 14.3%, Fire Districts – 12.3%, Colleges – 8.9%, and Towns – 1.7% (Garfield County 2009).

In addition to PILT payments, BLM shares revenue generated by commercial activities on public lands with state and county governments (BLM 2006). Federal mineral royalties are levied on oil and gas production from Federal mineral leases. Oil and gas lessees pay royalties equal to 12.5% of the wellhead value of oil and gas produced from public land. Half the royalty receipts are distributed to Colorado, and the amount distributed to Garfield County in 2002 attributable to oil and gas production was $14.1 million. In 2001, the amount was $5.5 million (BLM 2006). These funds are then allocated to fund county services, schools, and local communities.

The NEPA process requires a review of the environmental justice issues as established by Executive Order 12898 (February 11, 1994). The order established that each Federal agency identify any "disproportionately high and adverse human health or environment effects of its programs, policies, and activities on minority and low-income populations." The Hispanic/Latino community is the only minority population of note in the project vicinity. In 2010, approximately 28% of the residents of Garfield County identified themselves as Hispanic/Latino, compared to 17% in 2000. Statewide, the percentage of Hispanic/Latino residents grew from 17% to 21% during the same 10-year period. African-American, American Indian, Asian, and Pacific Islander residents accounted for a combined 2.6% of the Garfield County population in 2010, compared to a statewide level of 8% (CDLE 2010).

Environmental Consequences

Proposed Action

The Proposed Action would have minor positive impacts on the local economies of Garfield County through the creation or retention of job opportunities in the oil and gas industry and in supporting trades and services. In addition, local governments in Garfield County would experience an increase in tax and royalty revenues. The Proposed Action could result in minor negative social impacts, including reduced scenic quality, increased dust levels, and increased traffic. However, these impacts would be minor and limited to the relatively short duration of drilling and completion activities.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Soils (includes an analysis of Public Land Health Standard 1)

Affected Environment

The proposed activities are located at the base of battlement mesa on a large ancient landslide complex. According to the *Soil Survey of Rifle Area, Colorado* (USDA 1985), the proposed well pad, access road and pipeline would be located on Ildedonso Stony Loam of varying steepness. This loam is deep, well-drained soil is found on mesas, benches, and sides of valleys at elevations from 5,000 to 6,500 feet and

slopes of 6 to 45 percent. Portions of this soil unit are on very steep to extremely steep mesa escarpments. This soil is formed in mixed alluvium derived primarily from basalt. Surface runoff is medium and erosion hazard is moderate to severe. Portions of the pad, access road and pipeline cross moderately sloping to extremely steep escarpments.

Environmental Consequences

The Proposed Action would result in approximately 15.26 acres of short-term vegetation loss and soil disturbance, with a long-term loss of approximately 5.54 acres. The area generally contains adequate vegetation buffers that would minimize the potential for sediment transport. However, construction activities would cause slight increases in local soil loss, loss of soil productivity, and sediment available for transport to surface waters. Potential for such soil loss and transport would increase as a function of slope, feature (pad, road, or pipeline route) to be constructed, and proximity to drainages.

The proposed pad, access road and pipeline would be located on areas with moderate to severe risk of erosion and slope instability due to the soil characteristics and its location on an ancient landslide complex. A section of the access road, pipeline, and pad would cross an area of prior slope failure and associated scarp above the cut slope as depicted on Figure 2. In addition, the drainage area that the road and pipeline would cross through is susceptible to creep movement. Geotechnical review of the pad and road design will be conducted and particular care would be taken during construction and reclamation to ensure that proper design and BMPs, including the COAs listed in Appendix A, are utilized to prevent erosion and slope movement. In addition, the slope movement will be monitored before, during and after construction.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Analysis on Public Land Health Standard 1 for Upland Soils

The proposed project is within the Battlement Mesa Area Land Health Area (LHA). With the exception of one site-specific problem attributed to road runoff and grazing, the areas evaluated were achieving the soil standard (BLM 2000). The Proposed Action, with associated mitigation, and the No Action Alternative would be unlikely to prevent Public Land Health Standard 1 for Upland Soils from being met.

Special Status Species (includes an analysis on Public Land Health Standard 4)

Federally Listed, Proposed, or Candidate Species

PLANTS

Affected Environment

Federally listed, proposed, or candidate species potentially occurring within or affected by actions in Garfield County include four species of vascular plants. Table 8a lists these species and summarizes information on their habitat associations, potential for occurrence in the project vicinity based on known

geographic range and habitats present, and potential for adverse impacts from the Proposed Action. Species indicated as potentially affected are described in more detail following the table.

Table 8a. Potential for Occurrence of Threatened or Endangered Plants and Project Impacts

Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Parachute penstemon *(Penstemon debilis)* -- Threatened	Sparsely vegetated, south-facing, steep, white shale talus of the Parachute Creek Member of the Green River Formation; 8,000 to 9,000 feet	Other oil shale endemic species, such as Roan Cliffs blazing-star, Cathedral Bluffs meadow- rue, dragon milkvetch, Piceance bladderpod, and oil shale fescue	No	No
DeBeque phacelia *(Phacelia submutica)* – Threatened	Sparsely vegetated, steep slopes in chocolate-brown, gray, or red clay on Atwell Gulch and Shire Members, Wasatch Formation; 4,700 to 6,200 feet	Desert shrubland with four wing saltbush, shadscale, greasewood, broom snakeweed, bottlebrush squirreltail and Indian ricegrass, grading upward into scattered junipers	No	No
Colorado hookless cactus *(Sclerocactus glaucus)* – Threatened	Rocky hills, mesa slopes, and alluvial benches in salt desert shrub communities; often with well-formed microbiotic crusts; can occur in dense cheatgrass 4,500 to 6000 feet	Desert shrubland with shadscale, galleta grass, black sagebrush, Indian ricegrass grading upward into big sagebrush and sagebrush/pinyon-juniper	No	No
Ute ladies'-tresses orchid *(Spiranthes diluvialis)* – Threatened	Subirrigated alluvial soils along streams and in open meadows in floodplains; 4,500 to 7,200 feet	Box-elders, cottonwoods, willows, scouring rushes, and riparian grasses, sedges, and forbs	No	No

Environmental Consequences – Proposed Action and No Action Alternative

Because no potential habitat for any Federally listed, proposed, or candidate plant species occurs within or adjacent to the project area, the Proposed Action and the No Action Alternative would have **"No Effect"** on any of these species.

WILDLIFE

Affected Environment

Federally listed, proposed, or candidate species potentially occurring within or affected by actions in Garfield County include eight species of vertebrate wildlife. Table 8b lists these species and summarizes information on their habitat associations, potential for occurrence in the project vicinity based on known geographic range and habitats present, and potential for adverse impacts from the Proposed Action. Species indicated as potentially affected are described in more detail following the table.

Table 8b. Potential for Occurrence of Threatened or Endangered Wildlife and Project Impacts				
Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Canada lynx *(Lynx canadensis)* – Threatened	Expanses of subalpine and upper montane coniferous forests	Spruce-fir forests; also lodgepole pine and aspen	No	No
Mexican spotted owl (*Strix occidentalis lucida*) – Threatened	No historic occurrence in area; present in southwestern Colorado and southern Front Range	Rocky cliffs within closed-canopy coniferous forests	No	No
Yellow-billed cuckoo *(Coccyzus americanus)* – Candidate	Colorado, Dolores, Yampa, Rio Grande, and North Fork of Gunnison rivers	Large cottonwood stands along rivers	No	No
Razorback sucker *(Xyrauchen texanus)* – Endangered	Occur in mainstem of the Colorado River and major tributary rivers – upstream to Rifle, Colorado, in CRVFO	General: Deep, slow runs, pools, and eddies Spawning: silt to gravel substrates in shallow water and seasonally flooded overbank areas	Yes	Yes
Colorado pikeminnow *(Ptychocheilus lucius)* – Endangered			Yes	Yes
Humpback chub *(Gila cypha)* -- Endangered	Occur in mainstem of the Colorado River and major tributaries – upstream to Black Rocks near Utah line	Rocky runs, riffles, and rapids	No	Yes
Bonytail chub *(Gila elegans)* – Endangered		Shallow reaches of swift, deep rivers	No	Yes
Greenback cutthroat trout (*Oncorhynchus clarki stomias*) – Endangered	Native in South Platte drainage, recently documented in the CRVFO	Clear, cold mountain streams and headwaters lakes	No	No

Environmental Consequences

Proposed Action

Razorback Sucker, Colorado Pikeminnow, Humpback Chub, and Bonytail Chub. Federally listed as endangered. These four species of Federally listed big-river fishes occur within the Colorado River drainage basin near or downstream from the project area. Designated Critical Habitat for the razorback sucker and Colorado pikeminnow includes the Colorado River and its 100-year floodplain west (downstream) from the town of Rifle. This portion of the Colorado River lies a few miles northeast of the project area. The nearest known habitat for the humpback chub and bonytail is within the Colorado River approximately 70 miles downstream from the project area. Occasionally, the bonytail is in Colorado west of Grand Junction, but its range does not extend east from that point. Only one population of humpback chub, at Black Rocks west of Grand Junction, is known to exist in Colorado.

The Canada lynx, Mexican spotted owl, and western yellow-billed cuckoo are not expected to occur in the project vicinity based on documented occurrences and habitat types present. Therefore, the Proposed Action would have "**No Effect**" on these species.

The endangered Colorado River fishes could potentially be affected by the consumptive use of water taken from the Colorado River basin to support activities associated with the Proposed Action. Depletions in flows in the Colorado River and major tributaries are a major source of impacts to these fishes due to changes in the flow regime that reduce the availability and suitability of spawning sites and habitats needed for survival and growth of the larvae. Principal sources of depletion in the Colorado River basin include withdrawals for agricultural or industrial uses, withdrawals for municipal water supplies, and evaporative losses from reservoirs. On average, approximately 0.77 acre-feet of Colorado River water is consumed during activities related to each oil and gas well. This is equivalent to 0.04 to approximately 0.04 cubic feet per second (cfs) of water throughout the typical 10-day drilling period for an oil and gas well in the CRVFO area.

In 2008, the BLM prepared a Programmatic Biological Assessment (PBA) addressing water-depleting activities associated with BLM's fluid minerals program in the Colorado River Basin in Colorado. In response to this PBA, the USFWS issued a Programmatic Biological Opinion (PBO) (ES/GJ-6-CO-08-F-0006) on December 19, 2008. The PBO concurred with BLM's effects determination of "**May Affect, Likely to Adversely Affect**" the Colorado pikeminnow, humpback chub, bonytail chub, or razorback sucker as a result of depletions associated with oil and gas projects. To offset the impacts, the BLM has set up a Recovery Agreement, which includes a one-time fee per well. The estimated depletions from the Proposed Action will be added to the CRVFO tracking log and submitted to the USFWS per the PBA/PBO at the end of the year to account for depletions associated with BLM's fluid mineral program. The calculated mitigation fees are used by the USFWS for mitigation projects and contribute to the recovery of these endangered species through restoration of habitat, propagation, and genetics management, instream flow identification and protection, program management, non-native fish management, research and monitoring, and public education.

Other potential impacts to these species include inflow of sediments from areas of surface disturbance and inflow of chemical pollutants related to oil and gas activities. Construction activities would increase the potential for soil erosion and sedimentation. Although a minor temporary increase in sediment transport to the Colorado River may occur, it is unlikely that the increase would be detectable above current background levels. In any case, the Federally listed, proposed, or candidate fish species associated the Colorado River are adapted to naturally high sediment loads and would not be affected.

In contrast to inflow of sediments, the inflow of chemical pollutants could impact the endangered big-river fishes if concentrations are sufficient to cause acute effects. The potential for adverse impacts would be limited to the Colorado pikeminnow and razorback sucker, the two species known to occur within the CRVFO area. Spills or other releases of chemical pollutants as a result of oil and gas activities are infrequent in the CRVFO area due to the various design requirements imposed by BLM and the State of Colorado. In the event of a spill or accidental release into an ephemeral drainage that could flow to the Colorado River, the operator would be required to implement its Spill Prevention, Control, and Countermeasures (SPCC) plan, including such cleanup and mitigation measures as required by BLM or the State. For these reasons, and because any spills into the Colorado River would be rapidly diluted to levels below that are not deleterious, or even detectable, the potential for adverse impacts from chemical releases is not considered significant.

Based on the above, the BLM has determined that inflow of sediments and chemicals into the Colorado River would have "**No Effect**" on the endangered big river fishes. In the unlikely event of a spill with the potential to affect, or documented occurrence of an effect, the USFWS would initiate discussions with the involved parties to identify appropriate remedies.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed oil and gas well bottomholes from another, already approved pad on BLM surface. Although impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Because any alternative for accessing some of all of the bottomholes from another location would need to be in proximity to the proposed pad, impacts to Federally listed vertebrate wildlife can be assumed to be the same as under the Proposed Action, i.e., **"No Effect"** exclusive of the endangered big river fishes, and **"May Affect, Likely to Adversely Affect"** based on depletions of flows from the Colorado River. This would be addressed in any NEPA analysis conducted for an alternative location, if and when Encana pursues that possibility as a consequence of the No Action Alternative being selected by the BLM.

BLM Sensitive Species

PLANTS

Affected Environment

BLM sensitive plant species with habitat and/or occurrence records in Garfield County are listed in Table 9a, along with their habitat requirements and potential to be affected by the proposed project. Project-specific plant surveys located neither occurrences nor potential habitats for any of these BLM sensitive plant species within or near the project area.

