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BUREAU OF LAND MANAGEMENT

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MANUAL TRANSMITTAL SHEET

Subject

MS-3160 – DRAINAGE PROTECTION MANUAL (Public)

1. Explanation of Material Transmitted: This release transmits a revised Manual Section 3160 – Drainage Protection Manual on the BLM’s responsibilities, directions, and guidance for ensuring that lessees protect Federal and Indian leases from drainage of oil and gas resources by wells on nearby lands.
2. Reports Required: None.
3. Material Superseded: The Manual updates guidance released in Washington Office Instruction Memorandum 99-051, Bureauwide Interim Guidance on Oil and Gas Drainage Protection.
4. Filing Instructions: File as directed below.

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All of Rel. No. 3-352
(104 Pages)

A handwritten signature in black ink, appearing to read "Michael Nedd", written in a cursive style.

Michael Nedd
Assistant Director
Energy, Minerals, and Realty Management

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Chapter 1 - Overview

1.1 Purpose

This Manual Section provides guidelines, standards, and procedures to prevent the loss of oil and gas resources and any resulting loss of royalty revenues from drainage on leased and unleased public domain, acquired, and Indian lands. The Manual also provides guidance on implementing the BLM's regulations governing drainage, including 43 C.F.R. parts 3100, 3130, and 3160. The regulations lay out the responsibilities of oil and gas lessees and the owners of operating rights for protecting Federal and Indian oil and gas resources from drainage; the obligations of lessees or owners of operating rights to protect against drainage; and the steps to take to determine if drainage is occurring. This guidance does not address potential drainage of groundwater resources that may occur because of the development of oil and gas resources.

1.2 Objectives

The objective of drainage protection is to prevent substantial loss of oil and gas resources from Federal and Indian lands due to drainage, and when such loss is not prevented, to ensure that the Federal or Indian lessors are not subjected to revenue losses through drainage. A potential drainage situation (PDS) occurs when a well that is drilled or is in production adjacent to Federal or Indian leases or unleased lands is potentially draining Federal or Indian oil and gas resources. Ensuring drainage protection of leased lands may require the lessee of the drained lease, unit, unit participating area, or communitized area to drill a protective well, pay compensatory royalty, enter into an agreement (e.g., communitization agreement, participating area agreement, or unitization agreement), relinquish affected acreage, modify existing agreements, or a combination of these actions. For unleased lands, the BLM may require the operator to take protective measures or negotiate compensatory royalty agreements (CRA).

1.3 Authority

The BLM has authority under the Mineral Leasing Act of 1920 (MLA) (30 U.S.C. 181 et seq.), as amended and supplemented, to lease oil and gas resources in public domain lands and to regulate the development of those leases. Pursuant to 30 U.S.C. 226(j), the BLM may negotiate drainage agreements with the consent of any lessees when it appears that Federal lands are being drained of oil or gas by wells drilled on adjacent lands. The BLM also leases oil and gas in acquired lands pursuant to the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351–359).

The Act of March 3, 1909 (1909 Act) (at 25 U.S.C. 396), the Indian Mineral Leasing Act (IMLA) (at 25 U.S.C. 396d), and the Indian Mineral Development Act (IMDA) (at 25 U.S.C. 2107) authorize the Secretary of the Interior to regulate oil and gas operations and mineral agreements on certain Indian lands. The Secretary, through delegations in the Departmental Manual, as reflected in the Bureau of Indian Affairs (BIA) regulations, has assigned to the BLM part of the Secretary's trust responsibilities to regulate oil and gas operations on those Indian lands. The BIA regulations state that 43 CFR part 3160 applies to oil and gas operations on Indian lands. See 25 C.F.R. 211.4, 212.4, and 225.4.

Pursuant to the Federal Land Policy and Management Act of 1976 (FLPMA), 43 U.S.C. 1701 et seq., the MLA, Indian mineral leasing laws, and other statutes, the BLM is charged with administering oil and gas operations in a manner that protects Federal and Indian lands while allowing for appropriate development. The Secretary of the Interior promulgates regulations governing oil and gas operations on Federal mineral leases pursuant to those statutes.

The Federal Oil and Gas Royalty Management Act of 1982 (FOGRMA) (30 U.S.C. 1701 et seq.) requires the Secretary of the Interior to establish comprehensive fiscal and production accounting and auditing systems to accurately determine oil and gas royalties, interests, fines, penalties and other payments owed to the United States and Indian lessors, and to collect and account for such revenues in a timely manner.

The BLM regulations on onshore oil and gas operations are contained or incorporated by reference in 43 C.F.R. part 3160. The BLM regulations governing or related to drainage are found in 43 C.F.R. 3100.2-1 (compensation for drainage); 43 C.F.R. 3100.2-2 (drilling and production or payment of compensatory royalty); 43 C.F.R. 3106.7-2 (obligations after transfer or assignment); 43 C.F.R. 3106.7-6 (obligations of transferee); 43 C.F.R. 3108.1 (obligations upon relinquishment of lease); 43 C.F.R. 3120.1-1(d) (protective leasing); 43 C.F.R. 3130.3 (drainage within the National Petroleum Reserve-Alaska); 43 C.F.R. 3160.0-5 (definitions); 43 C.F.R. 3162.2-1 to 3162.2-15 (drilling, producing and drainage obligations); and 43 C.F.R. 3186.1 (model onshore unit agreement for unproven areas).

Pursuant to 43 C.F.R. 3162.2-14, a lessee or operating rights owner may request BLM State Director review under 43 C.F.R. 3165.3, and appeal to the Interior Board of Land Appeals (IBLA) under 43 C.F.R. parts 4 and 1840, a BLM decision to require drainage protective measures.

1.4 Responsibility

It is the responsibility of the Secretary of the Interior to protect the United States Government and Indian lessors from loss of royalty as a result of drainage. The Secretary has delegated this responsibility as follows:

- A. The Director provides overall management of BLM programs, including management of drainage protection within oil and gas programs.
- B. The Assistant Director for Energy, Minerals and Realty Management and provides effective program oversight from the Washington Office to ensure that Federal and Indian lands are adequately protected from drainage.
- C. The State Director is delegated responsibility for the following:

1. Tracking well completions and recompletions on Federal and Indian lands and on adjacent, non-Federal or non-Indian lands that are potentially involved with a drainage situation.
2. Requiring that lessees/operating rights owners take measures to protect leased Federal and Indian lands identified as potential drainage situations from drainage. They also ensure the protection of unleased Federal minerals by requiring protective measures when leasing or through CRAs or other agreements.
3. Notifying the BIA when unleased Indian lands are at risk of potential drainage and recommending what protective measures are necessary.
4. Ensuring that affected lessee(s)/operating rights owners promptly notify the BLM of such well completions and recompletions identified above. If notification is not received in a timely manner, the State Director will send a demand letter to affected parties that notifies them of their responsibility to protect the lease from drainage, and requests a plan for providing protection.
5. Reviewing technical, economic, and other data submitted by the affected lessee/operating rights owner in support of the lessee's position pertaining to the potential drainage situation.
6. Determining whether drainage is occurring or has occurred and determining the drainage factor that is applicable for each case. The State Director also reviews technical, economic, and other data submitted by the affected lessee regarding the potential drainage situation.
7. Determining if the lessee/operating rights owner could have drilled an economic protective well.
8. Establishing when compensatory royalty is assessed by determining the date from which compensatory royalty assessment begins and the date or conditions upon which the assessment ends.
9. Notifying the lessee, as appropriate, of the Bureau's assessment of compensatory royalty and of the lessee's rights for review and appeal.
10. Providing the Office of Natural Resources Revenue (ONRR) with appropriate data to set up compensatory royalty accounts, when applicable.
11. Providing guidance and assistance to District and Field Office Managers when any of the above responsibilities are delegated.

12. Ensuring quality control of the drainage program by gathering Field Office progress reports, evaluating content and verifying context, providing oversight for cases resolved by their Field Offices, and transmitting the Quarterly Fluid Minerals Report (QFMR) to the Washington Office each quarter, including a copy of any supporting work (or cuff) record to support the reported accomplishments. (Illustration 1)
 13. For consistency and uniformity, the BLM State Director must use the QFMR to report drainage program accomplishments.
- D. The District or Field Office Manager may carry out any or all of the responsibilities delegated by the State Director.
- E. The Office of Natural Resources Revenue (ONRR). The ONRR sets up and subsequently maintains compensatory royalty accounts in accordance with the Onshore Energy and Mineral Lease Management Interagency Standard Operating Procedures, signed by the Assistant Secretary, Policy, Management and Budget in September 2013. These responsibilities include determining dollar amounts of royalty due, collecting any compensatory royalty due, and requesting input from the BLM if problems arise. The ONRR also provides information to the BLM to verify that compensatory royalty is assessed and provides the BLM a copy of ONRR's quarterly report on compensatory royalty assessments and agreements.
- F. Bureau of Indian Affairs. The Bureau of Indian Affairs (BIA) approves leases of Indian lands, manages lease information, and approves or grants agreements when applicable for tracts where there is potential drainage (depending on the type of agreement). Indian tribes or individual Indians generally own the beneficial mineral interest for their lands; however, they are under the jurisdiction of the BIA for leasing purposes and the BLM for issuing drilling permits and managing production operations and lease compliance responsibilities for those tribes and individual Indians, with the exception of the Osage Mineral Estate and the restricted lands of members of the Five Civilized Tribes.

1.5 References and Relevant Documents

BLM Final Rule entitled “Oil and Gas Leasing: Onshore Oil and Gas Operations, “66 Fed. Reg. 1883 (Jan.10, 2001). The rule amended 43 C.F. R. parts 3100, 3130, and 3160. It clarified the responsibilities of oil and gas lessees and operating rights owners for protecting Federal and Indian oil and gas resources from drainage; specified when the obligations of the lessee or operating rights owner to protect against drainage begin and end; clarified the steps to take to determine if drainage is occurring; and specified the responsibilities of assignors and assignees for reclamation and other lease obligations. The effective date of the rule was April 10, 2001. 66 Fed. Reg. 9527 (Feb. 8, 2001).

- A. Onshore Energy and Mineral Lease Management Interagency Standard Operating Procedures (SOP) (2013). These procedures establish common standards and methods for creating effective working relationships among the BLM, BIA, and ONRR to achieve accurate energy and minerals accountability for onshore Federal and Indian leases.
- B. BLM Handbook H-3109-1 - Leasing Under Special Acts. This handbook contains guidance and procedures for processing Federal oil and gas leases and compensatory royalty agreements under the Act of May 21, 1930, involving leasing on certain rights-of-way and easements, and for the leasing of the oil and gas mineral rights under other special Acts.
- C. Memorandum from the Assistant Solicitor, Onshore Minerals, Energy and Resources, to the BLM Assistant Director for Energy and Mineral Resources, regarding "Various Drainage Issues" February 28, 1988 (BLM.ER.0648).
- D. Memorandum from the Assistant Solicitor, Onshore Minerals, to the BLM Director regarding "Appeal of CSX Oil and Gas Corp., G.J. Morgan, 104 IBLA 188 (1988) (BLM.ER.0667)
- E. *Nola Grace Ptasynski*, 89 I.D. 208, 63 IBLA 240 (1982).
- F. *Bruce Anderson*, 80 IBLA 286, (1984).
- G. *Gulf Oil Exploration & Producing Co.*, 94 IBLA 364 (1986).
- H. *R. K. Teichgraeber*, 96 IBLA 249 (1987).
- I. *CSX Oil and Gas Corp.*, 104 IBLA 188 (1988).
- J. *Atlantic Richfield Co.*, 95 I.D. 235, 105 IBLA 218 (1988).
- K. *Chevron U.S.A. Inc.*, 107 IBLA 126 (1989).
- L. *Cordillera Corp.*, 111 IBLA 61(1989).
- M. *Cowden Oil & Gas Properties*, 126 IBLA 32 (1993).
- N. *Amoco Production Co.*, 101 I.D. 39, 129 IBLA 186 (1994).

O. *Burlington Resources Oil & Gas Co.*, 153 IBLA 45 (2000).

P. *Great Western Drilling Co.*, 156 IBLA 42 (2001).

1.6 Policy

One of the BLM's primary responsibilities is to protect the United States Government and Indian lessors from loss of royalty revenues due to drainage. This Manual provides supplemental guidance to enable the BLM to fulfill its responsibility for ensuring that the public and Indian lessors receive full value for their oil and gas resources. Under the terms of Federal and Indian leases and the regulations in 43 C.F.R. parts 3100 and 3160, the lessee is required to drill and produce wells in a manner that protects the lease from drainage, if a protective well would be economic; or, with the consent of the authorized officer, to pay compensatory royalties. The BLM prioritizes drainage casework by using a production screen to estimate what the draining well is capable of producing based on publicly available data gathered on nearby wells producing in the same area or geologic horizon. The BLM ranks wells estimated to produce large amounts of oil and gas higher than those wells expected to have marginal or uneconomical production potential.

Chapter 2 - Potential Drainage Situation Procedures

2.1 Guidelines

A. Categories of potential drainage situations (Illustration 2)

1. **Ownership.** A potential drainage situation exists for Federal minerals where there is production of oil and gas resources from a well on adjacent lands not owned by the United States. A potential drainage situation exists for Indian lands where there is production of oil or gas resources from a well on adjacent lands not owned by the Indian tribe or individual Indian.
2. **Royalty Rate.** A potential drainage situation exists for Federal minerals where there is production of oil or gas resources from a well on an adjoining Federal lease bearing a lower royalty rate. A potential drainage situation exists for Indian lands where there is production of oil and gas resources from a well on adjoining Indian lands and individual Indian leases bearing a lower royalty rate.
3. **Lease Account.** A potential drainage situation exists for Federal and Indian lands where there is production of oil or gas resources from a well on an adjoining Federal lease when the revenues from that lease are distributed to different accounts. Specifically, this applies to wells on public domain lands draining acquired lands or wells on acquired lands draining public domain lands.
4. **Participation.** A potential drainage situation exists for Federal minerals where there is production of oil or gas from a well in which the Federal Government receives royalties, but at a smaller participation or allocation rate than the Federal minerals drained. Specifically, this applies to split mineral interests (e.g., 50 percent Federal, 50 percent either private or State), and lower Federal participation encountered in adjacent units and communitized areas.

B. The Prudent Operator Rule. The Interior Board of Land Appeals (IBLA) in *Nola Grace Ptasynski*, 63 IBLA 240 (decided April 19, 1982), 89 I.D. at 212, defined the Prudent Operator Rule as follows: “Under the usual statement of the standard for prudent operation there is no obligation upon the lessee to drill offset wells unless there is a sufficient quantity of oil or gas to pay a reasonable profit to the lessee over and above the cost of drilling and operating the well.” This economic principle has been codified in the regulations at 43 CFR 3162.2-5, which provides, “You are not required to take any of the actions listed in §3162.2-4 if you can prove to BLM that when you first knew or had constructive notice of drainage you could not produce a sufficient quantity of oil or gas from a protective well on your lease for a reasonable profit above the cost of drilling,

completing, and operating the protective well.” See also 3162.2-9(a): “As a prudent lessee, it is your responsibility to ... determine ... (3) Whether a protective well would be economic to drill.” This economic test may be applicable in some but not all drainage cases.

C. Compensatory Royalty. Protection against drainage is an express covenant of the standard Federal oil and gas lease agreement. Section 4 of BLM Form 3100-11 (October 2008) reads as follows: “Lessee must drill and produce wells necessary to protect leased lands from drainage or pay compensatory royalty for drainage in amount determined by lessor.” This requirement is incorporated in the regulations at 43 CFR 3162.2-4. The lessee must notify BLM within 60 days from the date of actual or constructive notice that drainage may be occurring as to which of the protective actions listed in 3162.2-4 the lessee will take. (43 C.F.R. 3162.2-9(b)) The BLM’s authorized officer will consider the lessee to have had constructive notice when a well completion or first production report for the draining well is filed with either the BLM, State oil and gas commissions or other regulatory agency, and was publicly available (43 CFR 3162.2-6).

If the lessee does not notify the BLM of plans to take protective action within 60 days, or if the lessee determines that drainage is not occurring, the lessee must provide evidence that the drilling of a protective well is not needed or is not economic. If the authorized officer does not agree with the lessee’s determination, the BLM must initiate action to collect compensatory royalty that the authorized officer determines is due for drainage.

