JONAH FIELD EXPERIMENTAL WELL PAD DEVELOPMENT TECHNIQUES

ENVIRONMENTAL ASSESSMENT

WY-100-EA05-345

Prepared By
U.S. DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
BLM-WYOMING, PINEDALE FIELD OFFICE

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CHAPTER 1: PURPOSE AND NEED

Introduction

In August 2005 the Bureau of Land Management (BLM) received a proposal from EnCana Oil and Gas USA (EnCana) to conduct a research project to test alternative well pad construction techniques that could potentially reduce impacts to surface resources associated with drilling operations. The project would also evaluate alternative well completion operations and contemporary reclamation techniques in the Jonah Field Natural Gas Development Project (Jonah Field). Specifically, the project would evaluate the use of wooden mats on well pads and roads leading to well pads, the use of centralized completion and production facilities on existing pads, and reclamation techniques designed to expedite the re-establishment of vegetation in disturbed areas.

The research project would be conducted in three different areas of the Jonah Field in south-central Sublette County, Wyoming approximately 32 miles southeast of Pinedale, 28 miles northwest of Farson, west of U.S. Highway 191. The Jonah Field lies primarily within the administrative boundaries of the Pinedale Field Office, although a small portion of the field is administered by the Rock Springs Field Office, and comprises approximately 30,500 acres of which 28,580 acres are federal lands and minerals, 1,280 acres are State of Wyoming lands, and 640 acres are private surface.

Natural gas development in the Jonah Field has been previously analyzed in the Jonah Field II Natural Gas Development Project Environmental Impact Statement (J2EIS), (April 1998), and Environmental Assessment for the Modified Jonah Field II Natural Gas Project (MJ2EA), March 2000. The most recent environmental analysis of proposed natural gas development is presented in the Jonah Infill Drilling Project Draft Environmental Impact Statement (JIDPA DEIS) (February 2005).

The J2EIS analyzed the impacts of natural gas development within a 59,600 acre area at a well pad density of 80 acre spacing (8 wells per 640 acres). The MJ2EA analyzed the impacts of natural gas development in the eastern half of the area (29,200 acres) studied in J2EIS at 40 acre spacing (16 wells per 640 acres). The BLM is in the process of analyzing EnCana's proposal to infill drill and develop wells within the M2JEA project area. The proposed well pad spacing ranges from 20-acre spacing to as dense as 10 to 5-acre spacing. (Jonah Infill Drilling Project Draft EIS, February 2005).

This EA will evaluate possible effects resulting from the application of techniques designed to reduce the amount of surface disturbance from oil and gas development on public lands. This EA is prepared to aid the BLM Authorizing Official in making an informed decision.

Purpose and Need for Action

The purpose of this project is to evaluate a new technique for well site development in the Jonah Field. This technique would use wooden mats during the drilling and

completions of natural gas wells as a mitigative measure to minimize disturbance to vegetation and soil and rapidly accelerate reclamation. The proponent has successfully used this technique in other vegetative and soil conditions outside of Wyoming and proposes to demonstrate decreased surface disturbance to local conditions in the Jonah Field.

Understanding the viability and effectiveness of the use of wooden mats as a means of minimizing surface disturbance is needed by both the proponent and the BLM. The amount of surface disturbance and associated impacts to resources using the standard site development cut and fill process is an ongoing concern. EnCana's proposal provides a means to scientifically evaluate a new surface disturbance mitigation technique with the potential to greatly reduce impacts for future gas field development, both in Jonah Field and other similar developments.

Due to the characteristics of tight sands natural gas reservoirs within the Rocky Mountain region, maximum gas recovery requires drilling numerous closely spaced wells. However, increased oil and gas development can create significant conflicts with management of other resource values such as preserving wildlife habitat and maintaining multiple land uses. Directional drilling has been the predominant mitigation to achieve tighter down-hole spacing with less surface disturbance. However, this method is not always technically or economically feasible and often results in reduced resource recovery. The Jonah Field has to date been developed on 40-acre surface spacing, and operators are requesting reduced surface spacing to maximize recovery (10-acre down-hole spacing has already been approved by the Wyoming Oil and Gas Conservation Commission). Because the infrastructure of existing gas field development is in place to host completion and production facilities for the matted pads, Jonah Field is an ideal area for testing this technique.

The project would be designed to collect information throughout the life of the Jonah Field and to answer the questions below.

1. Can the proposed action low impact drilling techniques be used to reduce surface disturbance associated with natural gas development?
2. Which treatment variables are most effective in the local environment to reduce soil and vegetation disturbance associated with the use of wooden mats?
3. How will archeological resources associated with soil compaction be affected by the proposed action?
4. How will wildlife respond to the matted locations, and what habitat condition will remain after mats are removed from drilling locations?
5. What type of topography will safely allow use of mats to achieve low impact drilling?
6. Will operators be able to reduce the foot print of matted locations from disturbance by current matted practices?

Public Involvement
On August 9, 2005 BLM issued a press release initiating scoping of EnCana's proposal and received 10 comment letters from other agencies, interest groups, and members of the public. There were suggestions, comments, and concerns expressed about potential effects of the Proposed Action on various resources, but most focused on wildlife, vegetation, and soil resources. Comments reflected concern for proper monitoring of vegetation and soils and also, concern that effects to wildlife would not be minimized by the Proposed Action. Comments regarding proper monitoring were incorporated into the monitoring plan (see attachment 1). Effects to wildlife are analyzed below. All comments were considered in the development of research and monitoring for this project.