Table 9a. Potential for Occurrence of BLM Sensitive Plants and Project Impacts

Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Debeque milkvetch (*Astragalus debequaeus*)	Varicolored, fine-textured, seleniferous or saline soils of Wasatch Formation- Atwell Gulch Member; 5,100 to 6,400 feet	Pinyon-juniper woodlands and desert shrub	No	No
Naturita milkvetch (*Astragalus naturitensis*)	Sandstone mesas, ledges, crevices and slopes in pinyon/juniper woodlands; 5,000 to 7,000 feet	Pinyon-juniper woodlands	No	No
Piceance bladderpod (*Lesquerella parviflora*)	Shale outcrops of the Green River Formation, on ledges and slopes of canyons in open areas; 6,200 to 8,600 feet	Pinyon-juniper woodlands, shrublands; often with other oil shale endemic species	No	No
Roan Cliffs blazing-star (*Mentzelia rhizomata*)	Steep, eroding talus slopes of shale, Green River Formation; 5,800-9,000 feet	Pinyon-juniper woodlands, shrublands; often with other oil shale endemic species	No	No

Table 9a. Potential for Occurrence of BLM Sensitive Plants and Project Impacts				
Species and Status	***Occurrence***	***Habitat Association***	***Range or Habitat in Vicinity?***	***Potentially Affected?***
Harrington's beardtongue (*Penstemon harringtonii*)	Sagebrush shrublands, including invaded by pinyon/juniper, rocky loams and rocky clay loams derived from coarse calcareous parent materials (basalt); 6,200 to 9,200 feet	Sagebrush, with some scattered pinyon-juniper	No	No
Cathedral Bluffs meadow-rue (*Thalictrum heliophilum*)	Endemic on sparsely vegetated, steep shale talus slopes of the Green River Formation; 6,300 to 8,800 feet	Pinyon-juniper woodlands, shrublands; often with other oil shale endemic species; may occur with rabbitbrush or snowberry	No	No

Environmental Consequences – Proposed Action and No Action Alternative

Because no potential habitat for any BLM sensitive plant species occurs within or adjacent to the project area, the Proposed Action and the No Action Alternative would have no adverse impacts on any of these species.

WILDLIFE

Affected Environment

Table 9b lists BLM sensitive vertebrate wildlife species that are known to occur in the region and, if present, could potentially be adversely affected by the Proposed Action. Potential impacts to species indicated as present or possible in the area of potential direct or indirect effects are discussed following the table.

Table 9b. Potential for Occurrence of BLM Sensitive Wildlife and Project Impacts		
Common Name	***Habitat***	***Potential for Occurrence***
Fringed myotis (*Myotis thysanodes*) and Townsend's big-eared bat (*Corynorhinus townsendii*)	Breed and roost in caves, trees, mines, and buildings; hunt over pinyon-juniper, montane conifers, and semi-desert shrubs.	Unlikely; habitat marginal
Northern goshawk (*Accipiter gentilis*)	Predominantly uses spruce/fir forests but also use Douglas-fir, various pines, and aspens.	No suitable habitat
Bald eagle (*Haliaeetus leucocephalus*)	Nests and roosts in mature cottonwood forests along rivers, large streams, and lakes.	Possible; nests and roosts along Colorado River
Peregrine falcon (*Falcon peregrinus*)	Nests on cliffs, usually near a river, large lake, or ocean. Hunts for waterfowl on water or upland fowl across grasslands and steppe.	Possible (foraging)

Table 9b. Potential for Occurrence of BLM Sensitive Wildlife and Project Impacts		
Common Name	***Habitat***	***Potential for Occurrence***
Brewer's sparrow (*Spizella breweri*)	Nests in large stands of sagebrush, primarily Wyoming sagebrush on level or undulating terrain.	Possible
Midget faded rattlesnake (*Crotalus viridis concolor*)	Cold desert dominated by sagebrush and with an abundance of rock outcrops and exposed canyon walls, typically farther west than the project area.	Unlikely; habitat marginal
Northern leopard frog (*Lithobates pipiens*)	Wet meadows and the shallows of marshes, ponds, lakes, streams, and irrigation ditches.	No suitable habitat
Great Basin spadefoot (*Spea intermontana*)	Habitat includes pinyon-juniper woodlands and semi-desert shrublands, typically farther west than the project area.	No suitable habitat
Flannelmouth sucker (*Catostomus latipinnis*) and roundtail chub (*Gila robusta*)	Restricted to rivers and major tributaries.	Present in Colorado River
Bluehead sucker (*Catostomus discobolus*)	Found in smaller streams with a rock substrate and mid to fast flowing waters.	No suitable habitat
Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*)	Headwaters streams and ponds with cool, clear waters and no non-native cutthroat subspecies	No suitable habitat

Environmental Consequences

Proposed Action

Fringed Myotis and Townsend's Big-eared Bat. No caves or other suitable roosting sites occur in the project area. Loss of large trees, potentially also used for roosting, would be negligible. Loss of habitat above which the bats could search for aerial prey would also be minimal, and disturbance due to construction activities would not occur at night when the bats are feeding.

Bald Eagle. Although bald eagles nest and roost along the Colorado River just southeast of the project area, the potential for use of the actual project area is moderate. Any such use would most likely be by an individual hunting across large expanses of open upland habitats during winter. The project area would represent a small portion of such potential winter hunting habitat, and the reclaimed grass-forb community would provide better habitat for prey than the current shrubland types.

Peregrine Falcon. Peregrine falcons nest along cliff bands south and north of the project and hunt for waterfowl along the Colorado River or other birds across open terrain. Use of the project area is unlikely, except for infrequent, transitory overflights while traveling between the Colorado River and the cliff bands to the south.

Brewer's Sparrow. Although the habitat is marginal in the project area, the possibility exists of nesting by this species. The 60-day TL to prohibit removal of vegetation during the period May 1 to July 1 (see Appendix A) would avoid or minimize the potential for impacts to nesting Brewer's sparrows. Construction activities outside this period could cause individuals to avoid the disturbance while feeding. However, this impact would be limited in duration at any point along the corridor, and individuals are expected to feed across very large home ranges outside the nesting season, thus minimizing the severity of this potential indirect impact.

Midget Faded Rattlesnake. This small viper is considered a small, pale-colored subspecies of the common and widespread western rattlesnake, although some authorities consider it and another western subspecies, the Great Basin rattlesnake (*C. v. nuntius*) to be genetically distinct species. Although movement patterns of midget faded rattlesnakes are not well known, they are believed to be limited to a few hundred meters from den sites. The limited distribution and small home range make this snake susceptible to impacts from human disturbance (USGS 2007). Threats include direct mortality from vehicles traveling on roads and pads, off-highway vehicle use throughout the landscape, capture by collectors, and livestock grazing. As access increases into previously undeveloped areas, the risk of encounters with humans would increase, resulting in some cases of mortality or collection.

Flannelmouth Sucker and Roundtail Chub. As with the ecologically similar Colorado River endangered fishes described above, the flannelmouth sucker and roundtail chub are adapted to naturally high sediment loads and therefore would not be affected by increased sediment transport to the Colorado River. Furthermore, protective COAs for water quality would minimize this potential (Appendix A). However, these species are vulnerable to alterations in flow regimes in the Colorado River (including evaporative loses from dams and depletions from withdrawal of water for irrigation or municipal water supplies) that affect the presence of sandbars and seasonally flooded overbank areas needed for reproduction. The amount of depletion in flows associated with this project is not expected to have a significant adverse impact on the survival or reproductive success of these species.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Analysis on Public Land Health Standard 4 for Special Status Species

According to a recent LHA, habitat conditions within this area appear suitable for special status animal species known or likely to occur (BLM 2000). However, large portions of the landscape are being fragmented due to extensive natural gas development. Continued habitat fragmentation is of concern as large blocks of contiguous intact habitat are required by many species. Sustained development and the proliferation of roads, well pads, pipelines, compressor stations, tank farms and other surface facilities would continue to reduce habitat patch size and affect both habitat quality and quantity. The potential to impact some species would increase as development continues.

Based on the protective stipulations listed in Appendix A, the Proposed Action would not jeopardize the viability of any population of special status plant or animal species due to habitat loss, modification, fragmentation, or indirect effects. The project would have no significant consequence on habitat condition, utility, or function or any discernible effect on species abundance or distribution at a landscape scale. Public Land Health Standard 4 would continue to be met.

Vegetation (includes an analysis on Public Land Health Standard 3)

Affected Environment

The affected environment consists of partially burned Utah juniper (*Juniperus osteosperma*) and sagebrush (*Artemisia* sp.) habitat. Common shrubs include rabbitbrush (*Ericameria nauseosa*), Gambel oak (*Quercus gambelii*), and sagebrush. The burned portions of this habitat are now dominated by

grasses, including widespread non-native grass species, smooth brome (and crested wheatgrass, which were seeded post-burn. Common forbs present include Osterhout's penstemon (*Penstemon osterhoutii*). Two noxious weed species, cheatgrass and musk thistle, are scattered throughout the burned area.

Environmental Consequences

Proposed Action

Under the Proposed Action, a total of approximately 15.26 acres of juniper/sagebrush and sagebrush/grassland habitat would be disturbed. Of this acreage, approximately 5.54 acres would remain in an unreclaimed condition over long-term production and maintenance activities. COAs identified in Appendix A. The revegetation seed mix would be restricted to native species. Noxious weeds would be treated in accordance with the standard COAs.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Analysis on Public Land Health Standard 3 for Plant and Animal Communities (partial, see also Wildlife, Aquatic and Wildlife, Terrestrial)

The proposed project is within the Battlement Mesa Area LHA. This assessment found the condition of the vegetative communities to be the most widespread problem within this LHA in 2000, with nearly half of the observation sites rates at risk or non-functional. Many of the sagebrush and woodland sites were not achieving the standards for healthy lands (BLM 2000). Implementation of this project would include weed treatment, and revegetation using native plant species. With these COAs, this project would not worsen the vegetation current conditions within this LHA.

Visual Resources

Affected Environment

The proposed pad, access road, and pipeline are located on public lands administered by the BLM southwest of Parachute, Colorado and south of I-70. These lands are classified as Visual Resource Management (VRM) Class II and III as identified by the 1984 Glenwood Springs Resource Management Plan (Figure 5). The objectives for VRM Classes II and III as defined in the BLM's Manual H-8410-1 – Visual Resource Inventory (BLM 1986), are described below.

- The objective of VRM Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- The objective of VRM Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The project area consists of finger-like mesas gently sloping upward towards the south/southeast from the Colorado River valley floor. The mesa slopes are dissected by drainages and terminate at the toe of Battlement Mesa ridgeline slopes. The area is characteristic of rural ranching land, scattered rural residences, the residential community of Battlement Mesa, and oil and gas development. The Proposed Action would occur along the toe of one of the ridgelines that descends from Battlement Mesa. Vegetation consists of a partially burned pinyon juniper woodland and sagebrush flat that is now dominated by grasses. The Proposed well pad, access road, and pipeline would cross an area of prior slope failure, leaving a small scarp (Figure 2).

The proposed PH21 well pad and access road would occur on VRM Class II and III land. Whereas, the proposed pipeline would occur on private land and VRM Class II and III (see Table 10 and Figure 6). The visual resource analysis area includes the town of Parachute, I-70 and U.S. Highway 6, and the community of Battlement Mesa. This viewshed is important, as it is viewed by a large number of people who live, work, recreate, and travel through the area. The Proposed Action would be in the viewer's foreground, less than 5 miles from each of these travel corridors. BLM guidance states that lands with high visual sensitivity are those within five miles of a primary travel corridor and of moderate to very high visual exposure, where details of vegetation and landform are readily discernible and changes in visual contrast can be easily noticed by the casual observer.

Table 10. Summary of VRM Class Designations Applicable to the Proposed Action

Project Component	***CRVFO VRM Class Designation***		***Total on BLM Land Short-term***	***Total on BLM Land Long-term***
	Class II	***Class III***		
Proposed PH21 Access Road	2.39 acres	.23 acres	2.62 acres	1.2 acres
Proposed PH21 Well Pad	0.94 acres	4.35 acres	5.29 acres	1.28 acres
Proposed PH21 Pipeline	1.67 acres	3.64 acres	5.31 acres	2.12 acres
Total	5 acres	8.22 acres	13.22 acres	4.6 acres

Calculations are derived using GIS data provided by the operator. Each project component was clipped to its associated VRM Class Designation and the length in feet and area was calculated for the Proposed Action.

The visual impact analysis is based on views from three Key Observation Points (KOPs) representing three linear viewing locations, viewing angles, and viewing directions with the highest frequency of viewers: the Parachute rest area (I-70 and U.S. Highway 6); the intersection of County Road (CR) 300 (Stone Quarry Road) and CR300D (Old Stone Quarry Road); and the intersection of CR303 (Gardner Lane) and CR308 (Four Corner Road). All three KOPs represent typical views that a viewer would see while traveling eastbound and westbound along I-70 and US 6, and from the community of Battlement Mesa. These KOPs are shown in Figures 7, 8, and 9, respectively.