Assessment of compensatory royalty will commence beginning on the first day of the month following the earliest reasonable time the BLM determines that the lessee should have taken protective action. In making this decision, the BLM may consider criteria that includes rig availability, time needed to acquire an approved drilling permit, average drilling time, and other aspects specific to the area. No compensatory royalty is assessed during the “reasonable time.” If BLM determines that the lessee did not take protection action timely, the lessee will owe compensatory royalty for the period of the delay. (43 C.F.R. 3162.2-11(c) and 3162.2-12)

Compensatory royalties, when assessed, will continue until:

- Lessee drills sufficient economic protective wells and remain in continuous production;
 - BLM approves a unitization or communitization agreement that includes the mineral resources being drained;
 - The draining well stops producing and is permanently plugged and abandoned; or
 - Lessee relinquishes interest in the Federal or Indian Lease.
- (43 C.F.R. 3162.2-12)

2.2 Well and Administrative Review

The following guidelines and procedures are outlined in the Drainage Flowchart (Illustration 3).

As directed in 43 C.F.R. 3162.2-9, it is the lessee's responsibility to monitor all drilling activity in the same or adjacent spacing or land units as leased lands and to analyze and evaluate information to determine the amount of drainage occurring from production of the draining well; the amount of mineral resources which will be drained from the Federal or Indian lease during the life of the draining well; and whether a protective well would be economic to drill. The lessee must notify BLM within 60 days from the date of actual or constructive notice of drainage about the actions in §3162.2-4 that will be taken (drill a protective well, enter into a unitization or communication agreement, or pay compensatory royalties); or the reasons a protective well would be uneconomic. If the lessee does not have sufficient information to notify BLM as required, the lessee must indicate when it will provide the information. If the BLM requests it, the lessee must provide the analysis required by 43 C.F.R. 3162.2-9 within 60 days after the request. The BLM Field Offices will evaluate all wells to determine the possibility of drainage by reviewing the contiguous spacing units, or in states that do not establish spacing units, by reviewing aliquot parts totaling at least 40 acres in the case of gas or 160 acres in the case of oil, unless the entire lease is smaller for the applicable land.

A. Well Review. The well review may identify a drainage case as follows:

1. Identify all well completions and recompletions. Note that the surface location and bottom-hole location often differ due to technology advancements that result in more horizontal and directional completions.
2. Identify and separate all wells by completions into two categories:
 - (1) Completions that do not create potential drainage situations (document and record method of determination); and
 - (2) Completions that do create potential drainage situations (these completions will require a detailed administrative review). All wells on or adjacent to Federal or Indian lands may create a potential drainage situation. Because many oil and gas wells drilled in the U.S. in recent years involved horizontal completions into shale gas and shale oil formations using hydraulic fracturing completion techniques, the review must determine if potentially draining wells were drilled through or were completed within the Federal or Indian lands subsurface estate. Additionally, wells with surface locations on fee lands not adjacent to Federal or Indian lands may create potential drainage situations if their bottom-hole locations target the Federal or Indian mineral estate in the area.
3. Identify Federal and Indian wells that are shut-in but capable of economic production that offset potentially draining wells. Selective shut-in of such wells, while the offset wells are still producing, may create drainage situations.
4. Field Offices must use a production or similar type of screen based on professional judgment and experience in the area to resolve potential drainage situations that are not likely to cause drainage. Field Offices must document the screening processes they use to resolve cases and keep a record of all cases resolved. The State and

Washington Offices will periodically review the resolved cases for context and completeness. The BLM will not establish a potential drainage situation as a case unless it passes this screen.

B. Administrative Review. When offices identify drainage cases during the well review, they will conduct a further administrative review to determine if there is an administrative resolution by which the Federal or Indian lessors are or can be protected. See Illustration 4 for an example of a checklist showing the data that Field Offices must review and include, either by copy or by reference, in the case file. The Administrative Review will:

1. Identify Federal or Indian lands where uncompensated loss of revenue could occur from different ownership, royalty rates (royalty rates can differ on portions of a lease or can differ by horizon), lease revenue accounts and participation or allocation. This would require a review of the spacing or land unit in which the potentially draining well is located and all adjoining spacing or land units.
2. Identify the existence of, or need for, any agreements that would protect Federal or Indian lands from drainage, for example, unit agreements, unit participating areas, communitization agreements, compensatory royalty agreements and other agreements.
3. Identify, on a spacing or other land unit and reservoir basis any actual or proposed drilling, producing, or abandoned Federal or Indian wells that may satisfy the requirements of protective wells. Such wells would include:
 - a) A well that is producing from the same reservoir(s) or horizon(s) in the case of horizontal or directional well completions,
 - b) A well that formerly produced from that reservoir and is now depleted, or
 - c) A well that adequately tested the reservoir.
4. File and Records Maintenance: The BLM Field Offices establish and retain an official case file for each drainage case. Each case file will include all data and information regarding the identification and resolution of each drainage case. Files are kept in the Official Field Office files under Oil and Gas Operations 3160. These case files are necessary in case of internal reviews, State Director Reviews, IBLA filings, FOIA Requests, or litigation. Record maintenance requirements vary depending on file type and are found in BLM Manual Section 1220 – Records and Information Management Drainage Identification Data Standards. Establishing a case file includes these steps:

- a) Prepare a drainage case file for each drainage case. Offices need to follow all rules pertaining to work file maintenance case according to BLM Records Policy. The official case file must contain a complete record of all reviews and reports, including the geologic, reservoir engineering, and well completion review, economic data and reports, and all pertinent correspondence.
- b) Use a consistent method among all field offices to establish a unique drainage case number(s) for each potential drainage case.
- c) Enter drainage cases into an automated drainage case tracking system. At a minimum, the tracking system should identify the draining well by API number and correlate the draining well, drained lease number, drained area, reservoir, and drainage case number. All Field Offices should maintain drainage case tracking system records and use the Drainage Protection Quarterly Fluid Minerals Report (Illustrations 1a and 1b) to provide the Washington Office with updates.
- d) The Washington Office will review the Drainage Protection Quarterly Fluid Minerals Report for context and consistency, identify emerging policy needs, and issue any necessary further guidance.

C. Case Prioritization. The reviewer assigns a priority classification to each case using a method that ensures royalty is not permanently lost due to, for example, unleased lands or a statute of limitations. They also ensure that the review of the drainage workload is done efficiently. The BLM must document the method used to prioritize cases.

Initial Contact Letter. If the lessee(s) has not notified the BLM within 60 days of actual or constructive notice of drainage, then at the conclusion of the administrative review, the BLM sends an initial contact letter to the lessee(s), as appropriate, informing them of their drainage case protection obligations and their requirement for taking protective action or proving technical data relative to each drainage case. The letter also instructs the lessee(s) to submit geologic and engineering data within 60 days of receipt of the letter if they believe that drainage is not occurring or that the drilling of an economic protective well is not feasible. An example of an initial contact letter is provided in this Manual (Illustration 5).

2.3 Technical Review

The Geologist and Petroleum Engineer (PE) perform a technical review when a well review establishes a drainage case. The technical review consists of a combination of geologic, well completion, and reservoir engineering reviews. The Geologic Review provides appropriate maps and reservoir parameters for comprehensive geologic reports (Illustration 6). The reservoir engineering review examines the reservoir and establishes the reservoir energy mechanism, the original oil or gas resources, the estimated ultimate recovery, and the probable areal extent of

drainage. The geologic, reservoir engineering, and well completion reviews must make clear recommendations to continue or resolve the case at each stage of the review.

- A. Geologic Review.** The Geologic Review (GR) is conducted after the administrative review and prior to, or in conjunction with, the Reservoir Engineering Review to determine whether it is geologically possible for drainage to occur. The Geologic Review will further identify or eliminate cases based on geology and provide reservoir parameters to the PE. A report that documents the geologic review is required. Supporting geologic documentation may include evidence for faults, permeability/porosity barriers, gas/oil-water contacts, and other structural/stratigraphic limitations. Other supporting documentation such as well logs, isopach, and structural contour maps, field reports, when appropriate, are included or referenced by the geologist in the case file to substantiate the conclusions of the review. The geologist may close a case at this point if they conclude that drainage is not geologically probable. Example: Illustration 6.
- B. Reservoir Engineering Review.** A Reservoir Engineering Review (RER) follows the Geologic Review, except in cases where the geologic review precludes drainage. The Reservoir Engineering Review determines the estimated ultimate recoverable resources and probable drainage area of the potentially draining well. The petroleum engineer must determine if the area drained by the potentially draining well intersects a property boundary. If so, the reviewer may determine that compensable drainage is indicated. The petroleum engineer determines whether to continue the case, if drainage is likely, or to close the case if no economic drainage is probable. The case file must include or reference supporting documentation and calculations to substantiate the conclusions of this review. Examples: Illustrations 7& 8.
- C. Well Completion Review.** The BLM must monitor wells spudded on fee or State lands that are subject to completion in the Federal or Indian mineral estate. When State Oil and Gas Conservation Commissions notify mineral owners of the subsurface estate about an operator's plan to drill through or complete horizontal wells, the Field Office technical staff must attend State Oil and Gas Hearings that involve Federal or Indian mineral spacing or drilling orders. For those State Commissions that do not notify mineral owners who own less than 10 percent of the mineral estate, BLM staff must monitor fee wells and review well completion reports where vertical wells are potentially drilled through or are completed in the Federal or Indian mineral estate. Where Federal minerals are under the jurisdiction of other Surface Management Agencies and operators plan to complete horizontal directional wells adjacent to the Federal mineral estate, the BLM will obtain consent for well completion from the Surface Management Agency with jurisdiction over those lands with the necessary lease stipulations and site-specific

conditions of approval to protect those lands from damage during drilling and producing operations. When horizontal or directional wells are completed adjacent to Federal minerals that are excluded from leasing, the BLM will negotiate a Compensatory Royalty Agreement (CRA) with the owner of the producing well to compensate the Government for drainage of oil and gas resources. The wellbore design, zonal isolation, and producing formation review will occur during the Application for Permit to Drill approval process to confirm reservoir drainage applicability.

2.4 Expired Leases

The BLM may initiate drainage cases to collect compensatory royalty on expired leases if the former lessee of an expired lease allowed drainage to occur during its active lease tenure. In that situation, the former lessee is liable for payment of compensatory royalty during the time that the former lessee held the lease that was subject to drainage during the time it was subject to drainage. Prior to the assessment of compensatory royalties, the BLM must conduct a prudent operator economic test to determine if the drilling of an economic well was feasible during the time that drainage started to occur. The commencement date for payment of any compensatory royalty is the date established through the constructive notice procedures. The termination date of such compensatory royalty is the date of lease expiration or the date of last production of the draining well, whichever occurs first.

2.5 Unleased Federal and Indian Minerals

The BLM or the BIA must lease and protect unleased Federal and Indian minerals identified as drainage cases as soon as possible. If unleased Federal minerals are under the jurisdiction of another Surface Management Agency such as the U.S. Fish and Wildlife Service, U.S. Forest Service, or U.S. Army Corps of Engineers, the BLM must obtain consent and work with the agency to authorize leasing and ensure that appropriate stipulations are added to the lease prior to leasing, as necessary. The procedures for resolving these situations are outlined below.

Unleased Federal minerals. If the administrative and technical reviews indicate that unleased Federal minerals are subject to potential drainage, the authorized officer notifies the BLM adjudication office by memorandum in order to initiate leasing of the subject lands. The BLM may not lease or allow surface occupancy on certain lands managed by the BLM or other Surface Management Agencies (e.g., National Forests, Wildlife Refuges, Wild and Scenic Rivers lands, Wilderness Areas), unless a drainage situation exists. If leasing is not possible or it is not in the overall public interest to lease and it is determined that drainage is occurring, the BLM will attempt to work with the Surface Management Agency and the operator of the draining well to satisfactorily resolve issues through a protective lease. If during the drainage case review process, the BLM finds wells drilled on unleased Federal lands, these wells are in mineral trespass, as specified under MS-9235 MINERAL TRESPASS, p. 12 c, . Section .14.

A.

1. **Drainage Stipulation.** When the subject lands are offered for lease, a special drainage stipulation is attached to the notice of sale and the lease. An example of a drainage stipulation is shown in this Manual (see Illustration 9).

2. **Compensatory Royalty Agreement.** If lands are excluded from leasing by the Mineral Leasing Act, or if attempts to lease unleased acreage are unsuccessful, the BLM will pursue a Compensatory Royalty Agreement jointly with the operator of the draining well. The negotiations for a Compensatory Royalty Agreement or other agreement with the operator of the draining well is pursued jointly with the adjudication staff (See BLM Adjudication Handbook H-3109-1, Leasing Under Special Acts). The appropriate BLM office maintains a file for each Compensatory Royalty Agreement. If negotiations of a Compensatory Royalty Agreement are unsuccessful, the BLM will offer these unleased lands during a lease sale. An example of a Compensatory Royalty Agreement that is used to resolve drainage situations for unleased Federal minerals is shown in Illustration 10 of this Manual.

B. Unleased Indian minerals. If the administrative review indicates that unleased Indian minerals are subject to drainage, the BLM must notify the BIA by memorandum to initiate leasing or negotiate an agreement that affords protection for the lease. An example of such a memorandum to the BIA is provided in Illustration 11 of this Manual.

2.6 Demand Letter

If the lessee does not respond within the period specified in the initial contact letter as specified in 43 CFR 3162.2-9, a demand letter is issued to all responsible lessees. The demand letter is sent via Certified Mail- Return Receipt Requested with a response due within 60 days from the date indicated on the return receipt. The responsible BLM office may send copies of the letter to other potentially affected parties at its discretion. The demand letter informs the affected lessees of their responsibility to protect the lease from drainage and requires them to submit a plan for protecting the Federal or Indian lease from drainage. The demand letter defines the affected lessees' options, which include the drilling of a protective well(s), payment of compensatory royalty, partial or total lease relinquishment, establishment of protective agreements, or any combination of these options that will resolve the drainage situation by protecting the Federal or Indian lessors from loss of mineral resources and revenue. The lessees may alternatively submit geologic, reservoir engineering, or economic data sufficient to show that there is no drainage or that an economic protective well cannot be drilled. The authorized officer will review the data that lessees submit and determine whether available geologic and reservoir data indicate drainage of mineral resources is likely occurring. The burden of proof is on the responsible lessee to dispute the assertion or findings of drainage. An example of a demand letter is provided in this Manual (Illustration 12).

2.7 Drainage Case Resolution

The BLM will allow the lessee 60 days to respond after the demand letter is issued. If no response from the lessee is received within that time, a follow-up letter is sent specifying consequences of failure to file the requested information. Failure to comply with an order of an

authorized officer could result in a noncompliance assessment. The authorized officer may grant an extension in which to file documentation if the lessee makes a justifiable request.

A. Lessee Takes Protective Action. When the lessee agrees and notifies the BLM that drainage is occurring and will take steps to protect the lease within the 60-day timeframe specified, the responsible BLM office evaluates the proposal. The authorized officer is the final authority on the adequacy of the proposed protection based on the BLM's independent evaluation. The BLM determines separately the adequacy of the protective measures for each case that is subject to drainage resolution and determines whether compensatory royalty assessment is due. If compensatory royalty is due, the BLM completes the Final Technical Analysis to determine the drainage factor. The drainage factor is the percentage of the draining wells' production that is attributable to the lease being drained. In cases where Indian lessors refuse to accept BLM's drainage case findings, the BLM takes the following steps:

- (1) Specify to the BIA the reasons for the drainage recommendation;
- (2) Notify the individual Indian/Indian tribe through the BIA that failure to accept the BLM's recommendation could result in the uncompensated loss of Indian oil and gas resources; and
- (3) Recommend to the individual Indian/Indian tribe discussions on the case with the appropriate BLM office and seek independent counsel.

B. Lessee Dispute of Drainage or Economics. If the lessee disagrees that drainage is occurring or that an economic protective well could have been drilled, the BLM conducts an independent technical analysis and evaluates any new data submitted by the lessee. If the Bureau's findings conclude that no drainage is occurring or has occurred, the drainage case is closed and an appropriate decision letter is issued (Illustration 13). If the Bureau's findings indicate drainage is occurring and a favorable economic well determination is made, the BLM issues a decision letter advising the lessee of the assessment of compensatory royalty .