CHAPTER 2: ALTERNATIVES

There are two alternatives analyzed for this project: No Action and the Proposed Action. A description of each follows.

No Action
Under the No Action Alternative, development in the Jonah Field would continue as authorized per decisions made for the J2EIS and MJ2EA. Well pads would be developed on 40-acre surface spacing in areas where well pad density has not reached the 16 pads/per section threshold set through the Modified Jonah II EA. Additional wells would also be developed by expanding pads to directional drill from existing well pads in those areas where the surface spacing has reached the 16 pads/section. There are approximately 800 acres that have been approved in the Jonah Field for development that have not yet been developed by the operators.

Proposed Action
The Proposed Action would evaluate three separate areas, referred to as "pilot areas". The pilot areas are all located within the Jonah Field but each varies with respect to topography, vegetation and soil type characteristics. The unique resource values present in each of the pilot areas will be surveyed, tested, and evaluated in order to determine the effectiveness, as well as limitations, associated with EnCana's Low Impact Drilling and Completion Operations proposal.

Drilling would commence in fall 2005 for each pilot area, and finish drilling in fall 2006. EnCana proposes to drill a total of 45 wells from 43 matted locations (two directional wells would be drilled). Instead of excavating a level surface, drill rigs and other heavy equipment would be situated on top of the wooden mats. Each of the 43 sites would have a unique set of treatments (see attachment 2).

Pilot Area 1 is located in the southwest quarter of Section 20, Township 29 North, and Range 108 West. EnCana proposes to drill and develop 20 natural gas wells from 18 matted locations on a five-acre spacing pattern as currently approved by the Wyoming Oil & Gas Conservation Commission (WOGCC). This pilot area offers relatively flat

terrain with deep soils and moderate to heavy sagebrush cover. Section 20 is an ideal location to test the utility of mat drilling as a potential alternative to either conventional vertical drilling or directional drilling in tightly spaced areas.

Pilot Area 2 is located in Section 34, Township 29 North, and Range 108 West. EnCana proposes drilling up to 14 natural gas wells from 14 locations on a 10-acre spacing pattern as also approved by the WOGCC. This pilot area would test the topographic limits of using matted drilling techniques, and also has different soil and vegetative conditions. Currently, operators believe the mats can only be safely used when the surface slope is less than 3%. The slope within this pilot area ranges up to 3%. Due to this topography, there are several different challenges for the use of mats and the centralization of production facilities. Area 2 would be located on top of Yellow Point Ridge with typically shallow soils and sparse to moderate sagebrush cover.

Pilot Area 3, is located in Section 28, Township 29 North, Range 108 West, EnCana proposes to drill and develop 11 natural gas wells from 11 matted locations on a 10-acre spacing pattern as currently approved by the WOGCC. This pilot area is proximate to Sand Draw, and near an area of archeological concern. Soil compaction studies would be performed on all locations in Section 28 in order to determine whether mat drilling techniques can be used to protect archaeological resources that may be located in the San Arcacio soils in the Sand Draw area. Area 3 also has sparse to moderate density sagebrush.

For the purposes of conducting research and studies as proposed, the following well locations listed in Table 2-1 would be approved. The 118.25 acres of potential disturbance associated with the development of these wells was analyzed in the 1998 J2EIS and the 2000 MJ2 EA. It is figured that each of the 43 matted well pads and road will be approximately 2.75 acres.

Table 2-1. Proposed Well Locations

Section	**Well Number**
Sec.20 T29N, R108W	112-20, 111-20, 54-20, 53-20, 112X-20, 58-20, 59-20, 60-20, 124-20, 71-20, 123-20, 70-20, 122-20, 69-20, 124X-20, 125-20, 75-20, 76-20, 113-20, 114-20
Sec. 34 T29N R108W	19-34, 29-34, 30-34, 31-34, 32X-34, 36-34, 35-34, 42-34, 43-34, 44-34, 46X-34, 47X-34, 48-34, 49-34
Sec. 28 T29N R108W	34-28, 33-28, 47-28, 45-28, 62-28, 52-28, 50-28, 61-28, 68-28, 77-28, 78-28

Site Preparation Treatments for all Study Areas

Various techniques would be used prior to the placement of mats on road and pad locations in order to test the effectiveness of pre-treatment techniques. These treatments include;

1) direct placement of the mats on the surface without treatment, mowing vegetation prior to mat placement,
2) Lawson aerator application prior to mat placement,
3) development of a joist system to create small pockets of air under the mats, or air-gaps between the mats and soils/vegetation,
4) pre-watering, pre-seeding, and/or pre-fertilization of locations or other appropriate soil amendment prior to mat placement.

EnCana would use minimal cut-and-fill as necessary to stabilize or level mat locations directly under the drilling rig substructure in order to maximize safety. EnCana would balance the use of cut and fill in order to minimize surface disturbance and eliminate the stockpiling of topsoil on any mat locations in order to maintain the viability of topsoil.

Construction of Production-Associated Pipelines and Road Mats

Prior to installation of mats on a location, one or two 3-inch diameter, 3000 psi-rated composite pipes and a 1 inch polyethylene fuel gas supply pipe would be installed between the existing parent pad and matted pad. Lines would be hydrostatically tested for leaks after installation. Wherever possible, vegetation and topsoil would not be removed, scraped or graded for the installation of pipelines. Rather, pipelines would be installed using a trenching technique whereby minimal topsoil would be removed and disturbance would be minimized. The trench would be backfilled immediately after the pipelines are installed. After the pipelines are installed, road mats would be installed over the pipeline right-of-way. Approximately 150 mats would be necessary to construct a 1000’ roadway.