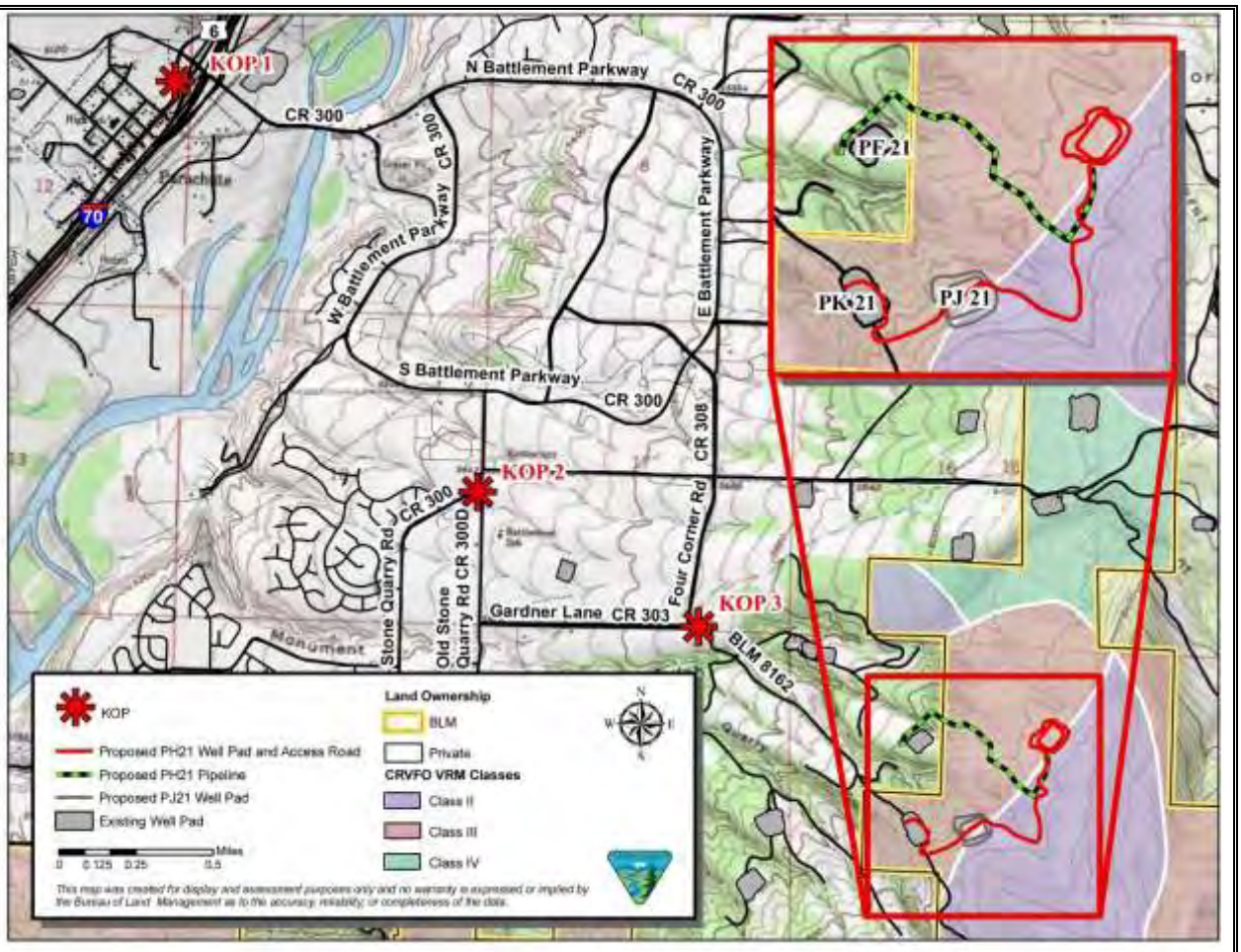


Figure 6. Proposed Action Relationship to CRVFO Visual Resource Management (VRM) Classes.

Environmental Consequences

Proposed Action

Short-term visual impacts due to pad and access road construction; pipeline installation, drilling and completion activities would occur within the project area. The construction of the proposed project would create contrast within the landscape by removing the existing vegetation, exposing bare ground, and creating distinct lines and forms within the landscape. The new pad, surface facilities, access road, and surface pipeline would increase the presence of drilling rigs, heavy equipment (e.g., dozers, graders, etc.), and vehicular traffic with an associated increase in dust, light pollution, and well flaring. All project components would be constructed on public land and would be subject to the BLM VRM designations.

PROPOSED PH21 ACCESS ROAD

The entire 0.58-mile length by 40-foot width of the new access road from the proposed PJ21 well pad to the proposed PH21 well pad across BLM surface would be constructed within VRM Class II and Class III creating approximately 2.81 acres of new surface disturbance. The road was designed to avoid areas at risk of erosion and slope instability. However, the road would cross a low scarp as depicted on Figure 2.

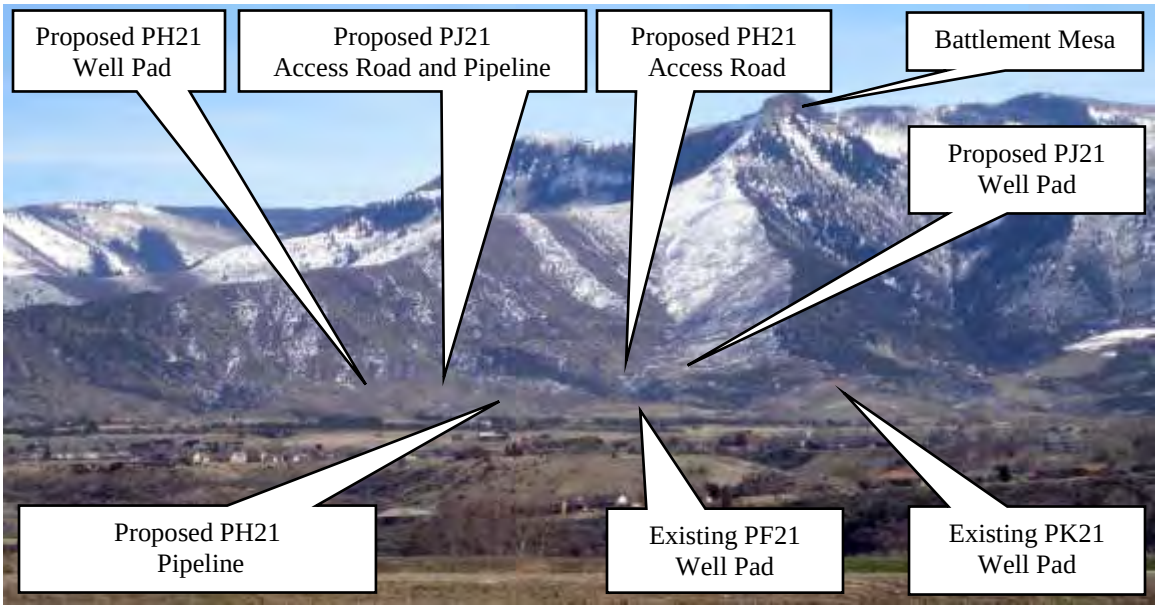


Figure 7. KOP 1 is at the Parachute rest area. The viewer would be slightly below the Proposed Action. This view is typical of a casual observer traveling on I-70 or US 6.

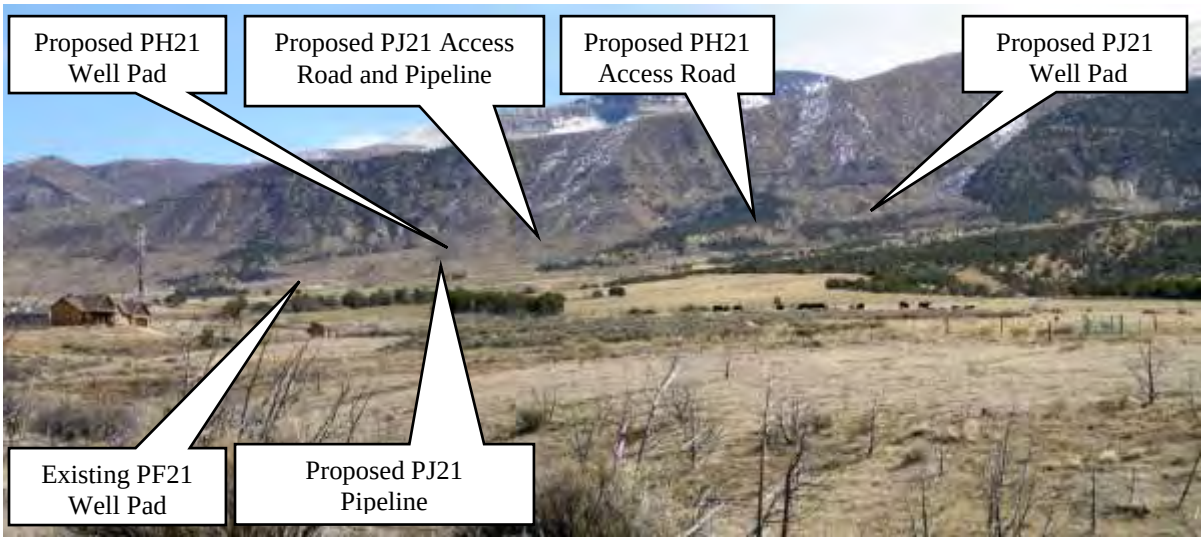


Figure 8. KOP 2 is at the corner of CR300 and CR300D. The viewer would be slightly below the Proposed Action. This is view is typical of the view from the community of Battlement Mesa.

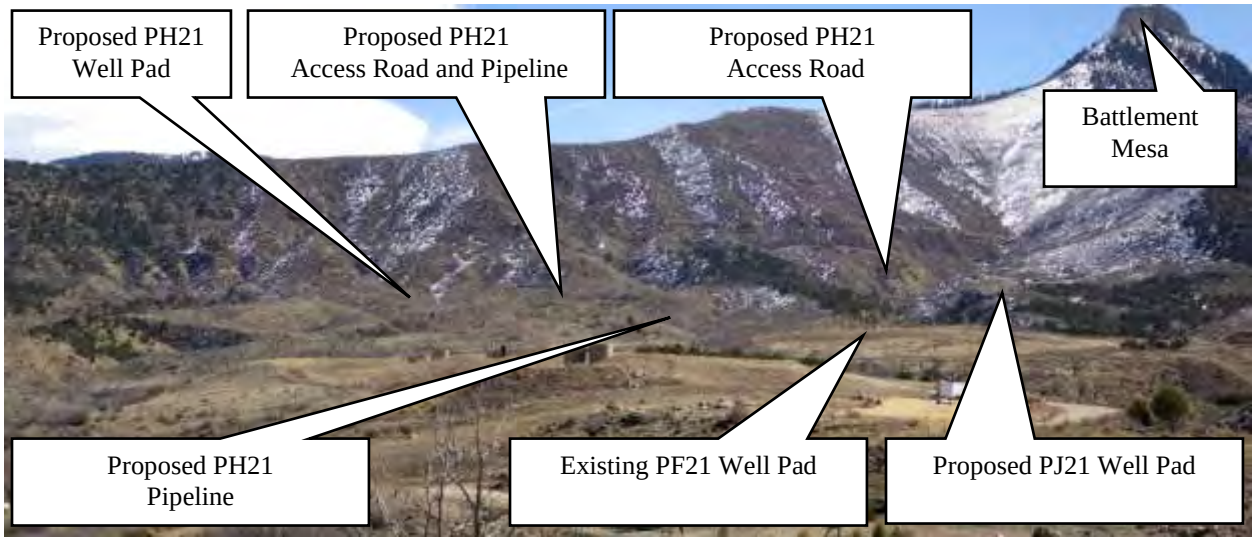


Figure 9. KOP 3 is near the corner of CR303 and CR308. The viewer would be slightly below the Proposed Action. This KOP is typical of the view from residences outside the community of Battlement Mesa.

The road would mostly follow natural contours, reducing cut and fill and contrasts in the landscape. The road would also cross a burned area with light tan colored soils. In the short-term, the road cuts and fills would be visible as the exposed soil color would be lighter than surrounding soils. Prompt reclamation of the cuts and fills would mitigate or soften the typical contrasts common with road construction footprints. To meet VRM II and III objectives, mitigation requirements are applied as COAs (See Appendix A).

The average disturbance width for the proposed road would be 40 feet. Total short-term disturbance associated with road construction would be 2.81 acres. The long-term disturbance (essentially the 20-foot road travelway, including the road ditches) would be approximately 1.4 acres.

PROPOSED PH21 PIPELINE

The PH21 pipeline would be constructed within VRM Class II and III. There were other alignments considered in the field but were not considered because of impacts to resources and soil stability concerns. The proposed alignment follows an existing two-track for part of the alignment. The topography where the pipeline alignment would be located gently undulates, creating areas where the pipeline corridor would be less visible. The pipeline corridor is located within a previously burned area with light tan colored soils. In the short-term the pipeline corridor would be visible as the exposed soil from construction would be lighter than the soils in the surrounding area. As with the road alignment, prompt reclamation would help mitigate or soften the typical contrasts common with pipeline corridors. To meet VRM II and III objectives, mitigation requirements are applied as COAs (See Appendix A).

The average disturbance width for the proposed pipeline would be 75 feet (30-foot permanent ROW and 45-foot temporary work area). Total short-term disturbance associated with the pipeline would be approximately 7.16 acres on BLM land; long-term disturbance following reclamation would be approximately 2.86 acres.

PROPOSED PH21 WELL PAD

The PH21 well pad would be constructed within VRM Class II and III. The well pad, located on a gently sloping sagebrush bench, would not be obvious to the casual observer, similar to the current PF21 well pad visibility as seen from each of the KOPs except during the drilling and completion phase of the project. The 35-foot cut slope in the southeast corner and the 35-foot fill slope in the northwest corner would be the most visible immediately after construction, as there is little vegetation in the immediate vicinity to screen it. The tanks would be located on the pad (Figure 3) but would be located to maximize the area for reclamation. Berms could be created along the northern edge of the pad to help screen the production facilities. As seen from the KOPs, the casual observer would be slightly below the proposed well pad. The nature of the topography and the angle of view would provide some visual screening of the production facilities. To meet VRM Class II and III objectives, mitigation requirements are applied as COAs (See Appendix A).