If the Bureau's findings indicate that drainage is occurring but that an economic protective well could not have been drilled since the obligation to protect from drainage began, the lessee is notified that no compensatory royalty is due for any drainage that has already occurred but future economic conditions may require drainage protection. The case is monitored for such economic changes and reevaluated when warranted. An example decision letter pertaining to this situation is shown in the Manual (Illustration 14).

C. Lessee does not timely notify the BLM or Respond to Demand Letter. If the lessee does not respond to the demand letter, the responsible BLM office conducts an independent technical analysis with available data. If the BLM's findings conclude that no drainage is occurring, the case is closed; however, if the BLM's findings indicate drainage is occurring and a favorable economic well determination is made,

the BLM advises the responsible lessee through a decision letter sent Certified Mail-Return Receipt Requested. Compensatory royalty is assessed until such time that the lessee provides an alternate method of protection acceptable to the authorized officer. An example of such a decision letter is provided in this Manual (see Illustration 15).

2.8 Final Technical Analyses

The BLM petroleum engineers and geologists conduct independent final technical analyses after the lessee responds to the demand letter or after the demand letter timeframe expires. The responsible office makes a comparison of the BLM's independent findings and the lessee's submittal of supporting information. Reviewers ensure that they track and pinpoint the wellbore path and whether directional or horizontal wells completed using hydraulic fracturing techniques are producing from the Federal or Indian mineral estate. The BLM resolves and explains any significant differences and completes the final geologic review, well completion, and reservoir engineering reports for the case file, including a geologic analysis and report, the horizontal or directional well completion review, and a reservoir engineering/economic analysis and report.

A. Geologic Analysis. The geologic analysis is a final comprehensive examination of the lithology, structural, and stratigraphic components of the subject area to determine whether drainage is geologically possible. The subject reservoir is analyzed as to its limits and physical characteristics using all available data. Similarities and differences between the BLM independent geologic analysis and the lessee's geologic analysis, if submitted, are discussed and resolved in the final report that describes in detail how the geology affects drainage in the subject area. The technical components necessary to complete the final geologic analysis and subsequent final report are outlined as follows:

1. Use all available well logs from the draining well and from as many surrounding wells as necessary and prepare geologic maps and cross sections to determine:
 - a) Areal extent and net pay of the producing reservoir(s).
 - b) Trapping mechanism (structural/stratigraphic).
 - c) Position of gas/oil/water contacts, if they exist.
 - d) Geologic conditions that preclude or otherwise influence the drainage pattern, such as:
 - i. Structural dip.
 - ii. Faults, folds, fractures.
 - iii. Stratigraphic pinch-outs, facies changes.

- iv. Porosity/permeability barriers.
2. Correlate well logs from the draining well with the well logs from the surrounding wells, including factoring in wellbore paths (especially for horizontal and directional wells). Analyze the well logs to determine:
 - a) Lithologic characteristics of the reservoir;
 - b) Net pay;
 - c) Porosity;
 - d) Water saturation;
 - e) Formation temperature;
 - f) Gas/oil/water contacts, if they exist;
 - g) Other geologic features or properties that may influence drainage.
 3. Substantiate and support the findings.
 - a) Consult published and unpublished literature covering the geology of the field.
 - b) Consult published and unpublished structure contour maps, structural and stratigraphic cross sections, and isopach maps of the field.
 4. **Geologic Map Standard.** Plot geologic maps on standard base maps. Each geologic map will contain the following:
 - a) A border line.
 - b) A legend block that includes:
 - i. Title, author, and study completion date (same date as report);
 - ii. North arrow;
 - iii. State and county boundaries;
 - iv. Signature of the geologist and date (dated same as report);

- v. Signature of reviewers and date reviewed;
 - vi. Bar scale;
 - vii. Line(s) of cross section (when applicable); and
 - viii. Definitions of all symbols used on map.
- c) Supporting geological data. Examples are:
- i. Structural closure on an anticline or dome;
 - ii. Isopach of a porous and permeable body containing oil or gas;
 - iii. Oil/gas/water interface(s);
 - iv. Porosity/permeability barriers;
 - v. Faults; and
 - vi. Other geologic characteristics that restrict the movement of oil or gas.

5. **Geologic Report.** Document the geologic analysis above and file a complete, signed, and dated comprehensive geologic report with appropriate maps (Illustration 16).

B. Reservoir Engineering/Economic Analysis. The reservoir engineering/economic analysis is the final examination of the reservoir performance, production history, and economic determinants used to establish whether a drainage situation exists and the feasibility of drilling an economic protective well. The BLM will evaluate any data the lessee submits and resolve or explain any significant differences from the BLM analysis. (Illustration 17)

1. **Ultimate Recoverable Resources.** The BLM will compute the Estimated Ultimate Recovery (EUR) attributable to the draining well using the geologic and engineering data along with information available from such sources as Reservoir Engineering Review, Geologic Review, lessees, operators, approved BLM software, publications, analogy wells, etc. The method of analysis is based on the parameters available and may include material balance, production decline curves, pressure analysis, and volumetric or geometric calculations. This step includes documenting the method used in

conducting the analysis including formula, parameters, and source and examining the reservoir and fluid properties from the wells surrounding the draining well to determine:

- a) Pressure history.
 - b) Recovery factor.
 - c) Permeability.
 - d) Net pay.
 - e) Residual oil saturation.
 - f) Production history.
 - g) Reservoir energy mechanisms.
 - h) Reservoir boundaries.
 - i) Specific gravity.
 - j) Compressibility.
 - k) Formation volume factor.
 - l) Viscosity.
 - m) Gas/oil ratio.
2. **Drainage Area and Configuration.** The reviewer determines the drained volume and estimates the probable drainage area and configuration after calculating the approximate recovery factor and the ultimate recoverable reserves of the draining well. The reviewer also considers all known or calculated flow boundaries such as faults, permeability barriers, interference from nearby wells, etc., in determining the drainage configuration. If the bottom-hole location differs significantly from the surface location, the location in the drained reservoir is used to determine the drainage configuration.
3. **Determine Whether Drainage Occurs.** After the drainage configuration is determined, the reviewer establishes whether the drainage area of the well intersects a property boundary. If it does, they determine the reserves in the drained portion of the lease and the drainage factor, as explained below.

4. **Drainage Factor.** The drainage factor is the percentage of the draining well's production attributable to the lease being drained and is calculated as the percentage of the draining well's total drainage volume that lies below the drained lease. The authorized officer establishes the drainage factor that the ONRR uses to compute the amount of the monthly compensatory royalty assessment for each product using the following equation:

Monthly Compensatory Royalty Charge	EQUALS	Product Sold from Draining Well	X	Product Value	X	Royalty Rate of Drained Area	X	Drainage Factor	X	Special Factors (as needed)
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*Special factors may include differences in royalty rates or allocation factors if both the draining tract and drained tracts are Federal or Indian leases, including other applicable considerations.

5. **Economic Well Determination.** If drainage is indicated, the BLM conducts an economic well determination to establish if a prudent operator is capable of drilling an economic protective well on the lease under evaluation for drainage. This analysis is conducted using a discounted cash flow (DCF) procedure to calculate a before-Federal income tax (BFIT) rate of return (ROR). The drilling of an economic protective well is feasible if the analysis returns a positive net present value when using the applicable discount rate as established in this Manual or, equivalently, results in a DCF ROR greater than the discount rate. Summary sheets showing discount rates used for an economic well determination are shown in the Manual (see Illustration 18).

The following sections are components of the economic well determination.

- a. **Gross Production.** The ultimate recoverable resources is the total oil or gas that a protective well is expected to produce the first time the drilling of an economic well is known. The production of these resources is projected and modeled using conventional reservoir engineering methods (volumetrics, decline curve analysis, material balance, etc.) when applicable and is derived from the draining well (or other area wells) considering all pertinent reservoir factors. The condition of the reservoir at the time the well is drilled must also be considered in determining the estimated ultimate recovery and the projected production.

- b. **Net Production.** Net annual production is calculated by multiplying the gross annual production by the revenue interest of the lessee. The revenue interest is 100 percent less the Federal or Indian royalty and over-riding royalties.
- c. **Product Price.** The value for oil and gas pricing is based on the sale prices of similar nearby wells during the applicable time. The current price per barrel of oil and per thousand standard cubic feet (MCF) of gas is based on the particular quality of the resource in the specific geographic area. Offices apply escalation of current prices consistent with the escalations used at the time the project should start and use industry standard projections when the lessee starts drilling a protective well.
- d. **Net Revenue.** Offices calculate the net revenue by multiplying the net production by the product price; operating costs are included in the next production from the well. The net revenue is projected annually until the economic limit of the well is reached. The economic limit is reached when the operating costs of the well, taxes, and depletion/depreciation allowances equal the net revenue.
- e. **Expenses.** The primary expenses associated with drilling an economic well are drilling, completing, and operating. These expenses are cash expenses and estimates are obtained from industry, professional publications, paying well determinations for similar wells, or experience in specific producing areas. Offices review the expenses of the draining well and other similar nearby wells with respect to the prudent operator rule, that is, the costs are not based on those of a particular operator but of a *prudent operator*. Offices apply escalation of estimated operating expenses consistent with the relevant market conditions. For example, episodes of dramatic worldwide oil price declines in 1985 to 1986 reduced oil prices more than one-half, but operating expenses remained high, and the same was true for the 2014 to 2015 reduction in oil prices. Offices use costs, prices, and expected escalations that were appropriate at the time of the project initiation, rather than the actual subsequent prices or costs.
- f. **Taxes.** Offices need to consider certain taxes in the economic evaluation including severance, ad valorem, and local taxes (exclusive of Federal income taxes). A severance tax is a sales tax based on production and ad valorem tax is property tax based on a diminishing

asset. These taxes vary between States, and offices must use current rates for each particular area.

- g. **Reasonable Rate of Return and Discount Rate.** The BLM uses the effective date that the well commenced drilling to determine the return and discount rates. The rate includes the components of value of money, inflation expectations, and perceived risk. The value of money and the inflation expectations are independent of the borrower and are estimated by the intermediate-term Government bond yield rate. The perceived risk for this type of project is similar to that of “B” bonds. To isolate the risk component of the yield for “B” bonds, the yield for the Government bond, perceived as risk-free, is subtracted. This value was projected back to 1926, the earliest known date of available data for Government bond yield rates (Illustration 18). The BLM Washington Office provides annual updates to this table.
6. **Reservoir Engineering/Economic Report.** The BLM Petroleum Engineer documents the procedures and methods, including formula and parameters, used to determine the reserves and the economics. The BLM Field Office must file a complete, signed and dated comprehensive Reservoir Engineering Report with appropriate maps.

2.9 Quality Control

Drainage cases that are identified or resolved (either administratively or technically) must comply with the established standards and procedures of this Manual and must have complete records of analyses and decisions. Quality control reviews are required for monitoring the review process. Implementation of the quality control program is the responsibility of each Field and State Office.

1. **Technical Review.** Peers with expertise in petroleum evaluations perform technical review for the Fluid Minerals program. The objectives of the review are to ensure that (1) established policy and procedures are followed; (2) normal technical principles and procedures are applied as appropriate; (3) all reasonably available information is considered; (4) the analysis is technically accurate; and (5) case files include proper, complete documentation. Offices must conduct enough quality control reviews to ensure that the program meets objectives. This Manual provides three checklists as examples of the documentation required, including the Drainage Case Quality Control Review (See Illustrations 4), the Geologic Quality Control Review (See Illustration 16), and the Reservoir Engineering Quality Control Review (See Illustration 17).

2. **State Office Review.** Each State Office must continually monitor its drainage program to ensure quality control. Oversight responsibilities may include:
 1. Active communication with the technical staff.
 2. Periodic due diligence visits to Field Offices conducting drainage reviews.
 3. Review of drainage documentation and tracking systems to ensure they are consistent among all BLM Field Offices.
 4. Consolidation and review of Quarterly Fluid Minerals Reports for accuracy; ensure the review is transmitted to the Washington Office on a quarterly basis; and provide a copy of the validation work and records to support the report.
 5. Review and provision of training according to Field Office needs.
 6. Review of automation needs so the Washington Office can provide appropriate hardware and software to the technical staff to conduct drainage reviews involving both vertical and horizontal horizons capable of production.
 7. Coordination with the appropriate BLM Field Offices and Field Solicitor on appeals and State Director Reviews.
 8. Notification of the Washington Office of the case numbers and dates of appeals to the IBLA.

3. **Washington Office Review:** The Washington Office must continually provide and update policy and provide direction and oversight of the program to ensure quality control. Responsibilities include:
 1. Ongoing communication with BLM Field Office staff including periodic Round Table calls to discuss the drainage program.
 2. Provision of budgetary resources necessary for Field Office to review drainage cases as a part of the Annual Work Plan.
 3. Provision of necessary automated reservoir analysis software and well data to conduct drainage reviews.
 4. Evaluation of Quarterly Fluid Minerals Reports for context, accuracy and consistency among BLM Field Offices. Review the work records to determine that the records support the reported numbers.
 5. Provision of oversight, review, and direction for the program to ensure that the BLM meets the objectives.

6. Identification of emerging trends and assessment of the vulnerability of the program as a part of oversight responsibilities; determination of policy updates and potential field office program reviews; and determination of program needs, staffing, and training.
7. Provision of audit responses to the Government Accountability Office and the Office of the Inspector General and edits to the source reports.

2.10 Coordination and Documentation

The authorized officer notifies the responsible lessee and affected agencies of the final decision in the appropriate sequence. In Indian cases, the BIA's concurrence must be documented prior to sending a decision letter to the lessee(s) and affected parties.

A. The Decision Letter. A decision letter is prepared documenting the drainage protective actions, if any, that are required. The decision letter to assess compensatory royalty will be conveyed initially only to the responsible lessee(s) and always sent Certified Mail-Return Receipt Requested. The decision letter will contain the following information:

1. Lease serial number.
2. Description of drained tract and formation(s).
3. Summary of the drainage determination.
4. Drainage factor, if applicable.
5. Draining well(s) name(s) and location(s).
6. Period of compensatory royalty assessment, if applicable.
7. State Director Review and appeal rights pursuant to 43 CFR 3165.3(b), 3165.4, 4.411 and 4.413.

B. Notification and Request to ONRR. ONRR is notified once the appeal period is exhausted or, if appealed, once the authorized officer's decision or the State Director Review (SDR) decision, if requested, is final. For Federal minerals, the decision is appealed to the Interior Board of Land Appeals (IBLA). ONRR is not notified unless IBLA renders a final decision upholding the authorized officer. For Indian lands, the decision is appealed to IBLA, and ONRR is notified that the decision/determination is on appeal once the appeal is taken. The BLM provides ONRR a copy of the certified Decision Letter and the required information listed below and asks ONRR to compute, bill, and collect the monies owed. An example letter to ONRR is shown in the Manual (see Illustration 19). The required information to be provided when

notifying ONRR of a decision to assess compensatory royalty for drainage includes the following:

1. Draining Well.

- a) Operator's name.
- b) Well name, number, and/or API number.
- c) Well location, surface or bottom-hole location in the case of horizontal or directional wells penetrating the Federal or Indian mineral estate. (Quarter-quarter and/or footages, section, township, range, principal meridian, county, and State).
- d) The complete lease serial number, or communitization agreement number, or unit agreement name and number if a well is located on a Federal or Indian lease or on a tract within and committed to a federally approved and supervised communitization or unitization agreement, as appropriate.
- e) The formation name (and depth of the producing interval) in which the drainage is occurring.
- f) The date that compensatory royalty begins.
- g) If established, the date that compensatory royalty terminates; otherwise, indicate that compensatory royalty will continue until the ONRR is subsequently notified of its termination.
- h) The average gravity of the oil or condensate produced from the formation involved.
- i) The average British thermal unit (BTU) content of the gas produced from the formation involved.
- j) For all Federal or Indian Lease wells, a copy of, or the necessary information from the applicable Monthly Report of Operations (Form 9-329 and/or ONRR Form 3160 and /or OGOR) for each month that compensatory royalty is assessed. If compensatory royalty assessment continues beyond the date of the initial advice to ONRR, ONRR will obtain the necessary information from the State or payor. Where any such reports are unavailable because the ONRR converted the lease, CA, or unit participating area to the Production Accounting and Auditing System (PAAS), the BLM notifies ONRR
- k) For State or Fee wells, information regarding the monthly production and sales of oil and gas for the draining well from the beginning of the assessment

period through the conclusion, or the available production to date. If the assessment continues beyond the initial advice, ONRR will, thereafter, obtain the needed information from the State or payor.