Drilling Operations

Individual 8’ by 14’ foot, three-ply wooden mats would be installed to create a drilling pad approximately +/- 2 acres in size. An estimated 776 mats would be needed for each drilling location. After the mats are installed, but prior to moving the drilling rig onto location, spill containment systems would be installed under the drilling rig substructure. All activity during drilling operations would be confined to the matted surface.

An existing previously authorized 40-acre spaced well pad would be used as the central “parent” well pad for each pilot area. Selected pads will not be expanded to accommodate equipment and operations required to support associated satellite mat location drilling and completion activities.

Closed loop systems would be utilized on all mat locations; no reserve pits would be constructed. Drill cuttings and fluids would be removed for further processing to the existing parent pad. A reserve pit at the parent well site would be constructed, reconstructed, or expanded on the existing disturbance to accommodate additional fluid and cuttings handling from the satellite mat locations. A flare stack would be constructed and utilized instead of a flare pit in case emergency flaring was needed. Personnel trailers and ancillary equipment would be located on the parent well pad whenever possible. Typical natural gas wells in the Jonah Field require, on average, between 16 and 22 days to drill. While the matted area would be managed to reduce the amount of time the mats are in contact with the ground surface, it is expected most mats will be in place for approximately 20-30 days for drilling activities.

Completion Operations

At the conclusion of drilling operations, portions of the matted surface would be removed, and the surface area would be reduced to about 0.3 - 0.5 acres that are matted. Surface hydraulic fracturing ("fracing") lines would be temporarily installed on the surface from the parent well pads to the satellite mat locations. The lines would be no more than 3000 feet long per individual line or 4000 feet of total frac line. Lines would be 4½", 13.5 lbs./ft. P-110 grade pipe with a pressure rating of 10,000 psi and a 0.8 safety factor applied. Only one central hydraulic fracing location, placed on parent well pads, would be necessary in each pilot project area. This will greatly reduce sand and water stimulation traffic by eliminating the need for repeated movement of equipment.

Flareless flowback and production equipment would be installed on the central "parent" well pad. Temporary surface lines already constructed would be used for hydraulic fracing flowback to the central flareless flowback equipment where the gas would be sold directly into the pipeline and liquids storage would occur. All hydraulic fracing fluids and production fluids would be gathered at the central site for processing.

All perforating and wireline operations on each well would be conducted on individual mat locations (following mat size reduction). All fracing equipment and ancillary operations would be confined to the central fracing location discussed above.

At the conclusion of the stimulation phase, the completion rig would perform drillout and tubing installation. The mats left in place for well completion (0.3 - 0.5 acres of matted surface) would remain for up to 45 - 60 days after the drill rig is removed. Reclamation as prescribed in the monitoring and research plan would commence upon removal of all mats and reduction in the size of the drilling location and continue into the completion phase.

Production Phase

After completion operations are finalized, all matting would be removed. Central hydraulic fracing and flareless flowback lines would be removed and used on other wells in the pilot project area. Post development soil compaction tests would be performed on all locations where pre-compaction tests were performed. All gas

processing, sales, measurement, and tanks would be centralized to the parent 40-acre location. Additional consolidation of facilities would occur over time as condensate and water production decreases.

Reclamation and evaluation of pre-matting surface treatment techniques would commence as soon as mats are removed from drilling locations and roadways. Access to the matted locations would be restricted to the original right-of-way utilized for pipeline installation. Because the matted locations would be generally level, they could be re-contoured if necessary, but would remain sufficiently level for any required remedial well work in the future. Remote telemetry or Supervisory Control and Data Acquisition (SCADA) technology and wellhead houses with heaters would be installed on each well location, further reducing traffic to well pads.

Monitoring and Research Plan

EnCana has developed and proposed a detailed monitoring and research plan to evaluate effectiveness of the new surface disturbance mitigation techniques outlined in the proposed action (see attachment 1). Following completion of this research project, BLM will analyze the documented results and determine the technique's mitigative value and possible applicability to other similar projects.

CHAPTER 3: AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

A complete and detailed description of the affected environment may be found in the JIDP DEIS (February 2005) and is incorporated by reference.

Critical Elements

The following elements of the human environment are subject to requirements specified in statute, regulation or executive order, and are considered for this analysis as follows.

Environmental Consequences

In addition to the critical elements that are present or may be affected by the project, other resources may be subject to potential effects. These include soils, vegetative types, wildlife, invasive weeds, rangeland and paleontological resources. Under each resource listed, there is an explanation of the affected environment and analysis of impacts under the proposed alternative and no action alternative.

Table 3-1. Critical Environmental Elements

Element	Present or Affected	Element	Present or Affected
Air Quality	Yes	**Threatened or Endangered or Sensitive Species**	Yes
Areas of Critical Environmental Concern	No	**Wastes, Hazardous or Solids**	No
Cultural Resources	Yes	**Water Quality (ground)**	Yes
Farm Lands	No	**Wetlands or Riparian Areas**	No
Floodplains	No	**Wild & Scenic Rivers**	No
Native American Religious Concerns	Yes	**Wilderness**	No

1. Air Quality

An air analysis for the Jonah Field was completed in the August 2005 Jonah Infill Drilling Project Air Quality Technical Support Document Supplement.

No Action:
Under this alternative, all 40-acre spaced well pads in the project area would be expanded in order to directionally drill wells to the decreased down-hole spacing authorized by the WOGCC in the project area. If the 45 proposed wells were drilled directionally, it would result in a minor increase in the amount of pollutants from drill rig engine emissions that were not accounted for in the air quality analysis conducted for the J2EIS or for the Pinedale Anticline Oil and Gas Development and (PAPA) final EIS.