Construction of the well pad would result in 5.29 acres of new surface disturbance, which would be reduced to approximately 1.28 acres during interim reclamation.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Wastes, Hazardous or Solid

Affected Environment

The affected environment for hazardous materials includes air, water, soil, and biological resources that may potentially be affected by an accidental release of hazardous materials during transportation to and from the project area, storage, and use in construction and operations. Sensitive areas for hazardous materials releases include areas adjacent to water bodies, above aquifers, and areas where humans or wildlife would be directly impacted.

BLM Instruction Memoranda numbers WO-93-344 and CO-97-023 require that all NEPA documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. The Glenwood Springs Resource Area, Oil & Gas Leasing & Development, Draft Supplemental Environmental Impact Statement (June 1998), Appendix L, Hazardous Substance Management Plan, contains a comprehensive list of materials commonly used for oil and gas projects and a description of common industry practices for use of these materials and disposal of waste products. These practices are dictated by various Federal and State laws and regulations, and BLM standard lease terms and stipulations that would accompany any authorization resulting from this analysis. The most pertinent of Federal laws dealing with hazardous materials are:

- The Oil Pollution Act (Public Law 101-380, August 18, 1990) prohibits discharge of pollutants into waters of the US, which by definition would include any tributary, including any dry wash that eventually connects with the Colorado River.

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Public Law 96-510 of 1980) provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment. It also provides national, regional, and local contingency plans. Applicable emergency operations plans in place include the National Contingency Plan (40 CFR 300, required by section 105 of CERCLA), the Region VIII Regional Contingency Plan, the Colorado River Sub-Area Contingency Plan (these three are Environmental Protection Agency-produced plans), the Mesa County Emergency Operations Plan (developed by the Mesa County Office of Emergency Management), and the BLM Grand Junction Field Office Hazardous Materials Contingency Plan.

- The Resource Conservation and Recovery Act (RCRA) (Public Law 94-580, October 21, 1976) regulates the use of hazardous substances and disposal of hazardous wastes. Note: While oil and gas lessees are exempt from RCRA, ROW holders are not. RCRA strictly regulates the management and disposal of hazardous wastes.

Emergency response to hazardous materials or petroleum products on BLM lands are handled through the BLM Grand Junction Field Office contingency plan. BLM would have access to regional resources if justified by the nature of an incident.

<u>Environmental Consequences</u>

Proposed Action

Possible pollutants that could be released during the construction phase of this project would include diesel fuel, hydraulic fluid, and lubricants. These materials would be used during construction of the pads, roads, and pipelines, and for refueling and maintaining equipment and vehicles. Potentially harmful substances used in the construction and operation phases would be kept onsite in limited quantities and trucked to and from the site as required. No hazardous substance, as defined by 40 CFR 355 would be used, produced, stored, transported, or disposed of in amounts above threshold quantities.

Waste generated by construction activities would not be exempt from hazardous waste regulations under the oil and gas exploration and production exemption of RCRA. Exempt wastes would include those associated with well production, transmission of natural gas through gathering lines, and natural gas itself. With the exception of produced hydrocarbons, ethylene glycol (antifreeze), lubricants, and amine compounds, chemicals subject to reporting under Title III of the Superfund Amendments and Reauthorization Act in quantities of 10,000 pounds or more would not be used, produced, stored,

transported, or disposed of during construction or operation of the facilities. None of the chemicals that would be used in construction meet the criteria for an acutely hazardous material/substance, or meet the quantities criteria per BLM Instruction Memorandum No. 93-344. In addition, no extremely hazardous substance, as defined in 40 CFR 355, in amounts above threshold planning quantities would be produced, used, stored, transported, or disposed of during construction or operation of the facilities.

Solid waste (human waste, garbage, etc.) would be generated during construction activities and, to a limited extent, during project operations. These would be removed to a landfill or water treatment facility as needed, and all would be removed prior to interim reclamation.

Surface water or groundwater could be affected under the Proposed Action. Pollutants that might be released during the operational phase of the project could include condensate, produced water (if the wells in the area produce water) and glycol (carried to the site and used as antifreeze). While uncommon, an accident could occur that could result in a release of any of these materials. A release could result in contamination of surface water or soil. Improper casing and cementing procedures could result in the contamination of groundwater resources. In the case of any release, emergency or otherwise, the responsible party would be liable for cleanup and any damages. Depending on the scope of the accident, any of the above referenced contingency plans would be activated to provide emergency response. At a minimum, the BLM Grand Junction Field Office contingency plan would apply.

These laws, regulations, standard lease stipulations, and contingency plans and emergency response resources are expected to adequately mitigate any potential hazardous or solid waste issues associated with the Proposed Action.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Water Quality, Surface and Ground (includes an analysis on Public Land Health Standard 5)

SURFACE WATER

Affected Environment

The project area is within Monument Gulch 6th code hydrologic unit, which drains to the Colorado River. The pad and access road drain to an ephemeral drainage of the east branch of Monument Gulch. The runoff from the road and pad flow ½ mile to the east branch of Monument Gulch , which flows into Monument Gulch and then to the Colorado River 3 miles northwest of the project location.

At this time, no water quality data exist for ephemeral drainages near the PH21 pad site. These are not currently on the State of Colorado's *Stream Classifications and Water Quality Standards* (CDPHE, WQCC Regulation No. 37) (CDPHE 2007), the State of Colorado's *303(d) List of Impaired Waters and Monitoring and Evaluation List* (CDPHE, WQCC Regulation No. 93) (CDPHE 2012). Sediment is a pollutant of concern for the Colorado River Basin (CDPHE, WQCC Regulation No. 93). The closest downstream sediment measuring station on the Colorado River is USGS station 9093700 near De Beque. For the period of 1974 to 1976 the mean sediment yield was 1,818 tons per day and varied between 8 and 41,300 tons per day. The median value for the same period was 267 tons/day (USGS 2007).

Environmental Consequences

Proposed Action

Potential impacts to surface water associated with the Proposed Action include increased erosion and sedimentation of streams, changes in channel morphology due to road and pipeline crossings, and contamination by drilling fluids, produced water, or condensate. Surface waters would be most susceptible to sedimentation during construction, drilling, and completion activities, which would collectively last approximately 150 days. After this period, reclamation activities would substantially reduce surface exposure, decreasing the risk to surface waters over the long term.

Although surface waters would be most susceptible to sedimentation over the short-term, access roads would remain in place over the life of the well (i.e., 20 to 30 years) and would channel runoff during periods of precipitation. Sedimentation and stream channel impacts associated with roads would be reduced through the implementation of Best Management Practices (BMPs) and other preventative measures. As proposed, these measures would include limiting cut slope steepness, step-cutting, limiting road grade to 10%, crowning road surfaces, installing culverts and drainage systems, and applying gravel to all new or upgraded BLM roads in the project area to a compacted thickness of 6 inches (Appendix A).

Other elements of the Proposed Action are designed to mitigate risks to surface waters associated with the release of drilling fluids, produced water, and condensate. A closed-loop drilling system would be implemented which recycles drilling fluids; cuttings would be dried through the use of a shaker system and be stacked in a cuttings trench. A traditional reserve pit would not be constructed.

Tanks used to store produced water and condensate would be placed in secondary containment to prevent offsite release. In the event of an accidental release, produced water and condensate would be confined for cleanup in a containment area and would not migrate to surrounding soils or surface waters. Pipelines associated with the transport of these liquids would be pressure tested to detect leakage prior to use. Cuttings must be decontaminated to COGCC standards prior to pit closure; the table of applicable standards can be found at http://cogcc.state.co.us/RR_docs_new/rules/900Series.pdf

Refer to Appendix A for standard COAs to mitigate impacts to surface water. Through the use of COAs and BMPs associated with construction activities, prompt interim reclamation, and the implementation of the preventative measures associated with the treatment of fluids, impacts to surface waters would be minimized

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Analysis on Public Land Health Standard 5 for Water Quality

The proposed project is within the Battlement Mesa Area LHA. All stream segments evaluated were achieving the water quality standards (BLM 2000). The Proposed Action with associated mitigation, and the No Action Alternative, would be unlikely to prevent Standard 5 for Water Quality from being met.

WATERS OF THE U.S.

Affected Environment

Waters of the U.S. located in the project vicinity include the ephemeral east branch of Monument Gulch. Section 404 of the Clean Water Act requires a Department of the Army permit from the U.S. Army Corps of Engineers (USACE) prior to discharging dredged or fill material into waters of the U.S. as defined by 33 CFR Part 328. A permit is required for both permanent and temporary discharges into waters of the United States; larger discharges require an individual permit, while smaller discharges may be granted a nationwide permit (NWP).

The access roads and pipeline cross ephemeral tributaries of east branch of Monument Gulch and may require USACE 404 permit.

Environmental Consequences

Proposed Action

Crossing for road access and pipelines to the PJ21 pad cross drainages that are potentially Waters of the US. It is not anticipated that any pad construction could discharge fill into Waters of the US. Based on the estimated impacts to waters of the U.S., any road construction and pipeline which cross drainages within the project would be authorized by the USACE. A COA listed in Appendix B required that the operator obtain a formal jurisdictional determination by USACE prior to any construction that could affect Waters of the U.S., and verification that the impacts do not require a permit.

Improperly designed crossings of small ephemeral drainages, in particular any undersized or poorly aligned culverts, could result in soil degradation, including erosion at culvert outlets. This could potentially supply sediment to the Colorado River approximately 3 miles to the northwest. However, standard and site-specific surface-use COAs listed in Appendix A would be implemented to protect Monument Gulch and, the Colorado River, and any other waters of the U.S. potentially impacted by long-distance stormflow transport.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

GROUNDWATER

Affected Environment

The Lower Piceance Basin contains both alluvial and bedrock aquifers (Colorado Geological Survey 2003). Unconsolidated alluvial aquifers are the most productive aquifers in the region (EPA 2004) and are defined as narrow, thin deposits of sand and gravel formed primarily along stream courses, in this case, along the Colorado River and its tributaries. Alluvial well depths are generally less than 200 feet and water levels typically range between 100 to 150 feet. Well yield is dependent upon the intended use of the well, well construction design, sediment type and saturated thickness. Domestic use wells are

limited to 15 gallons per minute (gpm) administratively, while municipal wells are designed and constructed for maximum potential yield.

The principal bedrock aquifers of the Piceance Basin are the Uinta Formation and the Parachute Creek Member of the Green River Formation, and are defined as the upper and lower Piceance Basin aquifer systems. The Uinta Formation consists of discontinuous layers of sandstone, siltstone, and marlstone and is less permeable than the hydrologically connected upper Parachute Creek Member (Robson and Saulnier 1981). The uppermost Uinta Formation also contains a shallow, perched aquifer that is separate from the upper aquifer unit (Cole et al. 1995). The upper Piceance Basin aquifer is underlain by the Mahogany confining unit, and correlates with the Mahogany Zone, the principal oil shale unit of the Piceance Basin. The Mahogany Zone separates the upper aquifer from the lower. The lower aquifer consists of the fractured marlstone of the lower part of the Parachute Creek Member. The thickness of the upper and lower aquifer units average 700 and 900 feet, respectively (CGS 2003). Both upper and lower aquifer systems are found within the surrounding cliffs of the project area, but no water wells are completed within either the upper or lower bedrock aquifers units as described above. Beneath these two aquifer systems is a confining unit which consists of the lower two members of the Green River Formation, and the Wasatch Formation. Although considered a confining unit, some fresh water wells are completed in the discontinuous water-bearing sands of the Wasatch Formation, but these water-bearing intervals are considered to be localized.

Below the Wasatch Formation is the Cretaceous-aged Mesaverde aquifer. The depth to the top of this aquifer beneath the project area is more than 5,000 feet below ground surface (bgs), far too deep for economic development. The Mesaverde aquifer is of regional importance, but does not provide recharge into the fresh water system within the shallower groundwater system of the project area.

Water quality of the upper Piceance Basin aquifer unit is relatively good, ranging in Total Dissolved Solid (TDS) levels from 500 to 1,000 milligrams per liter (mg/L). In the lower unit, TDS concentrations increase from 1,000 to 10,000 mg/L along basin flow paths. Waters with TDS values in excess of 1,000 mg/L are generally unsuitable for potable supply. Water suitable for drinking has a Federal secondary standard set at 500 mg/L or less (EPA 2006). The quality of the water in the Mesaverde aquifer is highly variable, with concentrations of dissolved solids ranging from less than 1,000 mg/L in many of the basin-margin areas to more than 10,000 mg/L in the central part of the Piceance Basin (EPA 2004). In general, areas of the aquifer that are recharged by infiltration from precipitation or surface water sources contain relatively fresh water. However, water quality in the Piceance Basin is generally poor overall due to the presence of nahcolite deposits and salt beds throughout the basin. Only very shallow waters such as those from the surficial Wasatch Formation are used for drinking water (Graham 2001, cited in EPA 2004).

One permitted domestic water well is located within a 1-mile radius of the proposed project. The well is approximately 4,050 feet to the northeast and has an unknown completion status.

<u>Environmental Consequences</u>

Proposed Action

Potential impacts to groundwater resources from the proposed development would include contamination of the groundwater with produced water, drilling mud, and petroleum constituents. Hydraulic fracturing would be incorporated to create additional pathways to facilitate gas production. Agents called proppants" used to prop open the fractures are mixed with both fresh water and produced water. Typical proppants include sand, aluminum, glass, or plastic beads, with less than 1% of other compounds such as corrosion-, friction-, and scale-inhibitors (EnerMax Inc. 2007). Fracing techniques are used to create

secondary porosity fractures, held open by proppants, allowing the otherwise trapped gas to migrate up the borehole for production.