2. Drained Acres.

- a) The drainage factor and special factor, if applicable.
- b) As appropriate to the acreage being drained, the complete serial number of the Federal or Indian lease, or the communitization agreement number, or the unit agreement name and number.
- c) The name of the lessee(s)/operating right owner(s) responsible for protecting the lease, communitized area, or unit area from drainage.
- d) Where a communitized area is experiencing drainage, the complete serial number of each Federal and/or Indian lease within the communitized area and the respective percentage of participation attributable to each such lease.
- e) Where a unit area is experiencing drainage, the complete serial number of all Federal and Indian leases within the affected participating area and the respective percentage of participation attributable to each such Federal and Indian lease. Where the unit acreage that is subject to drainage is not in a participating area, the complete serial number of all Federal and Indian leases affected and the respective percentage of the drainage factor is attributable to each such lease.
- f) Where the drainage is occurring between Federal or Indian leases having the same mineral ownership and distribution of funds (for example, a public land lease draining another public land lease or a Navajo tribal lease draining another Navajo tribal lease) because of diverse royalty rates, include the applicable royalty rate for both the draining and drained lease.

Address this information to the Program Management Director, Royalty Compliance Division, at the following address:

Office of Natural Resources Revenue
Royalty Compliance Division
P. O. Box 25165
Denver, Colorado 80225-0165

- C. Notification from ONRR to the BLM.** When compensatory royalty is assessed, ONRR will notify the BLM that a collection account for the recommended

assessment of compensatory royalty is established for the case. The case is not closed or resolved until the BLM receives notification from ONRR.

D. Reporting Requirements. Each State Office is responsible for collecting or compiling the data for the Quarterly Fluid Minerals Report. An example of the data reported is included in this Manual (Illustrations 1a and 1b.). The BLM uses the Quarterly Fluid Minerals Report for consistency across all states. The basic reporting elements are the number of cases resolved during the investigation process and through protective measures, and the estimated revenues from the latter as provided in the definition for Program Element “NC” in the Federal Business Management System guidelines. Each State Office is responsible for providing electronic versions of the Quarterly Fluid Minerals Report to the Washington Office at the end of each FY Quarter. Additionally, each State Office must provide an electronic version of the composite end of FY Report, totaling all data from their Field Offices, where applicable. The Washington Office will conduct a thorough review of the Quarterly Fluid Minerals Reports, including identifying emerging trends, potential concerns, and vulnerability of the drainage program. The Washington Office will provide feedback to State Directors concerning the results of the review, as appropriate. Examples of Drainage Review Cases are provided in Illustrations 20 & 21.

Chapter 3 - Appeals

Any lessee who is adversely affected by a drainage decision letter sent by the authorized officer may request a State Director Review and, if adversely affected by the State Director Review decision, may appeal that decision to Interior Board of Land Appeals (IBLA). (43 C.F.R. 3162.2-14 and 3162.2-15) The State Director or Administrative Law Judge may, under appropriate circumstances, order suspension of the requirement for compliance with an order or decision upon request or on the State Director's or Administrative Law Judge's own initiative. (43 C.F.R. 3165.4(c)) For Federal minerals, the BLM does not request that ONRR assess compensatory royalty until the decision is final, although any such royalty accrues during that time if IBLA upholds the decision of the State Director.

3.1 The State Director Review

If the lessee or other adversely affected party wishes to obtain a State Director Review for a decision on drainage, the request is made in accordance with 43 CFR 3165.3 (b). The State Director Review procedures should essentially follow the guidelines presented in Technical Review and are restricted to the issues raised in the request. Qualified petroleum geologists or reservoir engineers must review technical issues, as appropriate. A report is required to substantiate the decision of the State Director and placed in the official case file. Additional data that the appellant submits are evaluated as part of the State Director Review unless the data were not reasonably available to the appellant prior to the original decision. State Director Review decisions are appealable to the IBLA. Use Form 1842-1 to notify the lessee of the right of appeal to the IBLA.

A. Notice of Appeal to IBLA

All appeals to IBLA must strictly follow the regulations in 43 CFR Part 4. If a State Director Review decision is appealed, the appellant must file the notice of appeal to the IBLA in the office of the authorized officer that issued the decision within 30 days from the appellant's receipt of the decision so that the case file can be transmitted to the Board. A complete copy of the case file is made and the original file sent to the Board within 5 working days of the receipt of the notice. The case file must contain the lease document, all pertinent correspondence, the Final Technical Reports, a map or plat of the drainage situation, and any other relevant material. The Notice of Appeal may include a Statement of Reasons for the appeal. However, if it does not include a Statement of Reasons, the appellant must file such a Statement with the Board within 30 days after the notice of appeal is filed unless an extension is requested and granted.

B. Preparing the Response to the Statement of Reasons

The Regional or Field Solicitor is responsible for filing an answer to the Statement of Reasons within 30 days of receipt, unless an extension is requested and granted. The

office issuing the decision appealed should request a copy of the Statement of Reasons and should forward the information below to the Solicitor to assist in preparing the answer.

1. A case chronology including the draining well's spud, completion, and date of first production; lease effective date; term and ownership of record title and operating rights, as appropriate; all related correspondence and attempts to resolve the drainage situation; and the dates determined for constructive notice, reasonable time, and assessment.
2. An explanation of the BLM's position with respect to all technical points cited in the Statement of Reasons.

Glossary of Terms

- A -

Administrative review: conducted to determine if lands reviewed for drainage are subject to protection by existing agreements, protective wells, or well tests.

- B -

Bench price: the standard U.S. industry-wide oil and gas product price that is used at the time a drainage case is established. This price warrants a reevaluation if there are changes in these prices over time. It may be, for example, the estimated dollar value per barrel of oil or a ratio of product price to drilling cost per foot at which it is estimated that a prudent operator would drill a protective well on a lease based on the estimated ultimate recoverable reserves, drilling, completion, operating costs, taxes, and other economic factors.

- C -

Compensatory royalty agreement: a negotiated agreement by which the mineral estate owner is compensated for lost royalties due to drainage on unleased lands, excluded from leasing by the Mineral Leasing Act of 1920, as amended and supplemented

Compensatory royalty assessment: royalty assessed by the BLM to compensate the lessor for the loss of royalty caused by the failure of the lessee to take appropriate protective measures.

- D -

Demand letter: letter sent to the lessee informing the lessee that a potential drainage situation exists on its lands and requires the lessee to protect the leased lands from drainage. The demand letter explains the lessee's options for protecting the lease, which include drilling a protective well(s), executing protective agreements, paying compensatory royalty, relinquishing all or part of the lease, or any combination of the above that protects the Federal or Indian lease. The demand letter requires the lessee to submit a plan to protect the lease from drainage or to submit geologic, reservoir and economic data sufficient to show that either drainage is not occurring or that the drilling of an economic protective well is or is not feasible.

Discount rate: the rate at which future cash flow is discounted in order to calculate the present value of an investment.

Drainage: migration of hydrocarbons, inert gases (other than helium) or associated resources caused by production from other wells.

Drainage case: exists for each Federal or Indian lease or unleased tract affected by each potential drainage situation that is not eliminated during the well review. A drainage case is fully defined by the following: (1) lease or agreement number, (2) area drained, (3) potentially draining well, and (4) drained reservoir. This Manual provides details and examples of drainage cases.

Drainage case file: the file created for each drainage case for each lease or unleased tract that is subject to potential drainage. The findings of all reviews and decisions are documented in this file.

Drainage factor: the percentage of the draining wells production attributable to the lease being drained.

-E-

Economic determinants: factors that pertain to an economic well determination, e.g., prices, costs, minimum rate of return, etc.

Economic limit: the economic limit occurs when the operating costs, taxes, and depletion/depreciation allowances equal the net revenue.

Economic well: a well that, if drilled, would likely show a reasonable rate of return based on the technical and economic data and projections available at the time of drilling.

Express covenant (drainage): the specific intent of the lease terms pertaining to the responsibility of the lessee to protect Indian and Federal leases from the uncompensated loss of mineral interests associated with vertical, directional, and horizontal wells, as well as the use of hydraulic fracturing to produce oil and gas resources.

-H-

Hydraulic fracturing: those operations conducted in an individual wellbore designed to increase the flow of hydrocarbons from the rock formation to the wellbore through modifying the permeability of reservoir rock by applying fluids under pressure to fracture it. Hydraulic fracturing does not include enhanced secondary recovery such as water flooding, tertiary recovery, recovery through steam injection, or other types of well stimulation operations such as acidizing.

Horizontal well: a well that initially starts drilling as a vertical well to a depth at which it deviates horizontally to target formations that are produced economically through fracturing at intervals within the formation.

-I-

Indian lands: means any lands owned by any individual Indian or Alaska Native, Indian tribe, band, nation, pueblo, community, rancheria, colony, or other tribal group which owns land or interests in the land, the title to which is held in trust by the United States or is subject to a restriction against alienation imposed by the U.S. In the case of Osage Mineral Estate, the U.S. holds the minerals underlying Osage County, Oklahoma, in trust for the Osage Nation.

Initial contact letter: a letter sent to lessees once a drainage case is established notifying them of their obligation to inform the appropriate BLM office within 60 days whether their lease is/is not subject to drainage and their plans to take protective action.

-L-

Lessee: any person holding record title or owning operating rights in a lease issued or approved by the United States.

Lessor: the Federal or Indian royalty interest owner.

-N-

Net revenue from production: income from the production of a well after royalties are paid.

-O-

Operating expenses: the direct costs for producing and maintaining production from a well.

Operating rights owner: a person who owns operating rights in a lease. A record titleholder may also be an operating rights owner in a lease if it did not transfer all of its operating rights.

-P-

Potential drainage situation (PDS): a potential drainage situation exists when a well is drilled or is in production adjacent to Federal or Indian leases or unleased lands that may potentially drain Federal or Indian oil and gas resources, resulting in the loss of revenues.

Protective action: action taken to protect Federal and Indian lands from drainage. These actions include: (1) drilling a protective well; (2) executing a communitization agreement, compensatory royalty agreement, unit agreement, or unit participating area agreement; or (3) paying compensatory royalty.

Protective well: a well drilled or modified to prevent or offset drainage of oil and gas resources from its Federal or Indian lease.

- R -

Record titleholder: means the person(s) to whom the BLM or an Indian lessor, issued a lease or approved the assignment of record title in a lease.

Reservoir: for the purpose of drainage determinations, reservoir is defined as the individual continuous accumulation of oil and gas, geothermal resources within a geologic container.

- S -

Spacing unit: the development pattern established by State or Federal order roughly encompassing the area that can be efficiently and economically drained by one well. Spacing units typically vary by formation, horizon, depth, or product produced. Field orders may also stipulate where, within a spacing unit, a well can be drilled.

-T-

Trespass: A situation in which an operator drills a well into the Federal or Indian mineral estate, whether with or without knowledge without a lease or drilling permit

- U -

Uncompensated loss: production of oil or gas resources for which the Federal or Indian lessor does not receive the appropriate royalty.

Illustration 1a – Drainage Protection Quarterly Fluid Minerals Report Template

Office:

1	2	3	4	5	6	7	8	9	10	11	12	13		15	16	17	18					
FY & Qtr.	States	Land Category (Federal or Indian)	Active Drainage Cases (start of report period)	New Drainage Cases Established	Cases Resolved Administrative or Technical Review	Demand Letters Issued	Cases Resolved Final Technical Analysis, SDR or Appeal (No Protective Measures)	Cases Put in Suspense (Other)	Cases Resolved by Protective Measures	Active (**) Drainage Cases (End of Report Period)	Unleased Tracts with Drainage Stip.	Protective Wells Drilled (*)		Comp. Royalty Agrmt. Exe.	Prot. Agrmt. Exe. (*)	Comp. Royalty Assess. (*)	Estimated Revenues					
												Producing	Dry Hole				Royalty Income	Royalty Agrmt. Income	Protective Agreement Income			Royalty Assess. Inc.
																			Federal	Tribal	Individual Indian	
		F																				
		F																				
		F																				
		F																				
		F																				
		F																				
		Sub-Total																				
		I																				
		Sub-Total																				
		TOTALS																				

Illustration 1b Description of Data Entered in Quarterly Fluid Minerals Report template

Columns 4-11 are reported on a case basis only, as defined in the Manual. Do not count by lease, well, or PDS. Columns 5-8 and 10-16 are only for activity during the current reporting period; they are not intended to reflect cumulative figures. Columns 4, 9, and 11 are cumulative number of cases.

Column 4: Count all established cases that were not resolved through a finding of no significant drainage or through protective measures. The entry in this column must equal the entry in column 11 for the previous reporting period.

Column 5: Count all cases that were established during this reporting period, including those that are resolved in the same period.

Column 6: Count all cases that were resolved without sending a demand letter and without protective action.

Column 7: Number of cases for which demand letters were sent.

Column 8: Number of cases for which a demand letter is sent but is resolved at a later review stage and for which no protective measures are taken.

Column 9: Include the total number of cases that are put in suspense for economic reasons, or the wells are shut-in, etc. Cases put in suspense are still considered a part of the backlog and are reflected in Column 4. When a case is taken out of suspense and worked, it is ultimately reported in Column 6, 8, or 10, as appropriate.

Column 10: Count all cases that are resolved because adequate protective measures were taken. Include all cases resolved by protective wells, compensatory royalty assessments, or protective agreements such as CAs, Compensatory Royalty Agreements, and PAs/units.

Column 11: Equals Column 4 + column 5 - column 6 - column 8 - column 10.

Column 12: Count each lease that is issued with a drainage stipulation.

Column 13: Include wells that are shut-in but capable of producing under the producing column. Count each well drilled only once even though it may resolve more than one case.

Column 14: Count each agreement that resolves an identified PDS. Do not count CAs, Compensatory Royalty Agreements, units/PAs that were not initiated because of the drainage review process. Count each agreement only once even though it may resolve more than one drainage case.

Column 15: Number of cases that were resolved by compensatory royalty assessments.

Column 16: Estimated royalty value over the life of well.