Proposed Action:
Under the proposed action, 43 wells would be straight drilled, with 2 wells directionally drilled. There are anticipated reductions in pollutants associated with straight-hole drilling as opposed to directional drilling due to the greater horse power required for directional drilling and increased drilling time.

Table 3.2 Single-well Construction Emissions Summary for Both Straight and Directionally Drilled Wells.

Pollutant	**Well Pad and Access** Road Construction (lb/hr)	(tons/well)	Rig Move and Drilling (lb/hr)	(tons/well)	**Completion and** Testing **(lb/hr)**	**(tons/well)**	Pipeline Construction **(lb/hr)**	(tons/well)	Totals (lb/hr)	(tons/well)
Emissions for one straight well										
NO_x	12.23	0.23	**9.78**[2]	2.24	0.35	**0.10**	7.81	0.067	30.17	2.6362
CO	3.76	0.071	3.76[2]	1.47	**0.45**	0.13	3.03	0.024	**I1.00**	**1.6938**
SO_2	**1.46**	0.028	0.31[2]	0.071	**0.0096**	0.00	0.74	0.74	0.0067	**0.8400**
PM_{10}	10.76[1]	0.21	3.11[2]	**0.80**	**6.56**	**1.95**	**4.88**[3]	0.073	25.30	**3.0388**
$PM_{2.5}$	3.52[1]	0.069	**0.93**[2]	0.23	**1.00**	0.30	1.52[3]	**0.019**	**6.97**	0.6136
VOC	0.90	0.017	**1.97**[2]	0.45	0.17	57.62	0.76	0.76	0.0066	**58.8545**
Emissions for one directional										
NO_x	12.23[4]	0.23	12.09[5]	3.34	0.35[6]	0.10	**7.81**[6]	0.067	32.48	3.7420
CO	3.76[4]	0.071	**7.89**[5]	2.19	0.45[6]	0.13	3.03[6]	0.024	15.13	2.4130
SO_2	1.464	0.028	0.38[5]	0.106	**0.0096**[5]	**0.00**	**0.74**[6]	0.74	2.60	0.8751
PM_{10}	**10.76**[4]	0.21	**3.28**[5]	1.00	**6.56**[5]	**1.95**	**4.883'**[6]	0.073	25.47	3.2358
$PM_{2.5}$	3.52[4]	0.069	**1.07**[5]	0.31	1.00[5]	0.30	1.52[3,6]	0.019	7.11	**0.6958**
VOC	**0.90**[4]	0.017	2.43[5]	**0.67**	0.17[5]	57.62	**0.76**[6]	0.76	**4.26**	**59.0756**

(table 2.1 of the Air Quality Technical Support Document, Jonah Infill Project November 2004)

Sum of well pad construction, road construction, well pad and road construction traffic, and construction heavy equipment tailpipe emissions.
Sum of straight drilling traffic, straight drilling engines, and straight drilling heavy equipment tailpipe emissions.
Sum of pipeline construction, pipeline construction traffic, and pipeline heavy equipment tailpipe emissions.
Well pad and access road construction emissions for one directionally drilled well are equal to emissions for one straight drilled well. Sum of directional drilling traffic, directional drilling engines, and directional drilling heavy equipment tailpipe emissions. Completion and testing emissions and pipeline construction emissions are the same for straight and directional wells.

2. Cultural Resources and Native American Religious Concerns

Multiple cultural resource surveys have been conducted in the three sections proposed for experiment with known sites eligible for listing in the National Register.

Section 28 was subject to a 100% Class III inventory report, prepared by SWCA (SWCA, 2000). Additionally, the currently authorized 40 acre spacing field development resulted in a series of highly significant unexpected discoveries, involving Early Archaic-aged (5,000 to 7,000 years ago) prehistoric sites. House pit sites were discovered during construction of the SHB 11-28 and 7-28 well locations. These unexpected archaeological discoveries occur in a particular soil type identified as San Arcacio

(ERO, 1984). Soils in the San Arcacio series are known to be archeologically sensitive, based upon numerous discoveries and past investigations.

Archeological discoveries are not expected in Sec. 34. Soils in Sec. 20 are not nearly as sensitive as those found in Sec. 28. On Yellow Point Ridge soils are very thin, frequently containing a deflated pediment of cobbles, petrified wood, and clays. Buried archaeological sites and unexpected discoveries are not expected in pilot areas of section 20 and 34.

Within pilot area 3, in section 28, the existing 7-28 pad (which would be used to host completion and production facilities) was the location of a large, complex archaeological discovery involving extensive data recovery in 2002 at 48SU4479, the J. David Love site. Six prehistoric house pits were excavated and date to between 5300 and 7200 radiocarbon years ago. A seventh smaller archaeological feature housed "EnCana Woman", a 7300 year old human interment, the oldest known human remains discovered in Wyoming. Native American Graves Protection and Repatriation Act (NAGPRA) consultation was effected among BLM and the Shoshone Business Council throughout the summer, 2002.

No Action:
Under this alternative, existing 40-acre spaced well pads will be expanded to directional drill wells to reach WOGCC approved down-hole spacing in the project area. During the excavation process to expand pads, archeological resources could be disturbed. Research relating to the potential impact to cultural material posed by the use of wooden mats will not be gained.