Hydraulic fracturing would be conducted at 5,000 feet or more bgs. Drilling scenarios are developed to prevent fluids and produced hydrocarbons from migrating upward into fresh water zones. Also see the discussion of hydraulic fracturing on groundwater resources in the section of this EA on Geology and Minerals. Geologic and engineering reviews are conducted to ensure that the cementing and casing programs are adequate to protect all downhole resources. With proper construction practices, drilling practices, and BMPs, no significant adverse impact to groundwater aquifers is anticipated to result from the project (see Downhole COAs in Appendix A).

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Wildlife, Aquatic

Affected Environment

The Proposed Action would occur in an area of highly dissected terrain containing a number of ephemeral drainages. Due to the short stream lengths and small watersheds of ephemeral streams potentially affected by the Proposed Action, fish species do not occur. Aquatic macroinvertebrates most likely to occur include water striders, water boatmen, predaceous diving beetles, and the aquatic larvae of caddisflies and true flies such as biting midges, nonbiting midges, and mosquitoes. Amphibians, if present, would probably be limited to spadefoots and true toads, which are adapted to seasonal flow regimes in arid environments.

Environmental Consequences

Proposed Action

Implementation of the Proposed Action could result in increases in erosion and sedimentation into nearby drainages and eventually the Colorado River. Because the Proposed Action includes summer use of the project areas, it is likely that roads and pads would not be muddy for extended periods of time. Roads are generally drier and in better condition during the non-winter months and consequently are less prone to erosion. Vehicular use during muddy road conditions could contribute to increased erosion of sediments into nearby ephemeral washes and eventually the Colorado River. The potential increase of sedimentation into the Colorado River would probably be nominal given background sediment loads currently carried by the river. Sediment -intolerant aquatic wildlife could be negatively affected, as increased erosion potential would persist and impair water and habitat quality. Measures to minimize erosion and sedimentation of aquatic environments are included among the COAs (Appendix A).

No Action Alternative

The No Action Alternative constitutes denial of the Federal APDs described in the Proposed Action. Consequently, none of the planned development activities outlined in the Proposed Action would occur and there would be no additional impacts to Aquatic Wildlife Species.

Analysis on Public Land Health Standard 3 for Plant and Animal Communities (partial, see also Vegetation and Wildlife, Terrestrial)

The Proposed Action would not jeopardize the viability of any aquatic vertebrate species. The project would have no significant consequences on habitat condition, utility, or function or discernible adverse effects on species abundance or distribution at any landscape scale. Public Land Health Standard 3 would continue to be met (BLM 2000).

Wildlife, Terrestrial

Affected Environment

The project area would be located in sparse to medium density juniper woodlands with openings of sagebrush, saltbush, and greasewood. Understory vegetation consists of mostly native grasses and forbs with some cheatgrass. Given these vegetation types, the area provides cover, forage, breeding, and nesting habitat for a variety of big game and small game species as well as nongame mammals, birds, and reptiles.

MAMMALS

The project area is within overall ranges of mule deer (*Odocoileus hemionus*) and Rocky Mountain elk (*Cervus elaphus nelsonii*). Because of its low elevation the project area is primarily winter range which means deer and elk populations increase during the winter months when animals migrate to lower elevations from the Battlements to the south. Winter densities of big game animals in a given area are dependent on the type of habitat present and the severity of the winter. Deeper snows and colder temperatures result in increase in the number of big game animals using the area.

The project area falls within CPW-mapped mule deer and elk overall and winter range. It is within a mule deer winter concentration area, and the lower portion immediately north of I-70 is mule deer severe winter range. Severe winter range is the portion of overall winter range used primarily during the most severe winters in terms of temperatures and, especially, snow cover. Consequently, severe winter range is typically at the lower margins of overall winter range and often comprised of plant species that are not necessarily ideal as forage but remain available when higher quality winter range is covered with deep snow.

Large carnivores potentially present in the project vicinity include the mountain lion (*Puma concolor*), which moves seasonally with its preferred prey, the mule deer, and the black bear (*Ursus americanus*). Two smaller carnivores, the coyote (*Canis latrans*) and bobcat (*Lynx rufus*) are also present throughout the region in open habitats and broken or wooded terrain, respectively, where they hunt for small mammals, reptiles, and ground-dwelling birds. Smaller carnivores in habitats similar to those near the project site include the raccoon (*Procyon lotor*), ringtail (*Bassariscus astutus*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale gracilis*), and long-tailed weasel (*Mustela frenata*).

Small mammals present within the planning area include rodents such as the rock squirrel (*Spermophilus variegatus*), golden-mantled ground squirrels *(Callospermophilus lateralis)*, least chipmunk (*Neotamias minimus*), packrat (bushy-tailed woodrat) (*Neotoma cinerea*), black-tailed and/or white-tailed jackrabbit (*Lepus californica*, *L. townsendii*), and desert and/or mountain cottontail (*Sylvilagus audubonii, S. nuttallii*). Rodents and, to a lesser extent rabbits and hares, are the primary prey for a variety of predators.

BIRDS

The wild turkey (*Meleagris gallopavo*) is native to North America and the largest member of the upland fowl. Wild turkeys are omnivorous, foraging on the ground or climbing shrubs and small trees to feed. They prefer hard mast such as acorns and pine nuts but also relish berries, seeds, and large insects. Wild turkeys may move from cover into open areas such as woodland clearings and the margins of grasslands and pastures dusk and dawn. This site is located approximately 1.2 miles west of the area mapped by the CPW as wild turkey overall range. Neither the pad nor the access route goes through the mapped area. Therefore, the Proposed Action would not impact this species. See the sections on Migratory Birds and Special Status Species for discussions of other birds in the area.

REPTILES AND AMPHIBIANS

The project area is within elevational range of most reptile species known to occur in Garfield County. Two snake species—the gopher snake (bullsnake)(*Pituophis catenifer*) and striped whipsnake (*Coluber taeniatus*)—were observed during project-specific wildlife surveys. Other reptile species most likely to occur include the collared lizard *(Crotaphytus collaris)*, short- horned lizard, (*Phrynosoma hernandesi)*, plateau spiny lizard (*Sceloporus tristichus*), tree lizard (*Urosaurus ornatus*), and plateau whiptail (*Aspidocelis velox*), all commonly associated with pinyon-juniper woodlands, sagebrush shrublands, and grassy clearings such as occur in the project area. The milk snake (*Lampropeltis triangulum*), western terrestrial garter snake (*Thamnophis elegans*), and smooth green snake (*Opheodrys vernalis*) are potentially present but mostly associated with moister habitats.

In addition to a BLM sensitive species (the Great Basin spadefoot, see the section on Special Status Species), amphibians potentially present in the project vicinity include Woodhouse's toad (*Anaxyrus woodhousii*) and the western chorus frog (*Pseudacris triseriata*). Within the CRVFO area, Woodhouse's toad occurs primarily along ephemeral washes that do not support fish and contain persistent pools for at least a few weeks in spring. The chorus frog occurs primarily in cattail and bulrush wetlands and along the vegetated margins of seasonal or perennial ponds and slow-flowing streams.

Environmental Consequence

Proposed Action

Direct impacts to terrestrial wildlife from the Proposed Action may include mortality, disturbance, nest abandonment/nesting attempt failure, or site avoidance/displacement from otherwise suitable habitats. These effects could result from the 15.26 acres of habitat loss or modification, increased noise from vehicles and operation of equipment, increased human presence, and collisions between wildlife and vehicles. Impacts would be more substantial during critical seasons such as winter (deer and elk) or the spring/summer breeding season (raptors, songbirds, amphibians).

Deer and elk are often restricted to smaller areas during the winter months and may expend high amounts of energy to move through snow, locate food, and maintain body temperature. Disturbance during the winter can displace wildlife, depleting much-needed energy reserves and may lead to decreased over winter survival. Additional, indirect habitat loss may occur if increased human activity (e.g., traffic, noise) associated with infrastructure causes intolerant species to be displaced or alter their habitat use patterns. The extent of indirect habitat loss varies by species, the type and duration of the disturbance, and the amount of screening provided by vegetation and topography. In general, disturbance-related impacts are temporary, with patterns of distribution and habitat use returning to pre-disturbance conditions rather quickly when disturbance stops.

No Action Alternative

Under the No Action Alternative, the PH21 pad would not be constructed, and the construction of a new access road and pipeline would not be necessary. However, Encana would probably reach some of the proposed well bottomholes from another, already approved pad on BLM surface. Although both positive and negative impacts would be reduced compared to the Proposed Action, they would not be eliminated.

Analysis on Public Land Health Standard 3 for Plant and Animal Communities (partial, see also Vegetation and Wildlife, Aquatic)

The Proposed Action would not jeopardize the viability of any aquatic and terrestrial vertebrate species. The project would have no significant consequences on habitat condition, utility, or function or discernible adverse effects on species abundance or distribution at any landscape scale. Public Land Health Standard 3 would continue to be met areas that include the Battlement Mesa LHA (BLM 2000).

SUMMARY OF CUMULATIVE IMPACTS

Historically, habitat loss or modification in the CRVFO areas was characteristic of agricultural, ranching lands, rural residential, with localized industrial impacts associated with the railroad and I-70 corridors and the small communities. More recently, the growth of residential and commercial uses, utility corridors, oil and gas developments, and other rural industrial uses (e.g., gravel mining along the Colorado River) has accelerated the accumulation of impacts in the area. Cumulative impacts have included (1) direct habitat loss, habitat fragmentation, and decreased habitat effectiveness; (2) increased potential for runoff, erosion, and sedimentation; (3) expansion of noxious weeds and other invasive species; (4) increased fugitive dust from construction of oil and gas pads, roads, and pipelines and associated truck travel; (5) increased noise, especially along access and haul roads; (6) increased potential for spills and other releases of chemical pollutants; and (7) decreased scenic quality. Although none of the cumulative impacts was described in the 1999 FSEIS (BLM 1999a) as significant, and while new technologies and regulatory requirements have reduced the impacts of some land uses, various past, present, and reasonably foreseeable future actions have had and will continue to have adverse effects on various elements of the human environment. Anticipated impacts for existing and future actions range from negligible to locally major, and primarily negative, for specific resources.

The primary bases for this assessment are twofold: First, the rate of development, particularly oil and gas development, has generally been increasing in the area, resulting in an accelerated accumulation of individually nominal effects. Second, residential and commercial expansion, as well as most of the oil and gas development, has occurred on private lands where mitigation measures designed to protect and conserve resources may not be in effect to the same extent as on BLM lands. Recent COGCC regulations have closed considerably the gap between the potential environmental impacts associated with development of private versus Federal fluid mineral resources.

The Proposed Action would contribute to the collective adverse impact for some resources. Although the contribution would be minor, the Proposed Action would contribute incrementally to the collective impact to air quality, vegetation, migratory birds, terrestrial wildlife, and other resources.

PERSONS AND AGENCIES CONSULTED

Encana Oil & Gas (USA) Inc.: Jevin Croteau

INTERDISCIPLINARY REVIEW

BLM staff from the CRVFO who participated in the preparation of this EA are listed in Table 11.

Table 11. BLM Interdisciplinary Team Authors and Reviewers

Name	***Title***	***Areas of Participation***
John Brogan	Archaeologist	Cultural Resources, Native American Religious Concerns
Christine Cimiluca	Natural Resource Specialist	EA Project Lead, Access & Transportation, Socioeconomics, Wastes-Hazardous or Solid
Allen Crockett, Ph.D.	Supervisory Natural Resource Specialist	NEPA Review
Peter Cowan	Petroleum Engineer	Downhole COAs
Shauna Kocman	Hydrologist	Air Quality, Noise, Soils, Surface Water, Waters of the U.S.
Julie McGrew	Natural Resource Specialist	Visual Resources
Judy Perkins	Botanist/Ecologist	Invasive Non-native Species, Special-status Species (Plants), Vegetation
Sylvia Ringer	Wildlife Biologist	Migratory Birds, Special-status Species (Animals), Wildlife, Aquatic and Terrestrial
Todd Sieber	Geologist	Geology and Minerals, Groundwater, Paleontology

REFERENCES CITED

Air Resources Specialists. 2012. 7Garfield County Quarterly Monitoring Report, First Quarter, January 1 through March 31, 2012. Prepared for Garfield County Public Health Department Rifle, CO.

Bureau of Land Management (BLM). 1984. Glenwood Springs Resource Management Plan. Glenwood Springs Field Office, Colorado.

_____. 1986. BLM Manual Handbook 8410-1-Visual Resource Inventory.

_____. 1991. Record of Decision, Oil and Gas Plan Amendment. Glenwood Springs Field Office, Colorado.

_____. 1999a. Oil & Gas Leasing & Development – Final Supplemental Environmental Impact Statement. Glenwood Spring Field Office, Colorado.

_____. 1999b. Oil & Gas Leasing & Development – Record of Decision and Resource Management Plan Amendment. Glenwood Spring Field Office, Colorado.

_____. 2006. Final Roan Plateau Resource Management Plan Amendment & Environmental Impact Statement, Volume III, Appendix C. Glenwood Springs Field Office, Colorado.

_____. 2011. Air Resources Technical Support Document. Colorado River Valley Field Office, CO http://www.blm.gov/co/st/en/fo/crvfo.html

Cole, R.D., G.J. Daub, and L.K. Weston. 1995. Review of geology, mineral resources, and ground-water hydrology of Green River Formation, north-central Piceance Creek Basin, Colorado. *In* W.R. Averett (Ed.), The Green River Formation in Piceance Creek and Eastern Uinta Basins: Grand Junction, Colorado, Grand Junction Geological Society, p. 63-81.