Illustration 2 - Examples of Potential drainage situations (PDS) and Drainage Cases

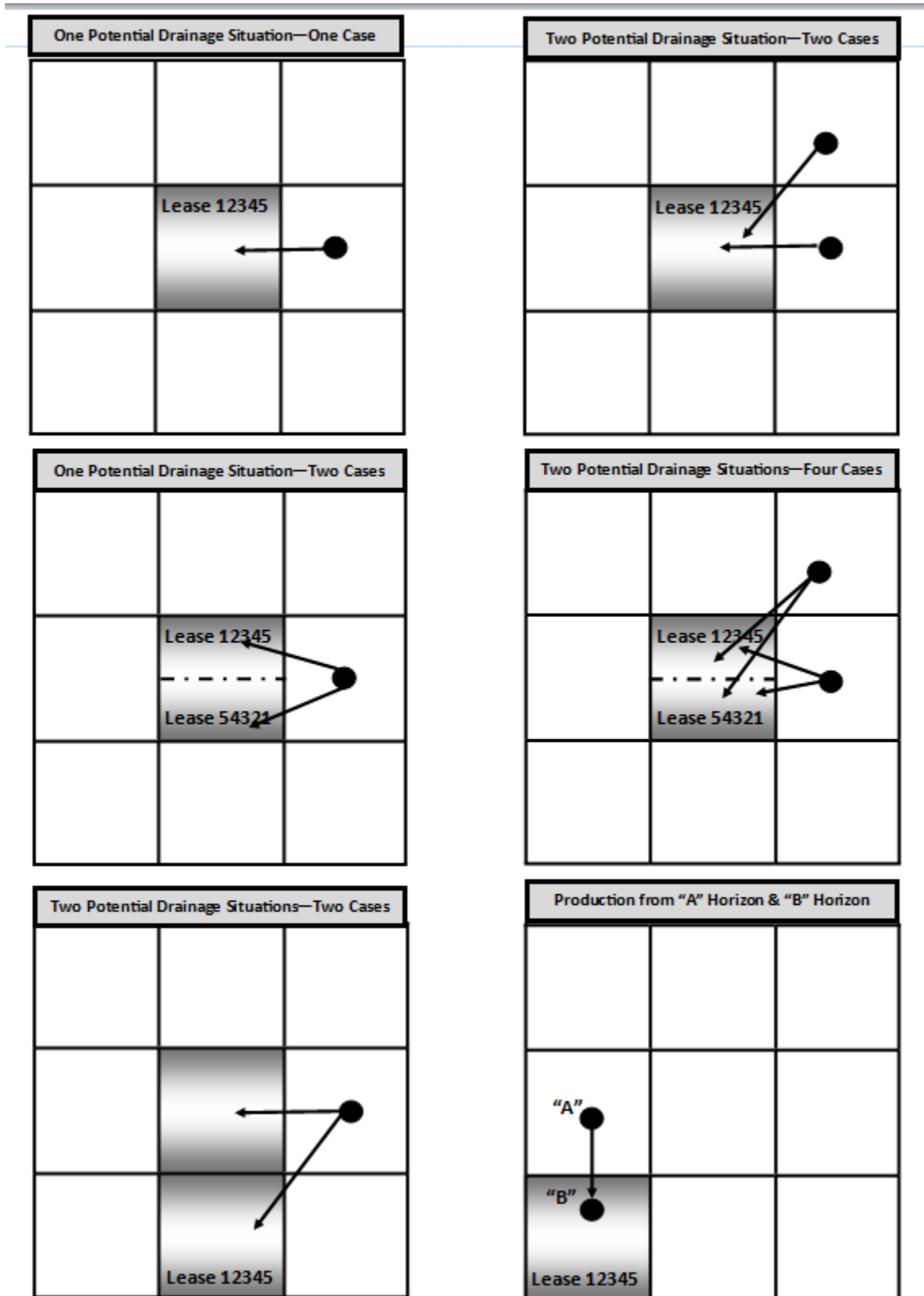


Illustration 3 – Drainage Flowchart

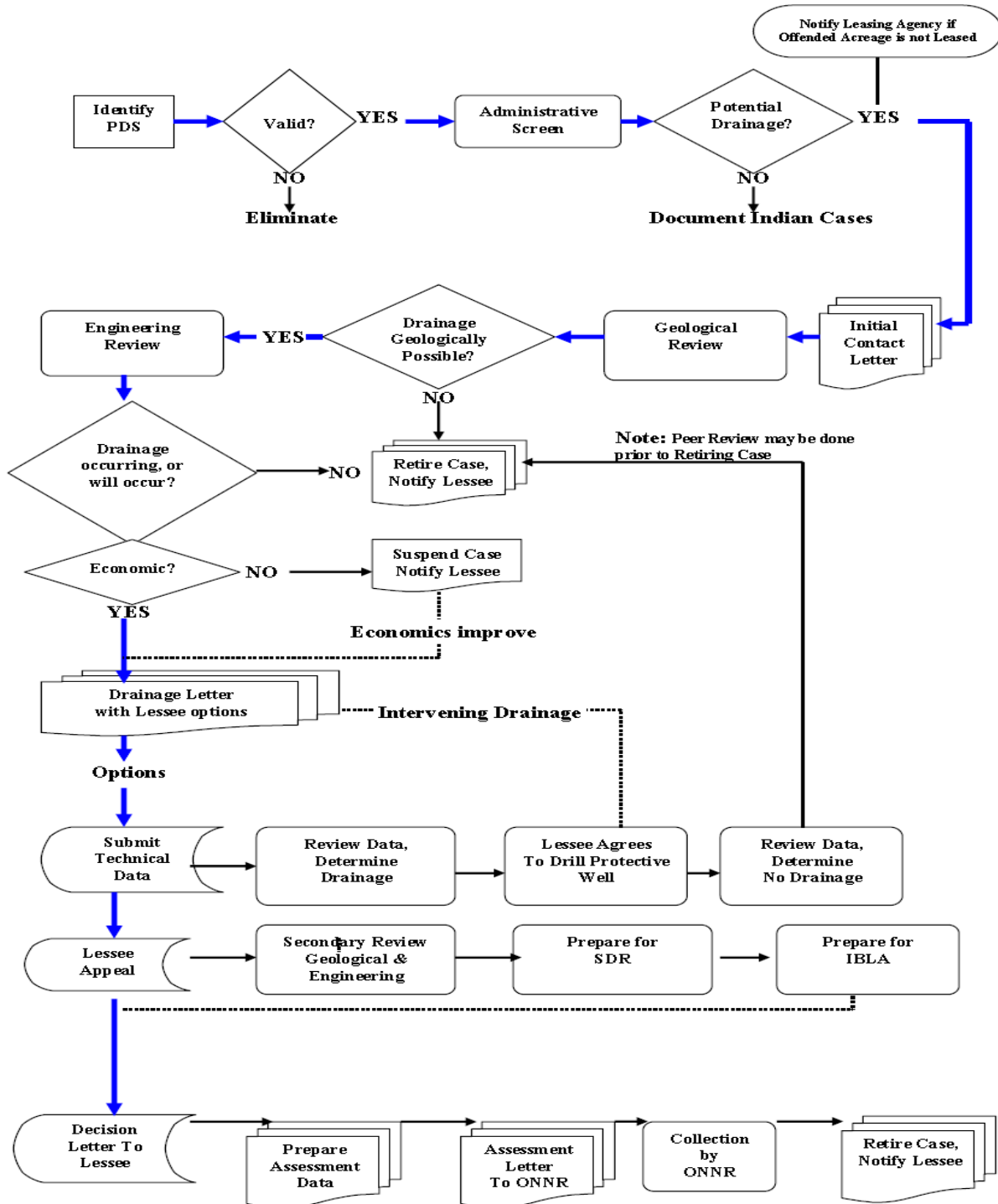


Illustration 4 - Drainage Case Quality Control Review Checklist

Case No. _____
Office _____

Administrative Review

- PDW and potentially drained tract clearly marked on case plat
- Nearby cases noted
- Well data clearly provided
- Dates checked
- Special factors (i.e., royalty rate differences, CAs, etc.) calculated
- Supporting documents included or referenced

Geologic Review

- Recommendation clearly stated
- PDW and drained tract clearly marked on maps and cross sections
- Logs included or referenced
- All operator submitted data discussed

Engineering Review

- Recommendation clearly stated
- Supporting documents referenced or included
- All operator submitted data discussed

Geologic Review - Final

- Recommendation/conclusions clearly stated
- Discussion of each well, each reservoir included and supports recommendation
- All operator submitted data discussed
- References cited

Engineering Review - Final

- Recommendation/conclusion clearly stated
- Discussion of each well included and supports recommendation
- All operator submitted data discussed
- Consistent with geologic interpretation
- References cited

Correspondence
Separate and in chronological order

Reviewer _____ Date

Illustration 5 – EXAMPLE Initial Contact Letter

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Lessee/Operating Right Owner:

The Bureau of Land Management, _____, is conducting a Statewide review of areas in which Federal and Indian oil and gas leases may be affected by offset producing wells. The proximity of such wells and normal well spacing are the factors used to determine whether lessees are notified of any potential drainage situations (PDSs) at this preliminary stage of review.

According to our records, you are (a) (the) (lessee) (operating rights owner) of (Federal) (Indian) oil and gas lease no. _____. All or portions of this lease are currently under review for potential drainage based on the proximity of the _____, in the _____, Section _____, T. _____, R. _____, _____ County, _____. This well was reported as completed on _____, in the _____ Formation, with an initial potential of _____.

Both the terms of your lease and the oil and gas operating regulations require you to protect the leased lands from drainage. If you believe that drainage is not occurring or that the drilling of an economic protective well is not feasible, you must submit geologic and engineering data that support your position within 60 days of receipt of this letter. Our technical staff will then review such data, as well as all available data in the area, to make a drainage determination. Any proprietary material you wish to submit will be held confidential, if requested. If our final determination is that drainage is occurring and the drilling of an economic protective well is feasible, the BLM may assess you compensatory royalty.

If you have any questions, please contact _____ at _____
 _____.

Sincerely,

Enclosure
 Addressees

Illustration 6 - Example of Summary Format for Geologic Review

Geologic Review

Case Number _____

Formation _____

Lease number and tract _____

Draining well name _____

Draining well location _____

If Federal KGS? Yes__ No__ Name _____

1. Does formation exist beneath potentially drained parcel? Yes __ No __

Source _____

2. Does reservoir exist beneath potentially drained parcel? Yes __ No __

Source _____

3. Are there geologic conditions known that would preclude drainage? Yes __ No __

Explain:

Source _____

4. If potential drainage exists, determine reservoir parameters and lithology.

(a) h _____ ft. Source _____

(b) Sw _____ percent Source _____

(c) ö _____ percent Source _____

(d) Fm T _____ °F Source _____

(e) Lithology of reservoir rock _____ Source _____

5. Other wells used for determination _____

Recommendation _____

Comments _____

Attachments:

Signature _____ Date _____

Illustration 7 - Example of Reservoir Engineering Review for a Gas Well

Reservoir Engineering Review - Gas Well

Case Number:		Lease Number:	
Draining Well:		Drained Tracts:	
Location:		Formation:	

Parameters

depth:	
h:	
S _w :	
ö:	
T _{fm} :	
Completion date:	
IP:	
GOR:	
SG gas:	
SG oil:	
T _c :	
P _c :	
P _i :	
P _{abd} :	
Z _j :	
Z _{abd} :	
RF:	
k:	
Distance to drained tract:	
Estimated ultimate recovery calculations	

Recommendations:

Signature _____ Date

Attachments:

Illustration 8– Example of Reservoir Engineering Review for an Oil Well

Case Number:		Lease Number:	
Draining Well:		Drained Tracts:	
Location:		Formation:	

Parameters

depth:	
h:	
S_w :	
ϕ :	
T_{fm} :	
Completion date:	
IP:	
SG oil:	
SG gas:	
GOR:	
P_i :	
$^{\circ}\text{API}$:	
S_{or} :	
B_o :	
RF:	
Distance to drained tract:	
Other:	

Estimated ultimate recovery calculations

Recommendation

Attachments:

Signature _____ Date

Illustration 9 - Drainage Stipulation for Federal minerals Put Up For Lease

All or part of the lands contained in this lease is subject to drainage by wells(s) located adjacent to this lease. The lessee/operating rights owner is required within 60 days of lease issuance to submit to the authorized officer plans for protecting the lease from drainage. The BLM will access compensatory royalty after the expiration of this 60-day period if no plan is submitted. The plan must include either an Application for Permit to Drill (APD), for a protective well, or an application to communitize the lease so that it is allocated production from a protective well off the lease. Either of these options may include obtaining a variance to State spacing for the area. In lieu of this plan, the lessee is required to demonstrate that a protective well would have little or no chance of encountering oil and gas in quantities sufficient to pay in excess of the costs of drilling, completing and operating the well. In the absence of either an acceptable plan for protecting the lease from drainage or an acceptable justification why a protective well would be uneconomical, the lessee is obligated to pay compensatory royalty to the Office of Natural Resources Revenue at a rate to be determined by the authorized officer.

Illustration 10 - Model Form for Compensatory Royalty Agreement for Unleased Lands

COMPENSATORY ROYALTY AGREEMENT
NO.

This Agreement made and entered into this ____ day of ____, by and between the United States of America, through the Secretary of the Interior, or designated representative, hereinafter called "United States." and _____, hereinafter called "Operator."

WITNESSETH:

WHEREAS, through a mineral reversion effective _____, the United States has acquired a one hundred percent (100%) mineral interest in a certain ____ acres located in the ____ and the of Section __, T. __, R. __, __ County, __ as described in Exhibit "A," attached to and made part hereof.

WHEREAS, Operator drilled the _____ well located from ____ Section line and ____ from Section line, on an __ acre unit consisting of the ____ of Section __, Township __, Range __, _____ County, said unit was established by the State Oil and Gas Board of ____ by Order No. ____ dated _____, 19 __.

WHEREAS, ____ acres of the said __ acre tract are within the __ acre producing unit effective .

NOW, THEREFORE, in consideration of the said premises, covenants, and Agreements hereinafter contained, and of the compensation to be paid the United States by the Operator, as hereinafter provided, it is expressly understood and agreed by and between the United States and the Operator, as follows:

ARTICLE I

Operator will pay the United States \$____, representing compensation for the estimated bonus the United States would have received on ____ had the __ acre tract been leased competitively. Beginning _____, Operator will pay to the United States a royalty of _____ percent _____ of the gross proceeds attributable to the said ____ acre tract based on the market value at the well of oil and gas produced (saved or marketed), used, or lost on or off the premises from the well drilled and now producing on said unit or any well, or wells drilled thereafter on said unit.

ARTICLE II

For the purpose of computing the compensation payable to the United States pursuant to the terms of this Agreement, the market value will be computed in accordance with Departmental regulations. Said payment will be made monthly on or before the last day of the calendar month following the month of production that such payment is based. Each payment will be accompanied by the statement of oil and gas runs showing the quantity and the market value of oil and gas produced, saved, and marketed during the period for which payment is made. All payments will be made by

check drawn to the order of the Department of the Interior and transmitted to the Office of Natural Resources Revenue, P. O. Box 25165, Denver, Colorado 80225.

ARTICLE III

The Operator hereby agrees to furnish the Secretary of the Interior or duly authorized representative with a log and history of the well drilled on the ___ acre unit on which the ___ acre tract is included; the statement of oil and gas runs and royalties, together with such reports as are deemed necessary to compute monthly the royalty due the United States.

ARTICLE IV

During the life of this Agreement the United States will not issue any oil and gas leases covering the land described in Exhibit "A." Operator will conduct no drilling on Federal acreage in said unit in the absence of an oil and gas lease issued by the United States.

ARTICLE V

This Agreement applies to and affects only the ___ acre tract of land described in Exhibit "A" and is not to be construed as affecting in any manner any right, title, and interest owned or claimed by the parties hereto in and to any other land.

ARTICLE VI

This Agreement will become effective _____, at the time of execution and will continue in full force and effect so long as said unit remains in force and effect. Illustration 8-2

ARTICLE VII

Operations on said land described in Exhibit "A" will be conducted in full compliance with the rules and regulations for the removal of minerals of lands owned by the United States. The United States will not acquire by this Agreement any right or authority to supervise or control the production or marketing of oil and gas from said tract, the full power or management, supervision, and control of Operator's business remaining in Operator, but Operator will protect said ___ acre tract drainage by an oil and gas well or wells which may be drilled affecting said tract.

ARTICLE VIII

Should Operator fail to make any payment herein provided and remain in default for 30 days after receiving written demands therefore, the United States will have the right to cancel and terminate this Agreement.

ARTICLE IX

This Agreement and all of its provisions will be binding upon and extend to the heirs, administrators, executors, personal representatives, successors, and assigns of the parties hereto.

ARTICLE X

It is also further agreed that no member of, or delegate to Congress, or Resident Commissioner, after this election or appointment, or either before or after qualification or continuance in office, and that no officer, agent or employee of the Department of the Interior will be admitted to any share or part in this Agreement derive any benefit that may arise therefrom, and the provisions of Section 3741 of the Revised Statutes of the United States, as amended (41 U.S.C. 22), and Section 431, 432, and 433, Title 18, U.S. Code, relating to contracts, enter into and form a part of this agreement so far as the same may be applicable.

ARTICLE XI

Nondiscrimination: In connection with the performance or work under this agreement, the Operator agrees to comply with all of the provisions of Section 202 (1) to (7) inclusive, or Executive Order 11246 (30 F.R. 12319), which are hereby incorporated by reference herein.

IN WITNESS thereof, Operator has caused these presents to be executed in its corporate name by its proper officials hereto duly authorized; and the United States has caused these presents to be executed by its Secretary of the Interior or designated representative, all on the day and year first above written.

BUREAU OF LAND MANAGEMENT
UNITED STATES DEPARTMENT OF THE INTERIOR

OPERATOR

Illustration 11 - EXAMPLE Memorandum to BIA Concerning Unleased Indian Lands

Unleased Indian
Case No.
3100.2

Memorandum

To: Superintendent, Bureau of Indian Affairs, _____ Agency

From: District Manager,

Subject: Drainage of Unleased (individual Indian)(Tribal) Lands

The following unleased (individual Indian)(tribal) lands are subject to possible drainage by the _____ well located in the _____ 1/4 _____ 1/4, Sec. _____, T. _____, R. _____, _____ County, _____, in the _____ formation.