Proposed Action
Class III archaeological surveys and pre-construction soil compaction studies would be conducted prior to initiating any surface disturbing activities or laying mats on proposed roads or drilling pads. While pipelines are being trenched to matted locations under the matted roads, archaeological trench inspection will be effected on a case-by-case basis depending upon soil sensitivity, per standard procedures. Archaeological investigations would be conducted prior to cut and fill of soils and application of aeration techniques using a Lawson Aerator.

Eight of the eleven matted locations proposed in Section 28 lie within 1/4 mile of the “EnCana Women” Native American burial locale. All the Section 28 matted locations lie within 1/2 mile of the burial. Under implementation of the Proposed Action the Shoshone tribe would be notified of the action and any surface disturbing activity within the Section 28 pilot area. Since the experimental well pad development techniques have not been tested in the Jonah Field, the BLM is unaware of the impacts to cultural resources. At the present time the BLM considers the use of wooden mats as disturbance and will take protective measures in order to preserve any potential cultural resource findings within in the all pilot areas.

Reclamation using equipment will be conducted subsequent to archaeological evaluations, per standard surface-disturbing activity procedures. Any sites located by standard inventory and pipeline trench inspection methods shall be evaluated for National Register status and if eligible, will be either avoided or mitigated as is standard practice. Following mat removal, post activity soil compaction analysis will be completed to determine possible effects on subsurface cultural resources.

3. Soils

Soils at Pilot Area 1 are of a Garsid composition with fine-loamy and coarse loamy deep soils. Pilot Area 2 has a vermillion variant, Hugoston, and Monte composition with rock outcrop, loamy, mixed calcareous, frigid, shallow, and loamy-skeletal soils. Pilot Area 3 has a San Arcacio, Huguston, Monte, and Garsid composition with a fine-loamy, coarse loamy, rock outcrop, and mixed calcareous soils.
(ERO 1984)

No Action:
Under this alternative, any wells drilled in the three pilot areas would be directionally drilled from existing 40-acre spaced well pads that would be expanded from about 3.6 acres to about 5.1 acres to reach WOGCC approved down-hole spacing. BLM could not evaluate alternative methods with the potential to reduce the amount of surface disturbance associated with natural gas development.

Proposed Action:
The weight of the mats, trucks and other vehicles, and the drilling rig, while dispersed by the area covered by the mats, may compact the underlying soils. This could lead to reduced infiltration of water into the soil and permeability of water through the soil, reduced diffusion of oxygen, carbon dioxide and other gases in and out of soils, reduced nutrient cycling and the availability of essential plant nutrients, reduced plant root penetration, reduced plant growth and production, and increased soil erosion and sedimentation.

Each of the three pilot areas possesses different soil characteristics. The Proposed Action would measure the bulk density of the soil, soil infiltration rates, and soil chemical and physical characteristics before and after matted operations. A number of treatment variables will be added to the soils research (see attachment 2). Overall, the Proposed Action is anticipated to reduce soil erosion and sediment transport.

4. Vegetation

Vegetation in the three project areas typically includes Wyoming big sagebrush, Gardner's saltbush, western wheatgrass, bud sagewort, winterfat, thickspike wheatgrass, June-grass, bluebunch wheatgrass, Sandburg blue grass, and Indian ricegrass. Pilot Area 1 is comprised of high density sagebrush, Area 2 with medium density sagebrush, and Area 3 with high density sagebrush. There are no known Federally listed Threatened and Endangered or sensitive plant species recorded in the

project area.

No Action:
Under this alternative, vegetation would be removed in order to expand existing 40-acre spaced well pads to directionally drill wells in the three pilot areas to reach WOGCC approved down-hole spacing. After the production and completion of the well facilities, interim reclamation species would begin to re-vegetate the area. Vegetation impacts associated with the use of mats would not be researched.

Proposed Action:
There may be an impact to underlying vegetation due to the lack of sunlight for photosynthesis and structural damage to the plants from the weight of the mats and operational equipment. However, seed sources and some degree of surface cover will be in place for re-growth and regeneration of plant species. The extent of root system damage to vegetation as a result of soil compaction is unknown.

A characterization of plant community composition, aerial cover, and vigor will be assessed before and after matted operations. Refer to attached monitoring plan for a full description of vegetation monitoring and evaluation.

5. Threatened and Endangered Species and Wildlife

The proposed parent well pads are located within two miles of an occupied sage-grouse lek, however this lek has not been active since 1998. The locations are not in a known sage-grouse winter concentration area. The area is in antelope spring-summer-fall range, and not in the range for mule deer, moose, or elk. No big game crucial winter range exists in this area. There is active raptor nests located within ½ mile of the parent pad locations, and species inhabiting the area include ferruginous hawks, short-eared owls, and burrowing owls. Mountain plover habitat may exist in some areas as plover have been documented in section 34. Pygmy rabbit habitat may exist in some areas. All of the proposed areas have been block-cleared for black-footed ferret by the U.S. Fish and Wildlife Service.

Wildlife mitigation measures described in J2EIS would continue to be considered applicable for both alternatives as necessary to reduce impacts to identified wildlife values in the area.

No Action:
Under this alternative, habitat would be lost on acres used to expand existing 40-acre spaced well pads to directionally drill wells in the three pilot areas to reach WOGCC approved down-hole spacing. Interim reclamation would commence after drilling completions and productions.

Construction, drilling and/or completion operations could result in some big game displacement and/or increased stress upon the animals. The displacement distance is variable, but studies for other species, have shown that it is not uncommon for big game

animals to move a mile or more from disturbance points. Additionally, expansion of each pad would remove approximately 2 acres of forage.

Potential impacts to occupied sage-grouse nests and/or raptor nests on, or in close proximity to the proposed construction location would be nest abandonment and subsequent egg mortality.