Colorado Department of Labor and Employment. 2010. LMI Gateway 2009 quarterly census of employment and wages data for Garfield County. Available online.

Colorado Department of Public Health and Environment (CDPHE). 2007. Water Quality Control Commission (WQCC), Regulation No. 37 Classifications and numeric standards for Lower Colorado River basin and tables. Amended February 8, 2010; effective June 3, 2010. Available online.

_____. 2012. Water Quality Control Commission (WQCC), Regulation No. 93, Section 303(d) List of impaired waters and monitoring and evaluation list. Effective April 30, 2010. Available online.

Colorado Division of Local Affairs (DOLA). 2010. Population totals for Colorado Counties; 1 year increments, 2000 – 2040. Available online.

Colorado Geological Survey (CGS). 2003. Ground water atlas of Colorado, Special Publication 53, pgs. 97-106.

Colorado Oil and Gas Commission (COGCC). 2008. Amended Rules. 800 Series Aesthetic and Noise Control Regulations Regulation 801. http://cogcc.state.co.us/

_____. 2010. Colorado Oil and Gas Information System (COGIS) Production. http://cogcc.state.co.us/.

_____. 2011. Colorado Hydraulic Fracturing State Review. Prepared by State Review of Natural Gas Environmental Regulations (STRONGER), Inc. Oklahoma City, OK. October.

Davies, R. J., S. Mathias, J. Moss, S. Hustoft, and L Newport. 2012. Hydraulic fractures: How far can they go? Marine and Petroleum Geology 37(1):1-6. November.

EnerMax, Inc. 2007. Hydraulic fracturing. http://www.enermaxinc.com/hydraulic-fracturing.

Fenneman, N. M. 1946. Physical subdivisions of the United States (Map): U.S. Geological Survey, 1:700,000, 1 sheet.

Franczyk, K.J., J.K. Pitman, and D.J. Nichols. 1990. Sedimentology, mineralogy, and depositional history of some Uppermost Cretaceous Lowermost Tertiary rocks along the Utah Book and Roan Cliffs east of the Green River: U.S. Geological Survey Bulletin 1787:27 pp.

Garfield County. 2000. Garfield County Demographic Summary prepared by U.S. Census Bureau from 2000 Decennial Census Data. Available online.

_____. 2007. Socioeconomic Impact Study. Available online.

_____. 2009. Abstract of Assessment and Tax Levies. Available online.

George, R.D. 1927. Geology and natural resources of Colorado. University of Colorado, Boulder, CO.

Graham, G. 2001. Colorado Division of Water Resources. Personal communication.

Green, C.A. 2006. Hydraulic-fracture-model sensitivity analysis of a massively stacked, lenticular, tight gas reservoir. Master's Thesis (Geophysics), Colorado School of Mines, Golden.

Green, C.A., R.D. Barree, and J.L. Miskimins. 2009. Hydraulic-fracture-model sensitivity analysis of a massively stacked, lenticular, tight gas reservoir. SPE Production & Operations Journal 24(1):66-73. SPE 106270-PA. February.

Harris, C.M. 1991. Handbook of acoustical measurements and noise control, McGraw-Hill, Inc., New York.

Hemborg, T.H. 2000. Gas production characteristics of the Rulison, Grand Valley, Mamm Creek, and Parachute Fields, Garfield County, Colorado: Turning marginally economic basin-centered tight-gas sands into profitable reservoirs in the Southern Piceance Basin. Colorado Geological Survey, Resource Series 39. Denver.

Holditch, S.A. 2006. Tight gas sands. Society of Petroleum Engineers Paper 103356, Journal of Petroleum Technology.

Johnson, R.C., 1985, Early Cenozoic history of the Uinta and Piceance Creek Basins, Utah and Colorado, with special reference to the development of Eocene Lake Uinta United States: Rocky Mountain Section, Society of Economic Paleontology and Mineralogy: Denver, Colo., p. 247–276.

_____. 1989. Geologic history and hydrocarbon potential of late Cretaceous-age, low-permeability reservoirs, Piceance Basin, western Colorado: U.S. Geological Survey Bulletin 1787, Evolution of sedimentary basins-Uinta and Piceance Basins, chapter E, 51 p.

Kuuskraa, V.A. 1997. Producing massively stacked lenticular sands of Colorado's Piceance Basin: Gas Tips – A Publication of Gas Research Institute GRI-97/0206:4-11.

La Plata County, Colorado. 2002. Final La Plata County Impact Report. October.

Lorenz, J.C. 1989. Reservoir sedimentology of rocks of the Mesaverde Group, multiwall experiment site and east-central Piceance Basin, northwest Colorado. *In* B.E. Law and C.W. Spencer, C.W. (*Eds*.), Geology of tight gas reservoirs in the Pinedale Anticline area, Wyoming, and at the multiwall experiment site, Colorado: U.S. Geological Survey Bulletin 1886:K1-K24.

Maxwell, S.C. 2011. Hydraulic fracture height growth. Canadian Society of Exploration Geophysicists (CSEG) Recorder. November.

Murphy, P.C., and D. Daitch, 2007. Paleontological overview of oil shale and tar sands areas in Colorado, Utah, and Wyoming, p. 58.

National Academy of Sciences (NAS). 2007. Weather and climate extremes in a changing climate. National Academies Press. http://dels.nas.edu/globalchange/reportDetail.php?id=4288&c=clim&t=pubs.

_____. 2012. Induced seismicity potential in energy technologies. National Academy Press, Washington, DC.

Palisch, T.T. M.A. Chapman, and J. Godwin. 2012. Hydraulic fracture design optimization in Unconventional Reservoirs: A Case History. Paper SPE 160206 presented at the Annual Technical Conference and Exhibition, San Antonio, TX. October 8-10.

Robson, S.G., and G.J. Saulnier, Jr. 1981. Hydrogeochemistry and simulated solute transport, Piceance Basin, northwestern Colorado. U.S. Geological Survey Professional Paper 1196, 65 p.

Ruggiero, L.F., K.B. Aubrey, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.M. Squires (*Eds*). 1999. The scientific basic for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT.

Spencer, C.W., and Wilson, R.J., 1988. Petroleum geology and principal exploration plays in the Uinta-Piceance-Eagle Basins Province, Utah and Colorado: U.S. Geological Survey Open-File Report 88-450-G, 35 p.

U.S. Department of Agriculture (USDA). 1985. Soil survey of Rifle area, Colorado: parts of Garfield and Mesa Counties. Soil Conservation Service [Natural Resources Conservation Service].

U.S. Department of Commerce (USDOC). 2011. State and county selection of 2010 Census data. Available online (http://2010.census.gov/2010census/data/index.php)

U.S. Department of Energy (DOE). 2009. Modern shale gas development in the United States: A primer. National Energy Technology Laboratory, Morgantown, WV, and Office of Fossil Energy, Washington, DC. April.

U.S. Department of the Interior and U.S. Department of Agriculture (USDI and USDA). 2007. Surface operating standards and guidelines for oil and gas exploration and development. The Gold Book. Fourth edition.

U.S. Environmental Protection Agency (EPA). 1974. Information on noise levels identified as requisite to protect public health and welfare with an adequate margin of safety. EPA-550/9-74-004, Arlington, VA.

_____. 2004. Environmental Protection Agency. Evaluation of impacts to underground sources of drinking water by hydraulic fracturing of coalbed methane reservoirs. EPA 816-R-04-003, Attachment 3, The Piceance Basin, June 2004.

_____. 2006. Drinking water standards and health advisories, EPA 822-R-06-013, August 2006. Available online.

U.S. Geological Survey (USGS). 2007. Water resources of the United States, NWISWeb. Water quality samples for the nation, Colorado River near DeBeque. Available online.

_____. 2010. Stratigraphic cross sections of the Eocene Green River Formation in the Piceance Basin, Northwestern Colorado. Chapter 5 of 7. Available online. DDS-69-Y.

U.S. Fish and Wildlife Service (USFWS). 2008. Birds of conservation concern. Division of Migratory Bird Management, Arlington, Virginia. 93 pp. Available online.

Vargas, M.F., and T.L. Davis. 2006. Characterization and 3-D reservoir modeling of fluvial tight-gas sandstones in the Williams Fork Formation, Rulison Field, Piceance Basin, Colorado, USA. American Association of Petroleum Geologists, Annual Convention, (SEPM) Technical Program Abstracts.

Warpinski, N.R. 2011. Fracture growth in layered and discontinuous media. Proceedings of the Technical Workshops for the Hydraulic Fracturing Study: Fate and Transport. U.S. Environmental Protection Agency, Washington, DC. May.

Warpinski, N.R., J. Du, and U. Zimmer. 2012. Measurements of hydraulic-fracture induced seismicity in gas shales. Paper SPE 151597 presented at the SPE Hydraulic Fracture Technology Conference, The Woodlands, TX. February 6-8.

Weiner, R.J., and J.D. Haun. 1960. Guide to the geology of Colorado. Geological Society of America.

Yeend, W.E., Donnell, J.R., Smith, M.C. Geologic map of the Rulison Quadrangle, Garfield County, CO. 1:24,000 scale. MF-2060.

Zhai, Z. and M.M. Sharma. 2005. A new approach to modeling hydraulic fractures in unconsolidated sands. Paper SPE 96246 presented at the SPE Annual Technical Conference and Exhibition, Dallas, TX. October 9-12.

Left blank for two-sided copying.

APPENDIX A

Surface-Use and Downhole Conditions of Approval

Left blank for two-sided copying.

Surface-Use Conditions of Approval
DOI-BLM-CO-N040-2012-0076-EA

The following standard surface use COAs are in addition to all stipulations attached to the respective Federal leases and to any site-specific COAs for individual well pads. Wording and numbering of these COAs may differ from those included in the South Parachute GAP (EA #CO140-2006-0050-EA). In cases of discrepancies, the following COAs supersede earlier versions.

1. Administrative Notification. The operator shall notify the BLM representative at least 48 hours prior to initiation of construction. If requested by the BLM representative, the operator shall schedule a pre-construction meeting, including key operator and contractor personnel, to ensure that any unresolved issues are fully addressed prior to initiation of surface-disturbing activities or placement of production facilities.

2. Road Construction and Maintenance. Roads shall be crowned, ditched, surfaced, drained with culverts and/or water dips, and constructed to BLM Gold Book standards. Initial gravel application shall be a minimum of 6 inches. The operator shall provide timely year-round road maintenance and cleanup on the access roads. A regular schedule for maintenance shall include, but not be limited to, blading, ditch and culvert cleaning, road surface replacement, and dust abatement. When rutting within the traveled way becomes greater than 6 inches, blading and/or gravelling shall be conducted as approved by the BLM.

3. Dust Abatement. The operator shall implement dust abatement measures as needed to prevent fugitive dust from vehicular traffic, equipment operations, or wind events. The BLM may direct the operator to change the level and type of treatment (watering or application of various dust agents, surfactants, and road surfacing material) if dust abatement measures are observed to be insufficient to prevent fugitive dust.

4. Drainage Crossings and Culverts. Construction activities at perennial, intermittent, and ephemeral drainage crossings (e.g. burying pipelines, installing culverts) shall be timed to avoid high flow conditions. Construction that disturbs any flowing stream shall utilize either a piped stream diversion or a cofferdam and pump to divert flow around the disturbed area.

   Culverts at drainage crossings shall be designed and installed to pass a 25-year or greater storm event. On perennial and intermittent streams, culverts shall be designed to allow for passage of aquatic biota. The minimum culvert diameter in any installation for a drainage crossing or road drainage shall be 24 inches. Crossings of drainages deemed to be jurisdictional waters of the U.S. pursuant to Section 404 of the Clean Water Act may require additional culvert design capacity. Due to the flashy nature of area drainages and anticipated culvert maintenance, the U.S. Army Corps of Engineers (USACE) recommends designing drainage crossings for the 100-year event. Contact the USACE Colorado West Regulatory Branch at 970-243-1199 ext. 17.

   Pipelines installed beneath stream crossings shall be buried at a minimum depth of 4 feet below the channel substrate to avoid exposure by channel scour and degradation. Following burial, the channel grade and substrate composition shall be returned to pre-construction conditions.

5. Jurisdictional Waters of the U.S. The operator shall obtain appropriate permits from the U.S. Army Corps of Engineers (USACE) prior to discharging fill material into waters of the U.S. in accordance with Section 404 of the Clean Water Act. Waters of the U.S. are defined in 33 CFR Section 328.3

and may include wetlands as well as perennial, intermittent, and ephemeral streams. Permanent impacts to waters of the U.S. may require mitigation. Contact the USACE Colorado West Regulatory Branch at 970-243-1199 ext. 17. Copies of any printed or emailed approved USACE permits or verification letters shall be forwarded to the BLM.

6. Wetlands and Riparian Zones. The operator shall restore temporarily disturbed wetlands or riparian areas. The operator shall consult with the BLM Colorado River Valley Field Office to determine appropriate mitigation, including verification of native plant species to be used in restoration.

7. Reclamation. The goals, objectives, timelines, measures, and monitoring methods for final reclamation of oil and gas disturbances are described in Appendix I (Surface Reclamation) of the 1998 Draft Supplemental EIS (DSEIS). Specific measures to follow during interim reclamation are described below.

   a. Reclamation Plans. In areas that have low reclamation potential or are especially challenging to restore, reclamation plans will be required prior to APD approval. The plan shall contain the following components: detailed reclamation plats, which include contours and indicate irregular rather than smooth contours as appropriate for visual and ecological benefit; timeline for drilling completion, interim reclamation earthwork, and seeding; soil test results and/or a soil profile description; amendments to be used; soil treatment techniques such as roughening, pocking, and terracing; erosion control techniques such as hydromulch, blankets/matting, and wattles; and visual mitigations if in a sensitive VRM area.

   b. Deadline for Interim Reclamation Earthwork and Seeding. Interim reclamation to reduce a well pad to the maximum size needed for production, including earthwork and seeding of the interim reclaimed areas, shall be completed within 6 months following completion of the last well planned to be drilled on that pad as part of a continuous operation. If a period of greater than one year is expected to occur between drilling episodes, BLM may require implementation of all or part of the interim reclamation program.