Township _____ North, Range _____ East,
Sec. ____: ____ 1/4 ____ 1/4

The BIA should offer these lands in the next oil and gas lease sale so this office may pursue obtaining drainage protection for this tract.

Please provide this office with a copy of any lease(s) issued on the above lands.

If you have any questions, contact _____.

cc: Tribe

Illustration 12 - EXAMPLE Demand Letter

3100.2

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Lessee/Operating Rights Owner:

According to our records, you are the (lessee) (operating rights owner) of (Federal) (Indian) Oil and Gas Lease No. _____. All or part of this lease is subject to possible drainage by the _____ No. _____ Well, located in the ___ 1/4 ___ 1/4 Section ___, T. ___, R. ___, ___ M., _____ County, _____. This well was reported as completed on _____, in the formation, with an initial potential of _____ per day. Lands within the lease subject to drainage are described as follows:

Both the terms of your lease and the regulations governing Federal onshore oil and gas leasing and operations require you to protect the leased lands from drainage (43 C.F.R. parts 3100 and 3160). Unless you can demonstrate that no drainage is occurring, you will be expected to:

1. Drill a protective well on the drained tract(s);
2. Enter into an agreement, which protects the drained tract(s);
3. Pay compensatory royalty; or
4. Relinquish the affected portions of the lease after payment of any compensatory royalty due.

By (60 days from date of letter), you must advise us of your plans for protecting the lease from drainage. If you contend that no drainage is taking place, you must submit detailed engineering and geologic data to support that contention. If you contend that a protective well would have little or no chance of encountering oil or gas in quantities sufficient to pay the cost of drilling and operating the well with a reasonable profit, you must submit detailed economic data. If you fail to submit a plan for protective action or if you fail to provide convincing evidence that no drainage has occurred, compensatory royalty will be assessed beginning _____ and ending the date that protective action is provided under one of the above options, or the date that the draining well ceases to produce.

If you have any questions, please contact _____ at _____.

Sincerely,

Illustration 13 – EXAMPLE Determination Decision Letter--Drainage Not Occurring

3100.2

DECISION

_____:

Reference is made to our letter of _____, concerning potential drainage of the _____ of lease no. ____ by the _____ well and the _____ well, ____, T. ____, R. ____, _____ County, _____.

Based on our review, we determined that drainage is not occurring. Therefore, no protective wells are required and the BLM will not assess any compensatory royalty.

If you have any questions, please contact _____ at _____.

Sincerely,

Illustration 14 – EXAMPLE Drainage Determination Decision Letter--POR Precludes Drainage Protection

3100.2

DECISION

_____:

Reference is made to our letter of _____, concerning potential drainage of lease no. ____ by the _____ well and the _____ well, __, T. ____, R. ____, _____ County, _____.

Based on our review, we determined that drainage is occurring, but that the drilling of an economic protective well was not feasible to date. Therefore, no protective wells are required and the BLM will not assess compensatory royalty assessed at this time. You are responsible for monitoring any changes in economic conditions, which would make it feasible to drill a protective well. You will be responsible for adequately protecting your lease from drainage once a protective well is feasible.

The BLM will valuate this situation periodically.

If you have any questions, please contact _____ at _____.

Sincerely,

Illustration 15 – EXAMPLE Drainage Determination Decision Letter--Protection Required

3100.2

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

DECISION

Lessee/Operating Rights Owner:

Our letter to you dated _____, (Demand Letter) regarding Well No. _____ located in the ___ 1/4 ___ 1/4 Section _____, T. ___, R. ___, ___ M., _____ County, _____, which has the potential for drainage of (Federal) (Indian) Lease _____, outlined your options for protecting the following portions of the drained lease from drainage in the _____ formation:
_____.

(Additional correspondence with your office) (Your failure to respond to our certified letter) dated _____ failed to result in lease protection by options other than assessment of compensatory royalty. This assessment will continue until protection is provided as outlined in previous correspondence. That portion of the draining well's production attributed to Lease No. _____ was determined by the BLM as ___ percent based on (see page 19 of Manual 3160-2 for necessary data to be included).

You will receive a notice for payment of compensatory royalty from the Office of Natural Resources Revenue.

You may request a State Director Review for this decision as described in 43 CFR 3165.3, and, if adversely affected by the decision of the State Director, you may appeal that decision pursuant to 43 CFR 3165.4 and 43 CFR 4.400. Copies of the appeal procedures are enclosed.

If you have any questions, please contact _____ at _____.

Sincerely,

Enclosure

Illustration 16 - Geologic Quality Control Review Checklist

Case No. _____

Office _____

Check calculations for accuracy and check maps and interpretations for soundness.

1. Well log analysis for all appropriate wells in the immediate area, analogy wells analyzed if data not available for draining well.

- (a) Net pay
- (b) Porosity
- (c) Water saturation
- (d) Formation temperature

2. Reservoir description

- (a) Lithology
- (b) Trapping mechanism
- (c) Correlations to draining tract
- (d) Barriers to drainage gas/oil/water contacts, structural dip faults, folds, permeability barriers reservoir limits

3. Maps--as available, minimum of one

- (a) Isopach
- (b) Structure
- (c) Net hydrocarbon pore volume
- (d) Cross section
- (e) Seismic

4. Discussion of operator response

- (a) Variables
- (b) Interpretations

5. Conclusions

- (a) Consistent with maps and discussion
- (b) Recommendation clearly stated

Peer Review findings:

Reviewer _____ Date _____

Volumetric equation:

A = total drainage area, ft²
 EUR = estimated ultimate recovery
 h = net pay thickness, ft.
 ϕ = porosity
 S_w = water saturation
 P = pressure, psia
 Z = real gas deviation factor
 T = temperature, °R
 RF = recovery factor

B_o = formation volume factor

SG = specific gravity
 μ = viscosity
 GOR = gas-oil ratio
 WOR = water-oil ratio
 IP = initial production rate (P = pumped, F = flowing)
 r = drainage radius
 d = distance to lease
 DCF = discounted cash flow
 ROR = rate of return

Subscripts: i = initial o = oil bh = bottom hole
 el = economic limit g = gas s = surface
 a, abd = abandonment w = water c = critical

Illustration 17 - Engineering Quality Control Review Checklist

Case No. _____

Office _____

Check for appropriate formulae, correct calculations, and reasonable assumptions

1. Analysis of PDW and appropriate protective or area wells.
Administrative review checked.

2. Production decline analysis
 (a) Visual fit
 (b) Hyperbolic exponent
 (c) Decline rate
 (d) Initial and final flowrates
 (e) EUR
 (f) Life

3. Reservoir parameters
 (a) Reservoir pressure
 (b) Final characteristics
 (c) Recovery factor

4. Calculations
 (a) Formulae
 (b) Accuracy

5. Discussions of operator response
 (a) Variables
 (b) Assumptions

6. Conclusions
 (a) Consistent with calculations and discussion
 (b) Consistent with Geologic Report
 (c) Recommendation clearly stated

Peer Review Findings

Reviewer _____ Date

Volumetric equation:

A = total drainage area, ft²
 EUR = estimated ultimate recovery
 h = net pay thickness, ft.
 ö = porosity
 S_w = water saturation
 P = pressure, psia
 Z = real gas deviation factor
 T = temperature, °R
 RF = recovery factor

B_o = formation volume factor

SG = specific gravity
 ì = viscosity
 GOR = gas-oil ratio
 WOR = water-oil ratio
 IP = initial production rate (P = pumped, F = flowing)
 r = drainage radius
 d = distance to lease
 DCF = discounted cash flow
 ROR = rate of return

Subscripts: i = initial o = oil bh = bottom hole
 el = economic limit g = gas s = surface
 a, abd = abandonment w = water c = critical

Illustration 18 – Discount Rates Table

Description of Formulation:

The Minimum Reasonable Rate of Return for a given year is the 10-Year Treasury Note (average yield) plus the Risk Component. The Risk Component represents the risk premium paid for Corporate Bonds above the yield for a 10-Year Treasury Note. The Risk Component for a given year is the average of the differences between the Moody's Baa Seasoned Corporate Bond Yield and the 10-Year Treasury Note over the past 10 years. Washington Office will provide annual updates to this table.

Historical Discount Rate

Year	10-Year Treasury Note (Avg Yield)	Risk Component (Avg Yield)	Minimum Reasonable Rate of Return
	(1)	(2)	(1) + (2)
2014	2.54	2.70	5.24
2013	2.35	2.68	5.03
2012	1.80	2.68	4.48
2011	2.78	2.69	5.47
2010	3.22	2.69	5.91
2009	3.26	2.64	5.91
2008	3.66	2.46	6.13
2007	4.63	2.28	6.92
2006	4.80	2.25	7.04
2005	4.29	2.24	6.53
2004	4.27	2.23	6.50
2003	4.01	2.17	6.18
2002	4.61	2.10	6.71
2001	5.02	1.98	7.00
2000	6.03	1.88	7.91
1999	5.65	1.83	7.47
1998	5.26	1.76	7.03
1997	6.35	1.78	8.13
1996	6.44	1.87	8.31
1995	6.57	1.97	8.55
1994	7.09	2.03	9.11
1993	5.87	2.06	7.93
1992	7.01	2.13	9.14
1991	7.86	2.29	10.15
1990	8.55	2.32	10.88
1989	8.57	4.21	12.78
1988	8.73	3.73	12.46
1987	8.19	3.66	11.85

Year	10-Year Treasury Note (Avg Yield) (1)	Risk Component (Avg Yield) (2)	Minimum Reasonable Rate of Return (1) + (2)
1986	7.72	3.62	11.34
1985	10.52	3.64	14.16
1984	12.30	3.74	16.04
1983	10.82	3.73	14.55
1982	12.59	3.69	16.28
1981	13.72	3.59	17.31
1980	11.25	3.73	14.98
1979	9.51	3.74	13.25
1978	8.25	3.74	11.99
1977	6.95	3.73	10.68
1976	6.64	3.64	10.28
1975	7.19	3.42	10.61
1974	7.56	3.20	10.76
1973	6.78	3.11	9.89
1972	5.99	3.03	9.02
1971	5.83	2.91	8.74
1970	7.27	2.74	10.01
1969	6.66	2.69	9.35
1968	5.58	2.66	8.24
1967	5.05	2.68	7.73
1966	5.00	2.69	7.69
1965	4.23	2.69	6.92
1964	4.09	2.70	6.79
1963	3.87	2.74	6.61
1962	3.83	2.75	6.58
1961	3.86	2.73	6.59
1960	3.99	2.72	6.71
1959	4.21	2.74	6.95
1958	3.09	2.82	5.91
1957	3.53	2.79	6.32
1956	3.10	2.77	5.87
1955	2.72	2.81	5.53
1954	2.35	2.86	5.21
1953	2.74	2.87	5.61
1952	2.48	2.93	5.41
1951	2.26	3.02	5.28
1950	1.62	3.13	4.75
1949	1.63	3.16	4.79
1948	2.00	3.01	5.01

Year	10-Year Treasury Note (Avg Yield)	Risk Component (Avg Yield)	Minimum Reasonable Rate of Return
	(1)	(2)	(1) + (2)
1947	1.34	3.38	4.72
1946	1.12	3.38	4.50
1945	1.03	3.38	4.41
1944	1.40	3.38	4.78
1943	1.45	3.38	4.83
1942	0.72	3.38	4.10
1941	0.82	3.38	4.20
1940	0.57	3.38	3.95
1939	0.98	3.38	4.36
1938	1.52	3.38	4.90
1937	1.14	3.38	4.52
1936	1.29	3.38	4.67
1935	1.63	3.38	5.01
1934	2.49	3.38	5.87
1933	3.25	3.38	6.63
1932	3.04	3.38	6.42
1931	4.12	3.38	7.50
1930	2.91	3.38	6.29
1929	3.62	3.38	7.00
1928	4.01	3.38	7.39
1927	3.40	3.38	6.78
1926	3.61	3.38	6.99

Illustration 19 – EXAMPLE Letter to ONRR Requesting CR Assessment

3100.2

Memorandum

To: Chief, Royalty Compliance Division, Office of Natural Resources Revenue
 From: Deputy State Director, Mineral Resources
 Subject: Compensatory Royalty Assessment

Attached please find our Decision letter of _____, assessing compensatory royalty for lease _____. The BLM notified the responsible lessees and operating rights owners and the decision is final. The data you requested to determine the value of the compensatory royalty (CR) are as follows:

Draining well:

Location:		Producing interval:	
Operator:		API gravity:	
Formation:		Drainage factor:	
Date of first production (DOFP):		Special factors:	
Production:		Date to begin CR:	
NGPA category:		Assessment:	
BTU:			

Lessee/Operating	
Rights Owner:	

Royalty rate:	
Unit:	
CA:	

By copy of this memorandum, this Office is requesting its Mineral Leasing Section to transfer the lease account to the ONRRs Mineral Royalty Management Support System. Please notify this Office when you make the assessment and the office will close the drainage case file.

If you have any questions, please contact _____ at _____.

Attachment
 Assessment Letter

Illustration 20 – Examples of Drainage Review Paperwork within a Case File

Case Number	Date Established	Priority	Case Status	Drainage Type	Date Suspended	Date Closed
1608	06/23/2009	Three/3	Closed	Fee CA well/ CA		9/30/2010

Offended Lease Information

Lease Number	Lessee	Location	County	Ownership
MTM69402/ NRM1394	Noble Energy	NE 18, T37N R31E	Phillips	Federal CA – 75% MI
Royalty Rate	Agreement	Field Spacing Orders	Serial Register Page	Reservation
12.5%	CA MTM69402	ORDERS 151-1981, 60-1982, 39-1907, 13-2007, 78-2007 (EAST LORING)	Yes	N/A

Draining Well Information

Well Number	Location	County	Operator	Well Type	IP	Status
FED 771-5	SE, Sec 7, T37N-R31E	Phillips	Nobel Energy	Gas	79 MCF	Producing
Formation	Field Spacing Orders	Dwights – MBOGC	API Number	Ownership		Distance to Offended lease
NI	ORDER 151-1981, 80-1982, 39-1907, 414-2006, 415-2006, 13-2007 78-2007 (EAST LORING)	Yes	26—071-23127	Fed WELL 50% MI in CA MTM97312		1225'

Review Dates

Preliminary Engineering Review	Preliminary Geologic Review	Final Engineering Review	Final Geologic Review 06/23//2009
06/23/2009		<i>DHM 9/30/2010</i>	

Correspondence Dates and Final Action

First Demand/CA	Second Demand	Follow Up	Assessment	Decision	District Action

General Remarks

<p>DRAINING WELL IS A DISTANCE OF 1225’ FROM THE REFERENCED TRACT. CONTACT LETTER WAS SENT TO NOBLE INDICATING LANDS IN THE NE SEC 18, T37N-R31E MAY BE DRAINED BY THE FED #771-5 WELL, AND THAT THE OPERTOR OF CA MTM69402 DISCLOSE IF THEIR LAND COULD BE DRAINED AND HOW THEY PLAN TO PROTECT THE LAND FROM POTENTIAL DRAINAGE (50% MI vs 75% MI) REGARDING THE INFORMATION.</p> <p>No drainage <i>DHM 9/30/2010</i></p> <p>See attached review – Engineering Section.</p>
--

Re: See List of Wells
DF 1608

Corres.

See Map/Plats Section for Map
See Lease/Well Data Section for Production Report

Noble Energy Production, Inc.
100 Glenborough Drive, Ste. 100
Houston, TX 77067

CERTIFIED MAIL – RETURN RECEIPT REQUESTED
No. 7008 1140 0000 1134 7373

Gentlemen,

As the lessee/operator of record for a lease, CA or Unit with respect to the Federal interests on the attached list, you are required to protect the lands with Federal mineral interests from potential drainage.