Although reclamation is not considered mitigation, it has the potential to lessen long term impacts to sage grouse populations, and other sagebrush-obligate species, and their required habitat needs over time.

Proposed Action:
Mat construction, drilling and/or completion operations from February 1 through July 31 may cause impacts to nesting raptors. Mat construction or other surface disturbing activities from April 10 through July 10 may impact nesting mountain plover. Potential impacts to active raptor and mountain plover nests on, or in close proximity to, the proposed locations would be nest abandonment and subsequent egg or chick mortality.

It is unknown what habitat condition is expected to exist following mat removal, but it is anticipated to result in less continuous loss of habitat than under existing mitigative prescriptions. Direct impacts associated with surface disturbance could potentially be reduced to an unknown level with the use of mats. Wildlife will be affected by indirect impacts from traffic, noise, and operations of natural gas development associated with all activity. Wildlife inventories for sage grouse, pygmy rabbits, raptors, and owls will be completed before mat construction.

6. Invasive species
Known species of noxious weeds in the project area include black henbane, Canada thistle, musk thistle, and perennial pepperweed. Invasive weeds are russian thistle, kochia, lambsquarter, halogeton, and cheatgrass.

No Action:
Under this alternative, all 40-acre spaced well pads would be expanded in order to directionally drill wells to reach WOGCC approved down-hole spacing in the project area. All vegetation would be removed from these expanded acres. All of this disturbed area will be at risk for colonization of invasive or noxious weeds due to the exposed soil.

Any surface disturbance could result in introduction of non-native species, such as russian thistle, halogeton, and lambsquarter. The invasion of henbane and other undesirable thistle or weed species would also be possible. Reclamation of disturbed areas with native grasses will eliminate the first three plants listed. A monitoring and spray program will be needed to control the invasion of henbane, thistles and other non-native and noxious weeds. Monitoring new reclamation sites and aggressive spray programs are feasible and prudent measures available to minimize risk. Potential sources of weed invasion would be vehicles, dormant seeds on site, straw used for mulching and commercial seeds for reclamation that may not be totally weed free. The

mitigation would control invasive species without precluding the ability of the operator to develop their lease.

Proposed Action:
Disturbance resulting from the implementation of the Proposed Action has the potential to introduce noxious weeds and non-native species into the project area, in the same manner as described under the No Action Alternative.

There is the additional potential risk of spreading noxious weeds while transporting wooden drilling mats from location to location. However, colonization of invasive plants may be reduced because there will not be high densities of bare ground and an unknown level of vegetation will be intact. Monitoring for weeds will take place, and will be treated on a case by case basis.

7. Rangeland Resources

The project area is within the Sand Draw grazing allotment. Season of use within the allotment is typically from early May to late June.

No Action:
Cattle could potentially fall in reserve pits and become trapped if not fenced properly. Active construction, drilling, and production during the authorized cattle use period for this allotment could result in conflicts between industrial activity and livestock operations. Potential conflicts could include vehicular collisions, cattle interference with facility maintenance, reclamation success, changes in cattle grazing distribution, and/or interruption of cattle management logistics (i.e. trailing). As such, these conflicts combined with an allotment-wide loss of vegetation could ultimately result in the BLM implementing changes in overall grazing management (i.e., AUM reduction) within the Sand Draw allotment.

Either action is not expected to interfere with access to livestock management facilities. Access roads to this project will not interfere, or cut off, access to existing 2-track trails which often lead to livestock management facilities. Active coordination/cooperation between the BLM, oil and gas operators and with the allotment permit holders should prevent many of the above-listed conflicts.

In the short-term, the overall loss of forage may increase the concentration by cattle on available forage. Although reclamation is not considered mitigation, re-vegetation of the disturbed sites should return vegetation to pre-disturbance conditions and meet long-term forage demands. Unfenced reclamation sites will provide additional forage for cattle, but could be detrimental to re-vegetation efforts.

Proposed Action:
All possible affects to the No Action alternative apply to the Proposed Action. It is unknown at this time what the effects on forage will be following mat removal. Seventeen matted locations have been identified as being fenced during reclamation of

the sites. These sites will not be grazed until reclamation efforts are successfully completed.

8. Paleontological Resources:
There are no known fossil locations within the proposed project area. However, additional, unidentified fossil remains may be exposed during the proposed construction, drilling, and/or surface disturbing activities. Since no site specific paleontological surveys are required for this location, impacts could include the discovery and/or loss of a valuable paleontological resource.

9. Water Resources:
Impacts to ground and surface water in the Jonah Field have been analyzed in the JIDPA DEIS. There are no perennial streams in the pilot area. No well locations will be constructed within 300 feet of Sand Draw, to avoid disturbance of erosive sandy soils.

Water for drilling, completing and operating wells will be obtained from a single water well drilled in each of the three pilot areas on the central fracing location under the Proposed or No Action Alternative.

The 45 gas wells would be drilled through other fresh water bearing zones. To prevent contamination of all fresh water zones and depletion of the culinary aquifer, the gas well would be cased and the outside of the casing would be cemented from 2500' back to surface. Based on these measures no impacts to ground water resources are anticipated.

10. Cumulative Impacts

Cumulative impacts are the impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

Cumulative impacts expected from the implementation of this proposal would be reduced from those described in the J2EIS and MJ2EA for air quality and wildlife habitat. Cumulative impacts expected from surface disturbance, vegetation and soil erosion are expected to be greatly reduced from existing mitigative techniques.