      Reclamation, including seeding, of temporarily disturbed areas along roads and pipelines, and of topsoil piles and berms, shall be completed within 30 days following completion of construction. Any such area on which construction is completed prior to December 1 shall be seeded during the remainder of the early winter season instead of during the following spring, unless BLM approves otherwise based on weather. If road or pipeline construction occurs discontinuously (e.g., new segments installed as new pads are built) or continuously but with a total duration greater than 30 days, reclamation, including seeding, shall be phased such that no portion of the temporarily disturbed area remains in an unreclaimed condition for longer than 30 days. BLM may authorize deviation from this requirement based on the season and the amount of work remaining on the entirety of the road or pipeline when the 30-day period has expired.

      If requested by the project lead NRS for a specific pad or group of pads, the operator shall contact the NRS by telephone or email approximately 72 hours before reclamation and reseeding begin. This will allow the NRS to schedule a pre-reclamation field visit if needed to ensure that all parties are in agreement and provide time for adjustments to the plan before work is initiated.

      The deadlines for seeding described above are subject to extension upon approval of the BLM based on season, timing limitations, or other constraints on a case-by-case basis. If the BLM approves an extension for seeding, the operator may be required to stabilize the reclaimed surfaces using hydromulch, erosion matting, or other method until seeding is implemented.

c. Topsoil Stripping, Storage, and Replacement. *All* topsoil shall be stripped following removal of vegetation during construction of well pads, pipelines, roads, or other surface facilities. In areas of thin soil, a minimum of the upper 6 inches of surficial material shall be stripped. The BLM may specify a stripping depth during the onsite visit or based on subsequent information regarding soil thickness and suitability. The stripped topsoil shall be stored separately from subsoil or other excavated material and replaced prior to final seedbed preparation. The BLM best management practice (BMP) for the Windrowing of Topsoil (COA number 19) shall be implemented for well pad construction whenever topography allows.

d. Seedbed Preparation. For cut-and-fill slopes, initial seedbed preparation shall consist of backfilling and recontouring to achieve the configuration specified in the reclamation plan. For compacted areas, initial seedbed preparation shall include ripping to a minimum depth of 18 inches, with a maximum furrow spacing of 2 feet. Where practicable, ripping shall be conducted in two passes at perpendicular directions. Following final contouring, the backfilled or ripped surfaces shall be covered evenly with topsoil.

   Final seedbed preparation shall consist of scarifying (raking or harrowing) the spread topsoil prior to seeding. If more than one season has elapsed between final seedbed preparation and seeding, and if the area is to be broadcast-seeded or hydroseeded, this step shall be repeated no more than 1 day prior to seeding to break up any crust that has formed.

   If directed by the BLM, the operator shall implement measures following seedbed preparation (when broadcast-seeding or hydroseeding is to be used) to create small depressions to enhance capture of moisture and establishment of seeded species. Depressions shall be no deeper than 1 to 2 inches and shall not result in piles or mounds of displaced soil. Excavated depressions shall not be used unless approved by the BLM for the purpose of erosion control on slopes. Where excavated depressions are approved by the BLM, the excavated soil shall be placed only on the downslope side of the depression.

   If directed by the BLM, the operator shall conduct soil testing prior to reseeding to identify if and what type of soil amendments may be required to enhance revegetation success. At a minimum, the soil tests shall include texture, pH, organic matter, sodium adsorption ratio (SAR), cation exchange capacity (CEC), alkalinity/salinity, and basic nutrients (nitrogen, phosphorus, potassium [NPK]). Depending on the outcome of the soil testing, the BLM may require the operator to submit a plan for soil amendment. Any requests to use soil amendments not directed by the BLM shall be submitted to the CRVFO for approval.

e. Seed Mixes. A seed mix consistent with BLM standards in terms of species and seeding rate for the specific habitat type shall be used on all BLM lands affected by the project (see Attachments 1 and 2 of the letter provided to operators dated May 1, 2008).

   For private surfaces, the menu-based seed mixes are recommended, but the surface landowner has ultimate authority over the seed mix to be used in reclamation. The seed shall contain no noxious, prohibited, or restricted weed seeds and shall contain no more than 0.5 percent by weight of other weed seeds. Seed may contain up to 2.0 percent of "other crop" seed by weight, including the seed of other agronomic crops and native plants; however, a lower percentage of other crop seed is recommended. Seed tags or other official documentation shall be submitted to BLM at least 14 days before the date of proposed seeding for acceptance. Seed that does not meet the above criteria shall not be applied to public lands.

f. Seeding Procedures. Seeding shall be conducted no more than 24 hours following completion of final seedbed preparation.

Where practicable, seed shall be installed by drill-seeding to a depth of 0.25 to 0.5 inch. Where drill-seeding is impracticable, seed may be installed by broadcast-seeding at twice the drill-seeding rate, followed by raking or harrowing to provide 0.25 to 0.5 inch of soil cover or by hydroseeding and hydromulching. Hydroseeding and hydromulching shall be conducted in two separate applications to ensure adequate contact of seeds with the soil.

If interim revegetation is unsuccessful, the operator shall implement subsequent reseedings until interim reclamation standards are met.

g. Mulch. Mulch shall be applied within 24 hours following completion of seeding. Mulch may consist of either hydromulch or of certified weed-free straw or certified weed-free native grass hay crimped into the soil.

NOTE: Mulch is not required in areas where erosion potential mandates use of a biodegradable erosion-control blanket (straw matting).

h. Erosion Control. Cut-and-fill slopes shall be protected against erosion with the use of water bars, lateral furrows, or other measures approved by the BLM. Cut-and-fill slopes along drainages or in areas with high erosion potential shall also be protected from erosion using hydromulch designed specifically for erosion control or biodegradable blankets/matting, bales, or wattles of weed-free straw or weed-free native grass hay. A well-anchored fabric silt fence shall also be placed at the toe of cut-and-fill slopes along drainages or to protect other sensitive areas from deposition of soils eroded off the slopes. Additional BMPs shall be employed as necessary to reduce soil erosion and offsite transport of sediments.

i. Site Protection. The pad shall be fenced to BLM standards to exclude livestock grazing for the first two growing seasons or until seeded species are firmly established, whichever comes later. The seeded species will be considered firmly established when at least 50 percent of the new plants are producing seed. The BLM will approve the type of fencing.

j. Monitoring. The operator shall conduct annual monitoring surveys of all sites categorized as "operator reclamation in progress" and shall submit an annual monitoring report of these sites to the BLM by **December 31** of each year. The monitoring program shall use the four Reclamation Categories defined in Appendix I of the 1998 DSEIS to assess progress toward reclamation objectives. The annual report shall document whether attainment of reclamation objectives appears likely. If one or more objectives appear unlikely to be achieved, the report shall identify appropriate corrective actions. Upon review and approval of the report by the BLM, the operator shall be responsible for implementing the corrective actions or other measures specified by the BLM.

8. Weed Control. The operator shall regularly monitor and promptly control noxious weeds or other undesirable plant species as set forth in the Glenwood Springs Field Office *Noxious and Invasive Weed Management Plan for Oil and Gas Operators*, dated March 2007. A Pesticide Use Proposal (PUP) must be approved by the BLM prior to the use of herbicides. Annual weed monitoring reports shall be submitted to BLM by **December 1**.

9. Big Game Winter Range Timing Limitation. To minimize impacts to wintering big game, no construction, drilling or completion activities shall occur during a Timing Limitation (TL) period from **January 1 to March 1 annually**.

10. Bald and Golden Eagles. It shall be the responsibility of the operator to comply with the Bald and Golden Eagle Protection Act (Eagle Act) with respect to "take" of either eagle species. Under the Eagle Act, "take" includes to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest and disturb. "Disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. Avoidance of eagle nest sites, particularly during the nesting season, is the primary and preferred method to avoid a take. Any oil or gas construction, drilling, or completion activities planned within 0.5 mile of a bald or golden eagle nest, or other associated activities greater than 0.5 miles from a nest that may disturb eagles, should be coordinated with the BLM project lead and BLM wildlife biologist and the USFWS representative to the BLM Field Office (970-876-9051).

11. Raptor Nesting. To protect nesting raptors, a survey shall be conducted prior to any construction, drilling, or completion activities that are to begin during the raptor nesting season (February 1 to August 15). The survey shall include all potential nesting habitat within 0.25 mile of a well pad or 0.125 mile of an access road, pipeline, or other surface facility. Results of the survey shall be submitted to the BLM. If a raptor nest is located within the buffer widths specified above, a 60-day raptor nesting TL will be applied by the BLM to preclude initiation of construction, drilling, and completion activities during the period of **March 15 to May 15.** The operator is responsible for complying with the MBTA, which prohibits the "take" of birds or of active nests (those containing eggs or young), including nest failure caused by human activity (see COA for Migratory Birds).

12. Birds of Conservation Concern. Pursuant to BLM Instruction Memorandum 2008-050, all vegetation removal or surface disturbance in previously undisturbed lands providing potential nesting habitat for Birds of Conservation Concern (BCC) is prohibited from **May 1 to July** 1. An exception to this TL may be granted if nesting surveys conducted no more than one week prior to surface-disturbing activities indicate that no BCC species are nesting within 30 meters (100 feet) of the area to be disturbed. Nesting shall be deemed to be occurring if a territorial (singing) male is present within the distance specified above. Nesting surveys shall include an audial survey for diagnostic vocalizations in conjunction with a visual survey for adults and nests. Surveys shall be conducted by a qualified breeding bird surveyor between sunrise and 10:00 AM under favorable conditions for detecting and identifying a BCC species. This provision does not apply to ongoing construction, drilling, or completion activities that are initiated prior to May 1 and continue into the 60-day period at the same location.

13. Migratory Birds (General). It shall be the responsibility of the operator to comply with the Migratory Bird Treaty Act (MBTA) with respect to "take" of migratory bird species, which includes injury and direct mortality resulting from human actions not intended to have such result. To minimize the potential for the take of a migratory bird, the operator shall take reasonable steps to prevent use by birds of fluid-containing pits associated with oil or gas operations, including but not limited to reserve pits, produced-water pits, hydraulic fracturing flowback pits, evaporation pits, and cuttings trenches. Liquids in these pits—whether placed or accumulating from precipitation—may pose a risk to birds as a result of ingestion, absorption through the skin, or interference with buoyancy and temperature regulation.

Based on low effectiveness of brightly colored flagging or spheres suspended over a pit, the operator shall install netting with a mesh size of 1 to 1.5 inches, and suspended at least 4 feet above the fluid surface, on all pits into which fluids are placed, except for storage of fresh water in a pit that contains no other material. The netting shall be installed within 24 hours of placement of fluids into a pit. The requirement for netting does not apply to pits during periods of continuous, intensive human activity at the pad, such as drilling and hydraulic fracturing phases or, as pertains to cuttings trenches, during periods of active manipulation for cuttings management, remediation of contaminated materials, or other purposes.

In addition to netting of pits, oil slicks and oil sheens shall be promptly skimmed off the fluid surface. The requirement for prompt skimming of oil slicks and oil sheens also applies to cuttings trenches in which precipitation has accumulated. All mortality or injury to birds shall be reported immediately to the BLM project lead and to the USFWS representative to the BLM Field Office at 970-243-2778 x28 and visit http://www.fws.gov/mountain-prairie/contaminants/oilpits.htm.

14. Range Management. Range improvements (fences, gates, reservoirs, pipelines, etc.) shall be avoided during development of natural gas resources to the maximum extent possible. If range improvements are damaged during exploration and development, the operator will be responsible for repairing or replacing the damaged range improvements. If a new or improved access road bisects an existing livestock fence, steel frame gate(s) or a cattleguard with associated bypass gate shall be installed across the roadway to control grazing livestock.

15. *Ips* Beetle. To avoid mortality of pinyon pines due to infestations of the *Ips* beetle, any pinyon trees damaged during road, pad, or pipeline construction shall be chipped after being severed from the stump or grubbed from the ground, buried in the toe of fill slopes (if feasible), or cut and removed from the site within 24 hours to a location approved by the Colorado State Forest Service.

16. Paleontological Resources. All persons associated with operations under this authorization shall be informed that any objects or sites of paleontological or scientific value, such as vertebrate or scientifically important invertebrate fossils, shall not be damaged, destroyed, removed, moved, or disturbed. If in connection with operations under this authorization any of the above resources are encountered the operator shall immediately suspend all activities in the immediate vicinity of the discovery that might further disturb such materials and notify the BLM of the findings. The discovery must be protected until notified to proceed by the BLM.

17. Cultural Education/Discovery. All persons in the area who are associated with this project shall be informed that if anyone is found disturbing historic, archaeological, or scientific resources, including collecting artifacts, the person or persons will be subject to prosecution.
Pursuant to 43 CFR 10.4(g), the BLM shall be notified by telephone, with written confirmation, immediately upon the discovery of human remains, funerary items, sacred objects, or objects of cultural patrimony. Further, pursuant to 43 CFR 10.4 (c) and (d), activities shall stop in the vicinity of the discovery, and the discovery shall be protected for 30 days or until notified by the BLM to proceed.