As referenced on the attached sheet, the draining wells have been identified as being drilled, completed and are now productive and that they are located adjacent to and could affect lands with Federal mineral interests. The list includes information regarding an draining well, the distance from the well to the affected leases/unit lands along with disclosed cumulative productions for each well (Source: Montana Board of Oil and Gas Conservation web site), and the disparity between the draining wells and offended lands with Federal mineral interests. The list was established based on the following questions with respect to a potentially draining well that lies adjacent to lands with Federal minerals interests:

- 1) Does the offended spacing unit presently have a productive well within it? if yes the well is listed.
- 2) If the answer to the previous question is yes, then which formations are completed in that particular well of question No. 1?
- 3) Based on a comparison of producing formations between the well in the offended spacing unit to the well in the draining spacing unit, draining wells made the list because the well within the offended spacing unit does not adequately protect that spacing unit from drainage because the well was not completed in the same formation as the draining well of the draining spacing unit and that disparity occurred between the two spacing units from low to high (draining spacing unit to offended spacing unit).
- 4) Is there any record in the BLM files presently indicating tht the operator of the offended spacing unit is planning to drill a protective well or recomplete in a zone in an existing well that would protect the spacing unit from potential drainage? If the answer to the questions was no, then the well and offended acreage made the list.

The regulations at 43 CFR 3162.2-9 (b) require that, within 60 days from the date of actual or constructive notice you notify this office what action you will take to protect your lease

from drainage. As of the date of this letter, you have not notified us of your plans as to how you plan to protect the Federal interests from drainage.

As a prudent lessee/operating rights owner, it is your responsibility to monitor the drilling of wells in adjacent spacing units and gather sufficient information to determine whether or not drainage is occurring. It is your responsibility, as required under 43 CFR 3162.2-9 (a), to analyze and evaluate this information and make the necessary calculations to determine; (1) the amount of drainage from production of the draining well; (2) the volume of mineral resources which will be drained from your Federal or Indian lease during the life of the draining well; and (3) whether or not a protective well would be economic to drill. The information required to support your reservoir analysis as to why a well could not be economically drilled or your analysis that the draining well is not draining Federal minerals at the time the well reaches ultimate recovery should include, but not be limited to the following information about the draining well; economics supporting the drilling of a protective well (drilling costs, price for production, royalty expenses, tax expenses, operating costs), the draining wells' decline curve (including a complete production history of the well), net pay, average porosity, average water saturation gas gravity, initial reservoir pressure, abandonment pressure, reservoir temperature, recovery factor, structural geology maps, net pay isopach maps.

Pursuant to 43 CFR 3162.2-9 (d), you must provide this office with your analysis as specified under 43 CFR 3162.2-9 (a); within 60 days after receipt of this letter regarding those wells identified on the attached table as class I cases; within 120 days regarding the wells identified on the attached table as class II cases and within 180 days for the remainder of the wells or those identified as class III case. If you do not have sufficient information to conduct your analysis at the end of the 6 months, an extension of time for submitting the analysis must be requested.

Melissa Lucero
 Noble Energy, Inc.
 633 17th Street, Suite #1950
 Denver, CO 80202

Dear Ms. Lucero:

DECISION

This office has completed the drainage review of drainage cases mentioned in our original letter to you dated June 23, 2009.

Following review of the most recent information regarding the referenced cases and information you provided in your November 12, 2009 and December 14, 2009 letters, we have determined that the listed five cases/five wells do not have the potential to drain the listed offsetting Lease, CAs or Unit.

Based on this information, we have closed the following five cases:

Drainage Case	Well Number	Location	Potential Offended Lease/Agreement
DF 1605	State 1633-1	SESW. 16-T.33N.-R.33E	Whitewater Unit/MTM69701X
DF 1607	Federal 0170-4	NWNE. 1-T.37N.-R30E	CA MTM69389
DF 1608	Fee 0771-5	SESE. 7-T.37N.-R.31E	CA MTM69402
DF 1609	Federal 07771-2	SENE. 7-T.37N.-R.31E	CA MTM69389
DF 1620	Fee 1934-4	NWSE. 19-T.33N.-R.34E	Federal Lease MTM15890

If you have any questions feel free to contact Dale Manchester at (406) 791-7767.

Sincerely,

Barney A. Whiteman
 Acting Oil and Gas Field Manager

Bcc: 5 Drainage files/BLM – Montana State Office—Pas Laborda/Reading File
 J:\Administration\Typing\Noble Energydrainagedecisionltr020811



Date
Manchester/MTSO/MT/BLM/
DOI
07/21/2009 03:50 PM

To BHilgers@nobleenergyinc.com
cc Don Justice/MTSO/MT/BLM/DOI@BLM
bcc
Subject Re: Extension Request

DC#1608
Comms

Brian,

Your request for the first 60 day time clock to begin July 20th is reasonable and therefore to meet the requirements of the letter, the following dates apply:

60 days – September 18, 2009
120 days – November 17, 2009
180 days – January 16, 2010

If you have any questions feel free to give me a call.

Sincerely,

Dale Manchester
Petroleum Engineer
Bureau of Land Management
Great Falls Field Station
1101 15th Street North
Great Falls, MT 59401
(406) 791-7767
Dale_Manchester@blm.gov
Bhilgers@nobleenergyinc.com



BHilgers@nobleenergyinc.co
m
07/21/2009 03:23 PM

To dale.manchester@blm.gov
cc jmuse@nobleenergyinc.com
Subject Extension Request

Dale,

I received your package on July 20th, with regard to protecting Federal mineral interests from potential drainage in the Bowdoin field. I would like to request your approval that the first 60 day time clock begin upon my receipt of the package (July 20th). Please respond to this email with your approval.

Thanks for your understanding
Brian Hilgers

Hi Ken,

Attached is the Montana Geological Society spreadsheet you were looking for. FYI, it is currently sorted on API number, however you may want to sort it differently. Let me know if you have any more questions. Thanks!

(See attached file; noble62009drainagecases.xlsx)

Dale Manchester
Petroleum Engineer
Bureau of Land Management
Great Falls Field Station
1101 15th Street North
Great Falls, MT 59401
(406) 791-7767

<p>By Robert D. Raforth Midlands Gas Group Lakewood Colorado 1988</p> <p style="text-align: center;">GENERAL FIELD DATA</p> <p>Regional Setting: Bowdoin Dome, North-Central Montana</p> <p>Surface Formations and Elevation: Upper Cretaceous Judith River and Claggett Formations. Elevation ranges from 1,900'-2500'</p> <p>Discovery Well and Date: Martin well. Drilled in 1913 as a water well, but Produced gas.</p> <p>Exploration Methods: Drilling to extend production guided by local mapping of porous sand trends.</p> <p>Oldest Horizon Penetrated: Cambrian</p> <p>Horizons with Shows:</p> <p>Nature of Trap: Combination of structure and stratigraphy.</p> <p>Area of Trap: Over 380,000 acres</p> <p>No. of Producing Wells: 547 Abandoned Wells 148 Shut In/Temp Abdn Wells: Disposal/Injection Wells Dry Holes:</p> <p>Major Operators: Midlands Gas Corp, Montana Dakota Utilities, Falcon of Colorado, Miami Oil Producers. Production Corp. of America, Southland Royalty Corp.</p>	<p>BOWDOIN FIELD DC</p> <p>#1608 (See map in packet) T.30-37 N., R.30-35 E. Phillips & Valley Counties, Montana</p> <p>of very fine quartzose sandstone with laminae of clay. The Phillips is approx. 180' thick.</p> <p>Avg. Depth (& MSL): 1500'</p> <p>Porosity/Permeability: Bowdoin—8-14% porosity 0.1-0.7 md permeability. Phillips—15-17% porosity, 0.1-3 md permeability.</p> <p>Oil, Gas Column: (Water Contact MSL): Irregular due to stratigraphic influences.</p> <p>Avg. Net Pay Thickness: 30-50'</p> <p>Area this Reservoir:</p> <p>Order/Docket No. and Spacing Details: Order No. 29-55 established Bowdoin Field with 160 acre spacing, Order No 3-72 delineated Bowdoin Field Order No. 23-75 delineated Swanson Creek Field with spacing of 320 acre/well. Order No. 41-82 allows 2 Wells/640 acres in Whitewater and Ashfield Federal Units. Order No. 43-82 delineated East Loring Field with Initial spacing of 160 acres/well. Order No 74-82 permitted 2 wells/government section in Loring Unit Order No. 106-83 permitted 2 wells/640 acres in East Whitewater Field.</p> <p>BO/MCF Per Acre Foot:</p>
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<p>Drilling and Casing Practices: Drill to TD, run 4½" J or K 55 casing.</p> <p>Logging Suite: FDC/CNL/GR, Sonic and DIL/SP.</p> <p>Testing Practices: Tested on completion utilizing 24 hour 1 point with a minimum 10 day shut-in to establish shut-in pressure.</p> <p>Market: KN Energy and Montana Dakota Utilities.</p>	<p>Range 30-60 MCF/AFT</p> <p>Drive Mechanism: Volumetric</p> <p>Character of Oil/Gas: Biogenic, 950 BTU, consisting of 93% Methane, 6% Nitrogen and 1% other gasses.</p> <p>Gas-Oil Ratio:</p> <p>Water Rw, Salinity: Water salinity, Chloride ranges from less than 100 mg/l to nearly 10,000 mg/l.</p> <p>Avg. Saturation: Not determinable.</p> <p>Initial and Present Pressure: Initial 400-630 psia, present 280-450 psia</p>
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	<p>Decline Rate Average 40% for first two years, then 5% per year thereafter.</p> <p>Present Daily Avg. Production: 48 MCFPD/well</p> <p>Amount of Water Produced: 5 BW/month/well</p> <p>Completion/Perforation/Treatment: Perforate through casing with 1 spf followed by gelled water sand frac.</p> <p>Shallow Gas Reservoirs in Low-Permeability Reservoirs of Late Cretaceous Age, Bowdoin Dome Area, North Central Montana, Paper presented at the 1979 SPE Symposium on Low-Permeability Gas Reservoirs. Overton, H.L., 1978, Appraisal of Water Movement From Subsurface Data, The Log Analyst., V 190, pp-3-20. Rice, D.D. and Shurr, G.W., 1978, Potential for Major Natural Gas Reservoirs in Shallow, Low-Permeability Reservoirs of the Northern Great Plains, Montana Geological Society Guidebook 24th Annual Conference, pp. 265-281. The paper would not have been possible without the assistance of many people at Midlands Gas Corporation. In particular, I wish to thank Ed Thompson, Supervisor of the Reservoir Engineering, for his help throughout this project. Appreciation is also due Darrell</p>
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	<p>Kempf, Supervisor Drilling and Production, and Steve Hoppe, Drilling and Production Engineer, for information they supplied.</p> <p>Finally, thank you to the progressive management of Midland Gas for allowing me to contribute to this publication.</p>
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Illustration 21 - Drainage Case Study Involving Horizontal Well Completions, from Montana- Dakotas Field Offices

The following discussion is a summary of ten drainage cases involving wells located in the Montana-Dakotas for example purposes only. It is part of a much larger report that the Montana State Office, Jack Wunder, Geologist, generated regarding Indian mineral owners claims that drainage was likely occurring on their lands and they had concern as to what the BLM was doing to minimize the effects of drainage to their minerals. Information in this Illustration is modified herein to protect Indian and Industry interests. Specific information such as general location, production history, reservoir characteristics were left alone as the information is portrayed in the original report to aid future BLM Petroleum Engineers or Geologists in identifying the necessary information to conduct a drainage review regarding horizontal wells.

CONCLUSIONS:

- 1) This study was conducted in response to a request from Mr. X and from Mr. Y, who requested a drainage analysis on X# Indian mineral tracts. Including a tract with an undefined and uncertain legal description, the subject X# tracts encompass approximately 7,768.07 acres, more or less, in W, X, Y, and Z Counties, State. This study is current as of September 30, 2012, because that was when the most recent and current production data was available at the beginning of this study.
- 2) Most oil and gas production in and around the subject tracts either has been or is currently from the Madison Group, and the Bakken and Three Forks Formations. Current exploration and development activity in the area is focused on oil production from the Bakken and Three Forks Formations.
- 3) The results of this study suggest there may be potential for drainage at the end of the respective economic life of potentially draining wells of the following two subject tracts:

Tract	Tract No.	Aliquot	Section	Township	Range	Acres
33	M9999	W/2	34	T99N	T99W	320
53	M9998	Lots 3 & 4, S2NW, SW	2	T96N	R96W	320

- 4) The BLM's Field Office of jurisdiction has established drainage cases involving potentially drained Tract No. 9999.
- 5) The BLM's Field Office of jurisdiction has received Applications for Permit to Drill (APDs) to develop the Bakken Pool involving potentially drained Tract No. 9998.

RECOMMENDATIONS:

It is recommended that:

- 1) The BLM recommend to the BIA to offer for lease all unleased mineral lands, if any, comprising the tracts described herein;

- 2) The BLM's Field Office of jurisdiction review the analyses and verify the findings in this report;
- 3) The BLM's Field Office of jurisdiction take appropriate action to ensure Tract Nos. M9999 and M9998 are protected from potential drainage; and,
- 4) Subject to the results of its review of the analyses and verification of the findings in this report, and with the exceptions of Tract Nos. M9999 and M9998, the BLM's Field Office of jurisdiction should consider all herein-described # of tracts to be not subject to effective drainage as of September 30, 2012.

DISCUSSION:

Purpose of Study

This study was conducted in fulfillment of the Bureau of Land Management's (BLM) responsibilities to Indian mineral owners. The purpose of this study is to conduct a drainage analyses of certain Indian mineral tracts located on the XYZ Indian Reservation in State Name in which Mr. X or Mr. Y owns a mineral interest.

It is the author's understanding that Mr. X initially contacted the BLM's ABC Field Office requesting information on potential drainage of tracts that he or closely related family members have an interest. Mr. Y, in an email dated June 28, 2012, to Mr. BLM Petroleum Engineer of the BLM's State Office, requested a drainage analysis of X# tracts identified in Table 1. Mr. X and Y, in his email of June 28, 2012, requested the drainage analysis include the following:

"Specifically, each analysis is for each parcel that shall include any source data on which it relied. I am requesting that the BLM identify all wells with a downhole location (not surface location) within one (1) mile of each tract. For each producing well within this range, I am requesting the monthly production for the past two years, and the well logs showing thickness, porosity, and resistivity."

It is the experience of this author, and other geotechnical professionals familiar with the area, that wells in the area typically drain less than 1,000 feet from the wellbore and never more than 2,000 feet from the wellbore. As a result, the author of this report did not analyze the drainage radius of currently producing wells that are greater than approximately 2,640 feet (0.5 mile) from a subject tract. Surface and downhole location, and production data from each analyzed well is included in this report, but data from wells located greater than approximately 2,640 feet (0.5 mile) to 5,280 feet (1.0 mile) from a subject tract is not included in this report, as requested by Mr. X and Y, because those distal wells will not drain a subject tract. Data from wells greater than 2,640 feet from a subject tract is available to the public from the Oil and Gas Commission, Department of Mineral Resources, Oil and Gas Division (OIL AND GAS COMMISSION).

The author did not include copies of the well logs in this report for each producing well analyzed, as requested by Mr. X and Y, because they are available from the OIL AND GAS COMMISSION and because the BLM's license to IHS Energy's proprietary well log database is for internal, official BLM use only, and not for general public distribution.

Although the request for the drainage analysis came from both Mr. X and Y, the author of this report shall mean “Mr. Y” whenever referring to “Mr. X and Y” hereinafter in the body of this report. This is because the written request for specific information and drainage analysis of specific tracts was from Mr. Y in his email dated June 28, 2012, addressed to Mr. BLM Petroleum Engineer.

Sources of Data

The author used information in this study that is available in the public domain from the OIL AND GAS COMMISSION at the following OIL AND GAS COMMISSION website: Oil and Gas Commission web site.

Information as to surface and bottom-hole well location, perforated interval, spud and completion dates, and total production were obtained from the OIL AND GAS COMMISSION Well Scout Ticket Data available through the OIL AND GAS COMMISSION website.

The reservoir parameters used to calculate the drainage area and drainage radius of potentially draining wells, such as average pay thickness, water saturation, porosity, formation volume factor, recovery factor, etc. were obtained from hearing docket exhibits filed with the OIL AND GAS COMMISSION and individual well logs. ***However, it should be noted that it is the responsibility of the geologist/petroleum engineer to obtain the well logs and perform the petrophysical analysis for the drainage analysis.*** There is a wide range of reservoir parameters for the same formation submitted as hearing docket exhibits to the OIL AND GAS COMMISSION from different companies for wells in close proximity to each other that do not appear to be geologically justified. To facilitate and standardize the analysis, and to make the results reasonable and more easily comparable between wells, the author applied the same most-likely reservoir parameters for a given formation to all analyzed wells located within the same general area. The reservoir parameters used for each analyzed well are provided in Appendix 1.