The key analysis here is researching the Proposed Action in order to reduce surface disturbance. The Proposed Action will not contribute to cumulative impacts because 1) there will be a reduction in air emissions associated with straight-hole drilling of wells authorized under the proposed action as opposed to directional drilling under continuation of existing management, 2) although the BLM is classifying all matted acres as surface disturbance until the research pilot is complete, we do expect overall reduction in soil displacement, soil disturbance, and erosion and 3) less habitat disturbance is expected with the Proposed Action than continuation of existing mitigative measures 4) without excavation for pad construction, cumulative impacts to cultural resources will be reduced.

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Attachment 1

MONITORING AND RESEARCH PLAN

INTRODUCTION

This plan will implement a monitoring strategy to evaluate various aspects of the proposed action. Data gathered will be useful to operators and land managers for further application of EnCana's proposed Experimental Well Pad Development Techniques (experiment).

BACKGROUND

The experiment involves placing constructed mats over the native ground surface. Activities associated with natural gas production will be conducted on these mats to reduce or eliminate the need for the excavation and construction necessary with conventional drill pads, roads and pipelines. The goal is to reduce impacts to soil and vegetation resources.

RESOURCES

Monitoring, sampling, and soil compaction testing for the project will be completed by a 3rd party contractor, chosen and funded by EnCana and approved by the BLM. An inventory for each of the monitored resources will be conducted before disturbance, to provide baseline data throughout the project.

EnCana will be testing and researching a number of treatment variables and tests on the different matted locations shown in attachment 2.

EnCana will provide a technical report to the BLM on the following dates:

November 1, 2006
November 1, 2007
November 1, 2010

The technical report will include baseline, pre-construction, and post-mat removal monitoring data on soils and vegetation. Assessments on soils and vegetation will be completed one, two, and five years after the start of the low impact drilling project. Reports will also incorporate data on seasonal and weather related affects on the project. Cultural resources and wildlife evaluations will be conducted pre construction and post construction to be included in the November 1, 2006 report.

Monitoring will be completed on each individual resource that is pertinent to the implementation of the experiment. The soil and vegetation monitoring program will consist of pre-mat construction (baseline) and post-mat removal measurements, observations and sampling efforts. Tests will be performed and monitored on cultural resources. Evaluations and monitoring will also be conducted for wildlife species.

SOILS

The monitoring team will measure soil bulk density for each discrete drill mat and roadway mat comprising the pilot study. Bulk densities will be measured using a nuclear surface moisture/density gauge. The use of a nuclear surface moisture/density gauge will facilitate the measurement of surface bulk densities at sufficient locations within the pilot study.

For each 2-acre rectangular drill mat, surface soil bulk density will be measured in locations along a diagonal transect using the nuclear surface moisture/density gauge. For each discrete roadway mat, bulk density will be measured in locations equally spaced along the centerline of the roadway footprint. Bulk density measurements will be made for the drill pad and roadway mats prior to construction of the mats and immediately upon removal of the mats. The number of measurements and the variety of mat construction, site preparation techniques, and soil types encountered will facilitate various analyses of soil bulk density before and after mat placement.

Soil Compaction Impact Study

A pre-construction and post-mat removal assessment will be conducted to quantify impacts associated with soil compaction. The results of this assessment will be used to compare mat treatments and provide an indication of any specific reclamation requirements. Assessment parameters will include bulk density, soil structure, soil infiltration rates, soil chemical and physical characteristics, and vegetation performance. The proposed pilot study layout will facilitate a randomized complete block experimental design for comparison of different mat construction techniques, site preparation techniques, and underlying soil types.

The pre-construction and post-mat removal assessment will be replicated three times for each mat construction/design, site preparation technique, and soil type combination. The selection of replication locations will be randomized within the hub and spoke layout. The ultimate experimental design will be completed once the pilot study layout is finalized.

The following assessments will be conducted for each 2-acre drill mat location prior to mat installation and after mat removal:

1. Measure surface soil bulk density at locations along a diagonal transect using the nuclear surface moisture/density gauge (part of the pilot-wide bulk density measurement program described above).

2. Measure soil infiltration rates using a tension infiltrometer at three locations within an established 25 square-foot monitoring location.

3. Excavate three small pits at three locations to a depth of 24 inches with a spade to describe soil profile features, soil structure and depth of compaction (in the case of the post-mat removal event). The baseline (pre-installation) and post-removal pits will be located immediately adjacent to one another to facilitate comparisons of soil features and evaluation of potential impacts.

4. Collect composite soil samples from 0-6, 6-12, and 12-24 inch depth increments for laboratory analysis of pH, electrical conductivity, carbon-nitrogen ratio, plant nutrients (nitrogen, phosphorus, potassium), sodium adsorption ration (SAR), percent calcium carbonate, saturation percentage, soil texture (percent sand, silt and clay), and percent coarse fragments. The samples will be collected to a depth of 24 inches from six locations equally spaced throughout the 2-acre pad site using a Giddings truck-mounted hydraulic soil probe. Each depth increment will be combined into a single sample, which will result in a total of three soil samples for analysis from each drill pad location.

Reclamation approaches for soil compaction

If the monitoring program described above reveals that significant soil compaction occurred beneath the mats during the pilot study, suitable compaction remediation and surface reclamation techniques would be employed to restore the sites. Reclamation would consist of two phases: (1) soil compaction relief, and (2) re vegetation. Soil compaction relief would be accomplished using deep tillage equipment such as a vibratory ripper shank system. The effectiveness of the soil compaction remediation and reclamation would be evaluated in the same manner as that described above for the low impact pilot study. In this way, any compaction reclamation efforts would become an extension of the project.