    If in connection with operations under this contract, the operator, its contractors, their subcontractors, or the employees of any of them discovers, encounters, or becomes aware of any objects or sites of cultural value or scientific interest such as historic ruins or prehistoric ruins, graves or grave markers, fossils, or artifacts, the operator shall immediately suspend all operations in the vicinity of the cultural resource and shall notify the BLM of the findings (16 USC 470h-3, 36 CFR 800.112). Operations may resume at the discovery site upon receipt of written instructions and authorization by the BLM.

Approval to proceed will be based upon evaluation of the resource. Evaluation shall be by a qualified professional selected by the BLM from a Federal agency insofar as practicable. When not practicable, the operator shall bear the cost of the services of a non-Federal professional.

Within five working days, the BLM will inform the operator as to:

- whether the materials appear eligible for the National Register of Historic Places
- what mitigation measures the holder will likely have to undertake before the site can be used (assuming that *in-situ* preservation is not necessary)
- the timeframe for the BLM to complete an expedited review under 36 CFR 800.11, or any agreements in lieu thereof, to confirm through the SHPO State Historic Preservation Officer that the findings of the BLM are correct and that mitigation is appropriate

The operator may relocate activities to avoid the expense of mitigation and delays associated with this process, as long as the new area has been appropriately cleared of resources and the exposed materials are recorded and stabilized. Otherwise, the operator shall be responsible for mitigation costs. The BLM will provide technical and procedural guidelines for relocation and/or to conduct mitigation. Upon verification from the BLM that the required mitigation has been completed, the operator will be allowed to resume construction.

Antiquities, historic ruins, prehistoric ruins, and other cultural or paleontological objects of scientific interest that are outside the authorization boundaries but potentially affected, either directly or indirectly, by the Proposed Action shall also be included in this evaluation or mitigation. Impacts that occur to such resources as a result of the authorized activities shall be mitigated at the operator's cost, including the cost of consultation with Native American groups.

Any person who, without a permit, injures, destroys, excavates, appropriates or removes any historic or prehistoric ruin, artifact, object of antiquity, Native American remains, Native American cultural item, or archaeological resources on public lands is subject to arrest and penalty of law (16 USC 433, 16 USC 470, 18 USC 641, 18 USC 1170, and 18 USC 1361).

18. Visual Resources. Production facilities shall be placed to avoid or minimize visibility from travel corridors, residential areas, and other sensitive observation points—unless directed otherwise by the BLM due to other resource concerns—and shall be placed to maximize reshaping of cut-and-fill slopes and interim reclamation of the pad.

Above-ground facilities shall be painted with BLM Standard Environmental Color **Shadow Gray** to minimize contrast with adjacent vegetation or rock outcrops.

All woody vegetation (live and dead) shall remain standing at the toe of the fill slopes and at the top of the cut slopes of the well pad, access road, and pipeline to provide visual screening. All woody vegetation left standing at the toe and at the top of the cut slopes shall be protected and remain standing and undamaged when fill material is pulled back to recontour the well pad, access road, and pipeline. Rocks and woody debris saved during the construction process shall be re-placed onto the cut and fill slopes of the well pad, access road, and pipeline to emulate the color and texture closer to that of the native landscape and to encourage vegetation growth. Rocks (white side down) and woody debris saved during construction shall be re-placed on the pipeline to deter off-road travel, which will prevent additional surface disturbance, expansion of the corridor and visual impacts.

All cut and fill slopes shall have undulating contours which emulate the slopes seen in the adjacent landscape. Constructed slopes should meet existing grades with a similar slope to eliminate the line created at the edge where two different grades meet.

19. Windrowing of Topsoil. Topsoil shall be windrowed around the pad perimeter to create a berm that limits and redirects stormwater runoff and extends the viability of the topsoil per BLM Topsoil Best Management Practices (BLM 2009 PowerPoint presentation available upon request from Glenwood Springs Field Office). Topsoil shall also be windrowed, segregated, and stored along pipelines and roads for later spreading across the disturbed corridor during final reclamation. Topsoil berms shall be promptly seeded to maintain soil microbial activity, reduce erosion, and minimize weed establishment.

20. Reserve Pit. A minimum of 2 feet of freeboard shall be maintained in the reserve pit. Freeboard is measured from the highest level of drilling fluids and cuttings in the reserve pit to the lowest surface elevation of ground at the reserve pit perimeter.

21. Soils. Cuts and fills shall be minimized when working on erosive soils and slopes in excess of 30 percent. Cut-and-fill slopes shall be stabilized through revegetation practices with an approved seed mix shortly following construction activities to minimize the potential for slope failures and excessive erosion. Fill slopes adjacent to drainages shall be protected with well-anchored silt fences, straw wattles, or other acceptable BMPs designed to minimize the potential for sediment transport. On slopes greater than 50 percent, BLM personnel may request a professional geotechnical analysis prior to construction.

SITE-SPECIFIC COAS APPLICABLE TO PH21 WELL PAD

The following site-specific surface use COAs are in addition to the standard COAs applicable to all wells within the PH21 well pad and all stipulations attached to the respective Federal leases.

1. Requirement for Geotechnical Consultant Oversight. Prior to commencing any surface disturbing activities, a qualified geotechnical engineer licensed in the State of Colorado shall prepare a site evaluation and analysis in at risk areas showing evidence of slope instability (e.g., past mass movement or slumping soils, high soil moisture content present in undisturbed soils, presence of springs or seeps), for cut and fill slopes in excess of 30 feet in height, and cut of fill slope angles steeper than the requirements in the BLM Gold Book 2007 (3:1 in erosive soil, 1:1 common soils, 0.5:1 conglomerate, 0.25:1 solid rock) as determined by the BLM.

   During the construction of the pad/and or road sections in areas at risk of slope instability or environmentally sensitive areas a qualified independent construction inspector or civil/geotechnical engineer shall be onsite during all phases of construction in the at risk areas and as determined by the BLM. The inspector/ engineer shall confirm the pad and/or road sections are built to specification in the design package including, but not limited to cut and full slope staking, disturbance limits staking, excavation and embankment placement, slope compaction, slope retention devices, slope benching, at grade and subgrade drainages stormwater control measures etc. Inspection reports prepared by the construction inspector or onsite engineer will be submitted to the BLM Authorized Officer.

DOWNHOLE CONDITIONS OF APPROVAL
Applications for Permit to Drill

Company/Operator: Encana Oil & Gas

Well Pad Surface Location: NE¼NW¼, Section 28, T7S R95W

See list of wells following the COAs.

1. Twenty-four hours *prior* to (a) spudding, (b) conducting BOPE tests, (c) cementing/running casing strings, and (d) within 24 hours *after* spudding, the CRVFO shall be notified. One of the following CRVFO inspectors shall be notified by phone. The contact number for all notifications is: 970-876-9064. The BLM CRVFO inspectors are Julie King, Lead PET; David Giboo, PET; Greg Rios, PET; Alan White, PET; and Tim Barrett, PET.

2. A CRVFO petroleum engineer shall be contacted for a verbal approval prior to commencing remedial work, plugging operations on newly drilled boreholes, changes within the drilling plan, sidetracks, changes or variances to the BOPE, deviating from COAs, and conducting other operations not specified within the APD. Contact, Bob Hartman at 970-244 3041 (office) or 970-210-2374 (cell) for verbal approvals.

3. If a well control issue or failed test (e.g. kick, blowout, water flow, casing failure, or a bradenhead pressure increase) arises during drilling or completions operations, Bob Hartman at 970-244 3041 (office) or 970-210-2374 (cell) shall be notified within 24 hours from the time of the event. IADC/Driller's Logs and Pason Logs (mud logs) shall be forwarded to CRVFO – Petroleum Engineer, 2300 River Frontage Road, Silt, CO 81652 within 24 hours of a well control event.

4. The BOPE shall be tested and conform to Onshore Order No. 2 for a **5M** system and recorded in the IADC/Driller's log. A casing head rated to 5,000 psi or greater shall be utilized.

5. An electrical/mechanical mud monitoring equipment shall be function tested prior to drilling out the surface casing shoe. As a minimum, this equipment shall include a trip tank, pit volume totalizer, stroke counter, and flow sensor.

6. Prior to drilling out the surface casing shoe, gas-detecting equipment shall be installed in the mud return system. The mud system shall be monitored for hydrocarbon gas/pore pressure changes, rate of penetration, and fluid loss.

7. A gas buster shall be functional and all flare lines effectively anchored in place, prior to drilling out the surface casing shoe. The discharge of the flare lines shall be a minimum of 100 feet from the wellhead and targeted at bends. The panic line shall be a separate line (not open inside the buffer tank) and effectively anchored. All lines shall be downwind of the prevailing wind direction and directed into a flare pit, which cannot be the reserve pit. The flare system shall use an automatic ignition. Where noncombustible gas is likely or expected to be vented, the system shall be provided supplemental fuel for ignition and maintain a continuous flare.

8. As a minimum, cement shall be brought to 200 feet above the Mesaverde. After WOC for the production casing, a CBL shall be run to verify the TOC and an <u>electronic copy in .las and .pdf format shall be submitted to CRVFO – Petroleum Engineer, 2300 River Frontage Road, Silt, CO 81652 within 48 hours.</u> If the TOC is lower than required or the cement sheath of poor quality, a CRVFO petroleum engineer shall be notified for remedial operations within 48 hours from running the CBL and prior to commencing fracturing operations,

A greater volume of cement may be required to meet the 200-foot cement coverage requirement for the Williams Fork Formation /Mesaverde Group. Evaluate the top of cement on the first cement job on the pad (Temperature Log). If cement is below 200-foot cement coverage requirement, adjust cement volume to compensate for low TOC/cement coverage.

9. On the first well drilled on this pad, a triple combo open-hole log shall be run from the base of the surface borehole to surface and from TD to bottom of surface casing shoe. This log shall be in submitted within 48 hours in .las and .pdf format to: CRVFO – Todd Sieber, 2300 River Frontage Road, Silt, CO 81652. Contact Todd Sieber at 970-876-9000 or asieber@blm.gov for clarification.

10. Submit the (a) mud/drilling log (e.g. Pason disc), (b) driller's event log/operations summary report, (c) production test volumes, (d) directional survey, and (e) Pressure Integrity Test results within 30 days of completed operations (i.e. landing tubing) per 43 CRF 3160-9 (a).

11. During hydraulic frac operations, monitor the bradenhead/casing head pressures throughout the frac job. Frac operations shall be terminated upon any sharp rise in annular pressure (+/- 40 psi or greater) in order to determine well/wellbore integrity. Notify BLM Bob Hartman at 970-244 3041 (office) or 970-210-2374 (cell) immediately.

12. Per 43 CFR 3162.4-1(c), not later than the 5th business day after any well begins production on which royalty is due anywhere on a lease site or allocated to a lease site, or resumes production in a case of a well which has been off production for more than 90 days, the operator shall notify the authorized officer by letter or sundry notice, Form 3160-5, or orally to be followed by a letter or sundry notice, of the date on which such production has begun or resumed.

Table A-1. Surface and Bottomhole Locations of Proposed Federal Wells

Proposed Wells	***Federal Lease***	***Surface Location***	***Bottomhole Location***
Federal 22-14 (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	SE SW, Section 22, T7S, R95W
Federal 22-12D (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NW SW, Section 22, T7S, R95W
Federal 22-12A (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NW SW, Section 22, T7S, R95W
Federal 22-11B (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NE SW, Section 22, T7S, R95W
Federal 21-9A (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NE SE, Section 21, T7S, R95W
Federal 21-8C (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	SE NE, Section 21, T7S, R95W
Federal 21-8 (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	SE NE, Section 21, T7S, R95W
Federal 21-2B (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NW NE, Section 21, T7S, R95W
Federal 21-1C (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NE NE, Section 21, T7S, R95W
Federal 21-1 (PH-21)	COC01523 (BH)	SE NE, Section 21, T7S, R95W	NE NE, Section 21, T7S, R95W

FONSI

DOI-BLM-CO-N040-2012-0076-EA

The Environmental Assessment (EA) analyzing the environmental effects of the Proposed Action has been reviewed. The project design and approved mitigation measures result in a Finding of No Significant Impact (FONSI) on the human environment. Therefore, an Environmental Impact Statement (EIS) is not necessary to further analyze the environmental effects of the Proposed Action.

DECISION RECORD

DECISION: It is my decision to approve the Proposed Action as described and analyzed in this EA. This decision will provide for the orderly, economical, and environmentally sound exploration and development of oil and gas resources on a valid Federal oil and gas lease.

RATIONALE: The bases for this decision are as follows:

1. Approval of the Proposed Action is validating the rights granted with the Federal oil and gas leases to develop the leasehold to provide commercial commodities of oil and gas.

2. The environmental impacts would be avoided, minimized, or offset with the mitigation measures incorporated into the Proposed Action or attached and enforced by BLM as Conditions of Approval (COAs).

3. This Decision does not authorize the initiation of drilling activities associated with any Federal oil and gas well. Initiation of activities related to the six new Federal oil and gas wells to be drilled from the PH21 well pad may commence only upon approval by BLM of an Application for Permit to Drill (APD) submitted by Encana Oil & Gas (USA) Inc.

MITIGATION MEASURES: Mitigation measures presented in Appendix A of the EA will be incorporated as COAs for both surface and drilling operations and attached to APD for the Federal wells drilled on the PH21 well pad.

NAME OF PREPARER: Christine Cimiluca, Natural Resource Specialist

SIGNATURE OF AUTHORIZED OFFICIAL:

Allen B. Crockett, Ph.D., J.D.
Supervisory Natural Resource Specialist

DATE: Oct 31, 2012