VEGETATION

Vegetation sampling will be conducted on proposed mat locations and adjacent non-matted locations before mat construction and after mat removal. Sampling will be completed using a method to record percent species composition by cover. Density of grasses, forbs, and sagebrush will be measured in the number of plants per area.

Post mat-removal monitoring will evaluate living vegetation diversity to determine the affects of low impact drilling on individual plant species.

Attachment 1

Comparisons between the EnCana Experimental Well Pad Development Techniques Project and EnCana's current Reclamation Pilot Project will be analyzed.

Photo points will be set up to take the same photo of the matted location along with the non matted location throughout the life of the operations and reclamation.

WILDLIFE

Wildlife inventories will be conducted on matted locations before construction for active raptor nests, sage grouse, burrowing owls, and pygmy rabbits. On site inventories will be conducted during matted operations for rodents. Post-operation inventories for any wildlife activity on previously matted locations will be conducted.

CULTURAL RESOURCES

Archaeological soil compaction studies will be conducted at sufficient depths and locations to accommodate archeological findings in the section 28 pilot area. Most of the archaeologically sensitive sediments exist in the Bt soil horizon and the sediment are encountered at depth between 20 to 60 cm. The archaeological soil compaction study will be prepared by an approved consulting archaeologist, and approved by BLM and SHPO prior to mat installation. This information will be submitted to the BLM in annual technical reports.

A "pseudo-artifact" experiment will be conducted whereby non artifacts in mapped surface and subsurface locations are placed underground before mat installation. Once the mats are removed, an assessment of damage, transmigration, vertical and/or horizontal displacement or other effects will be made. Compaction tests will be performed on "pseudo-artifact" sites. Potential non-artifacts include: modern ungulate bone, both whole and broken; articulated and nonarticulated bone; ceramic artifacts, both whole/complete and as a "sherd scatter"; lithic items such as tools and debitage (as with all of this, we need to be careful here so the experiment doesn't result in the artificial creation of archaeological sites); hearth-like features; glass, tin cans, shell, wood and perhaps even a house pit re-creation.

Conducting such an archaeological experiment is within the parameters of the project, and could add to understanding of post depositional site modification, disturbance, or preservation.

CONCLUSIONS

Findings from the monitoring will be used by the BLM to determine the effectiveness of the Proposed Action, its potential future in the Jonah Field and in other developments.

Attachment 2

Section 20 Pilot Area 1		Mechanical Method	Mat type	Mulch	Fertilize	Seed	Irrigate	Fence	Soil Compaction Test
1	control site	none	Regular wood	none	no	no	no	no	yes
2	control site	none	Regular wood	none	no	no	no	no	yes
3		remove vegetation	Regular wood	yes	before	before	yes	no	no
4		aerate	Regular wood	none	no	no	no	no	no
5		none	Regular wood	none	no	after	yes	yes	no
6		mow	Regular wood	none	no	after	yes	yes	yes
7	2 well directional pad location - 2x times	Mow	Regular wood	none	no	after	yes	yes	yes
8	2 well directional pad location - 2x times	aerate	joist	none	no	after	no	no	yes
9		remove vegetation	Regular wood	none	no	after	yes	no	no
10		aerate	Regular wood	none	no	after	no	no	no
11		mow	Regular wood	none	after	after	no	no	no
12		none	Regular wood	none	after	after	no	no	no
13		remove vegetation	Regular wood	yes	after	after	no	no	no
14		aerate	Regular wood	yes	after	after	no	no	yes
15		mow	Joist	yes	no	no	no	no	no
16		none	Joist	yes	no	no	no	no	no
17		remove vegetation	Joist	none	no	before	no	no	no
18		aerate	Joist	none	no	no	no	no	no

Attachment 2

Section 34 Pilot Area 2		Mechanical Method	Mat type	Mulch	Fertilize	Seed	Irrigate	Fence	Soil Compaction Test
1	control site	none	Regular wood	none	no	no	no	no	yes
2	control site	none	Regular wood	none	no	no	no	no	yes
3		remove vegetation	Regular wood	none	after	before	no	yes	no
4		aerate	Regular wood	none	before	after	no	yes	yes
5		mow	Joist	none	before	before	yes	yes	no
6		none	Joist	none	no	no	yes	yes	yes
7		remove vegetation	Joist	none	after	after	yes	yes	no
8		areate	Joist	none	before	no	no	no	no
9		mow	Regular wood	yes	before	before	yes	yes	no
10		none	Regular wood	yes	no	after	yes	yes	yes
11		remove vegetation	Regular wood	yes	after	after	yes	yes	no
12		aerate	Regular wood	yes	before	after	yes	yes	no
13		mow	Regular wood	none	no	no	no	no	no
14		none	Regular wood	none	no	no	yes	yes	no
Section 28 Pilot Area 3									
1	control site	none	Regular wood	none	no	no	no	no	yes
2	control site	none	Regular wood	none	no	no	no	no	yes
3		remove vegetation	Regular wood	yes	after	after	no	no	yes
4		mow	Joist	none	no	after	no	no	yes
5		none	Joist	before	before	no	no	no	yes
6		remove vegetation	Joist	after	after	before	yes	yes	yes
7		none	Regular wood	none	no	before	no	no	yes
8		remove vegetation	Regular wood	none	before	after	no	no	yes
9		mow	Regular wood	none	no	no	no	yes	yes
10		none	Regular wood	none	no	no	no	no	yes
11		remove vegetation	Regular wood	none	no	yes	no	no	yes