Geologic Setting

The tracts identified by Mr. Y in his email dated June 28, 2012, are all located within the Williston Basin of producing state. The Williston Basin is a large (~300,000 mi²) intracratonic basin covering parts of Manitoba and Saskatchewan in Canada, and Montana and the Dakotas in the United States. It is approximately oval shaped, with the axis oriented approximately north-northwest to south-southeast. The deepest part of the structural basin is in northwestern North Dakota, with a maximum thickness of sedimentary rocks of about 16,000 feet. Heck and others (2002) provide an excellent overview of the petroleum geology of the North Dakota portion of the Williston Basin.

Although significant oil production from the Madison Group has occurred in and around some of the subject tracts, the current principal reservoir objectives in the study area are the Bakken and Three Forks Formations. Thus, the focus of this study is on production from the Bakken and Three Forks Formations.

Figure 1 is a generalized stratigraphic column for the Williston Basin of the producing state illustrating the stratigraphic relationships of the productive formations.

Pollastro and others (2008) report a mean estimate of 3.645 billion barrels of undiscovered technically recoverable oil and 1.848 trillion cubic feet of undiscovered technically recoverable gas,

and 148 million barrels of technically recoverable natural gas liquids for the Bakken-Lodgepole Formations Total Petroleum System in Montana and North Dakota. This assessment will soon be updated, as Secretary of the Interior, Ken Salazar announced on May 19, 2011, that the U.S. Geological Survey will perform a new assessment of the Bakken Formation in a two-year study scheduled to begin in October, 2011.

The USGS describes the Bakken Formation as a continuous reservoir that is distributed across the entire Williston Basin where it is thermally mature to generate hydrocarbons from its shale members. The Bakken Formation is present underlying all of the subject tracts identified by Mr. Y.

Systems	Rock Units							
Quaternary	Pleistocene		Permian	Minnekahta				
				Opeche				
Tertiary	White River		Pennsylvanian	Broom Creek				
				Amsden				
				Tyler				
Tertiary	Golden Valley		Mississippian	Otter				
				Fort Union Group	Kibbey			
					Madison Group	Charles		
Mission Canyon								
Cretaceous	Hell Creek		Devonian	Lodgepole				
				Pierre	Bakken			
					Judith River			
					Three Forks			
				Eagle	Birdbear			
					Duperow			
					Souris River			
				Cretaceous	Niobrara		Devonian	Dawson Bay
								Prairie
								Winnipegosis
								As hern
								Silurian
Stonewall								
Jurassic	Swift		Ordovician					Stony Mountain
				Red River				
				Winnipeg Group				
Triassic	Spearfish		Cambrian	Deadwood				
				Permian	Precambrian			

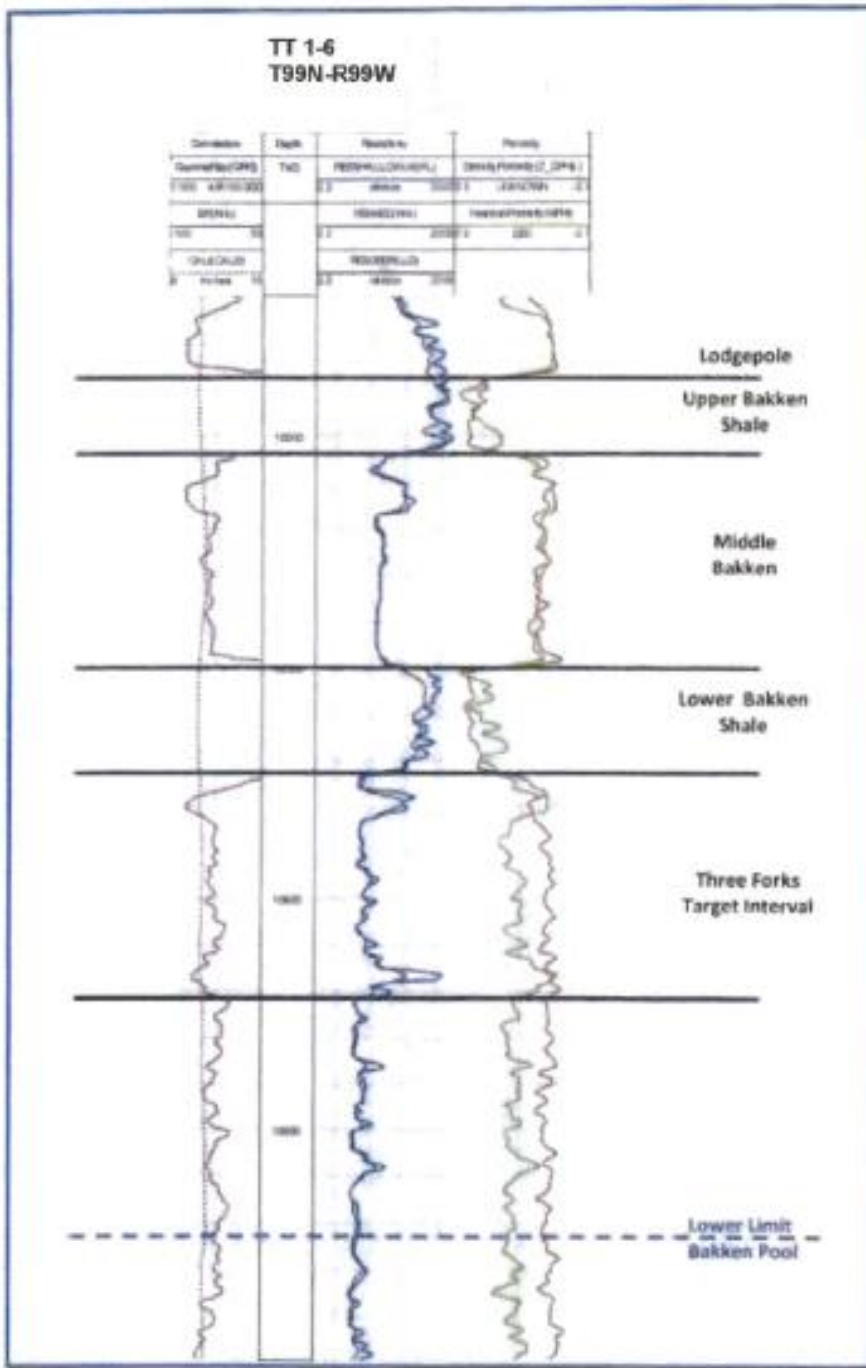
Figure 1 - Generalized stratigraphic column for the Williston Basin, with gas-producing horizons shown in red and oil-producing horizons shown in blue (Source: Heck and others, 2002)

The Bakken Formation in the study area is comprised of three members: (1) an upper shale member; (2) a middle member predominately composed of calcareous/dolomitic, sandy siltstone/ silty sandstone; and, (3) a lower shale member. The upper and lower shale members are organic-rich and serve as the primary source rocks for the hydrocarbons produced from the Bakken Formation. The middle member is the primary reservoir target.

The Three Forks Formation underlies the Bakken Formation and is predominately composed of dolostone and dolomitic sandstone (i.e. Sanish Member). The Three Forks Formation is also present

underlying all of the subject tracts identified by Mr. Y. The source of most of the hydrocarbons produced from the Three Forks Formation is likely from the lower shale member of the Bakken Formation.

Figure 2 is a representative well log from the TT 1-6 vertical well located in NE/4NW/4 of Section 6, T. 99 N., R. 99 W., illustrating the generalized well log characteristics of the Bakken and Three Forks Formations throughout the study area.



*Base of Bakken Pool as defined by NOIC - 100 ft below Base of Lower Shale

Figure 2 - Representative well log showing the generalized well log characteristics of the Bakken and Three Forks Formations throughout the study area. (Source: XYZ Resources Docket Exhibits for OIL AND GAS COMMISSION Case No. #####)

Drainage Analysis

Mr. X and Y provided the BLM with a list of X# of tracts in which they have a mineral interest. The list was sorted by township and range and, to facilitate the analysis, each tract was assigned a number in sequence from 1 to X# corresponding to the original Tract Numbers provided by Mr. X and Y, as shown as Table 1 below. Mr. X and Y's mineral interest in the tracts was verified after the necessary corrections were made to the legal descriptions.

Tract	Tract No.	Aliquot	Section	Township	Range	Acres
33	M9999	W/2	34	T99N	T99W	320
53	M9998	Lots 3 & 4, S2NW, SW	2	T96N	R96W	320

Appendix 1 is a summary of all wells identified by the author to be located within approximately 0.5 mile of each tract listed in Table 1, as of September 30, 2012. Also shown in Appendix 1 are the results of the drainage analysis performed on each currently producing well within approximately 0.5 mile of a subject tract. Any omissions on Appendix 1 are the result of an inadvertent oversight on the part of the author.

NOTE: Wells currently in “confidential” status in Appendix 1 may be listed herein as being within 0.5 mile of a subject tract; however, actual production from such a well may be located much further than 0.5 mile from the tract. The bottom-hole locations of horizontal wells in “confidential” status are unknown. Thus, such wells are only included in Appendix 1 for the sake of completeness, as there is a possibility a “confidential” well’s horizontal borehole within the reservoir interval might be within 0.5 mile of a subject tract.

The author of this report performed a decline-curve analysis on X# currently producing wells (current as of September 30, 2012) located within approximately 0.5 mile of the tracts identified in Table 1 to determine the Estimated Ultimate Recoverable (EUR) amount of oil each well will likely ultimately produce. The analyses was based upon production data available from the Oil and Gas Commission and shown in Appendix 2. The production data is current through September 2012. The author forecasted future production based upon a hyperbolic regression analysis of historical production data. Projections of future production were stopped when each well achieved an assumed economic production limit of 210 stock-tank barrels of oil per month (7 stbo/day) or after a production period of 35 years, whichever event occurred first. The results of the decline-curve analyses are shown in Appendix 3. No analyses were made on plugged and abandoned wells or on inactive wells.

NOTE: The decline-curve analyses shown in Appendix 3 are the author’s most-likely estimate of what each analyzed well may ultimately produce at the assumed end of its economic life. These deterministic estimates represent a single value that lie within a wide range of possible EUR values at various levels of probability. The author is not a petroleum or production engineer; thus, the author’s decline-curve analyses and results presented herein may differ significantly from similar analyses performed by other geotechnical professionals. For example, the author assumed a hyperbolic production decline curve for each analyzed well, whereas other professionals may assume an exponential production decline curve would better describe a well’s decline of production through time, with production broken up into multiple segments. Nevertheless, the author believes the EUR

values shown in this report to be reasonable at the time the analyses were conducted (i.e. current as of September 30, 2012).

The producing formations are assumed by the author to be homogeneous, isotropic reservoirs with uniform permeability. The drainage radius of a horizontal well is assumed, with the exception described below in the following paragraph, by the author to be constant throughout the length of the open wellbore within the productive reservoir. The formula used to calculate the area of drainage assumes the drainage area of a horizontal well is represented as two half circles at the “heel” and “toe” at the ends of the horizontal lateral, and by a rectangle in the central, main portion of the lateral wellbore.

***NOTE:** The Oil and Gas Commission has taken the general position that the drainage radius of a horizontal lateral well producing from the Bakken or Three Forks Formation does not extend beyond approximately 200 feet beyond the “heel” and “toe” of the well. Thus, the correlative rights of offset mineral owners are believed by the Oil and Gas Commission to be not adversely impacted by such wells located at least 200 feet from the well’s “heel” and “toe” within the productive reservoir. The Oil and Gas Commission adopted that position based upon technical evidence and testimony presented by industry experts at various OIL AND GAS COMMISSION oil and gas public hearings. The OIL AND GAS COMMISSION routinely permits the “heel” and “toe” of horizontal Bakken or Three Forks Formation wells to be located no closer than 200 feet to the exterior boundaries of designated spacing units. Because it is the general position of the OIL AND GAS COMMISSION that drainage does not occur beyond 200 feet at the “heel” and “toe” of Bakken or Three Forks Formation horizontal wells, and there is technical evidence to support that position, the author of this report has assumed the same position in this study.*

Thus, for purposes of the present study described herein, drainage is assumed to not occur beyond 200 feet from the “heel” or “toe” of horizontal wells producing from the Bakken or Three Forks Formations. The drainage maps shown in this report may incorrectly depict drainage extending beyond 200 feet at the “heel” or “toe” of a well, but that is merely a consequence of the “buffer feature” within the mapping software program used to generate the maps.

It is also important to note that the calculated drainage areas and drainage radii are applicable to only that portion of a wellbore open to the reservoir (i.e. perforated interval). Thus, given the deviation angle of a horizontal wellbore, a horizontal well penetrates the targeted reservoir usually many feet distal from the well’s surface-hole location.

The standard formula to estimate original oil-in-place resources (OOIP) underlying a tract is as follows:

$$\text{OOIP} = \frac{7,758 \text{ bbls}}{\text{ac} - \text{ft}} \times \text{Area} \times \text{Net Pay} \times \text{Porosity} \times (1 - S_w) \times \frac{1}{\text{FVF}}$$

Where,

OOIP = Original oil-in-place (stbo)

Area = Area of reservoir (acres)

Net Pay = Net pay thickness (feet)

Porosity = Porosity of the rock (fraction)

S_w = Water saturation (fraction)

FVF = Formation volume factor (reservoir barrels/stock-tank barrels)

Thus, given the above formula to calculate OOIP, the drainage area “A_h” of a horizontal well in an isotropic reservoir is calculated by the following formula:

$$A_h = [OOIP \times FVF] / [(7,758 \text{ bbls/ac-ft}) \times \text{Net Pay} \times \text{Porosity} \times (1 - S_w) \times RF]$$

Where,

A_h = Area drained by horizontal well (acres)

OOIP = Original oil-in-place in area drained by the well (stbo)

FVF = Formation Volume Factor (reservoir barrels/stock-tank barrels)

Net Pay = Average net pay thickness (feet)

Porosity = Average reservoir porosity (fraction)

S_w = Water saturation (fraction)

RF = Recovery Factor

The radius of drainage “R_d” of a horizontal well in an isotropic reservoir is calculated by the following formula:

$$R_d = [-2 \times L + \sqrt{[(2 \times L)^2 - (4 \times \pi \times (-A_h \times 43,560))]}] / [2 \times \pi]$$

Where,

R_d = Radius of horizontal well drainage (feet)

L = Length of the open horizontal wellbore in reservoir (feet)

π = Pi (3.14159)

A_h = Area of horizontal well drainage (acres)

The author of this report calculated the likely ultimate drainage area and drainage radius of each currently producing well within approximately 0.5 mile of each subject tract by solving the above-described equations using the reservoir parameters shown in Table 2 and by incorporating the estimated ultimate recoverable quantity of oil determined from each well from the decline-curve analysis.

Appendix 2 shows historical production data for each well located within approximately 0.5 mile of each subject tract identified in Table 1.

Appendix 3 shows the decline-curve analysis performed by the author of this report on each currently producing well located within approximately 0.5 mile of each subject tract identified in Table 1.

Appendix 4 shows the drainage areas calculated by the author of this report for each currently producing well located within approximately 0.5 mile of each subject tract identified in Table 1.

NOTE: Appendix 4 may indicate drainage from some producing wells potentially extending beyond the exterior boundaries of the spacing unit containing the producing well. In such cases, it is assumed that if a well is drilled in the potentially offended spacing unit to the same productive reservoir as the potentially draining well, then the potentially offended spacing unit is precluded from drainage and no effective drainage case exists.

SUMMARY:

The BLM's office of jurisdiction should review the findings of this report, and initiate appropriate drainage protection action, if necessary.

Although most of the subject tracts are protected from drainage by Indian CA's or by protective wells drilled within the spacing unit containing a subject tract, the results of this study indicate that there is a possibility that the following two subject tracts may be drained by nearby wells when those potentially draining wells reach the end of their respective economic life.:

Tract	Tract No.	Aliquot	Section	Township	Range	Acres
33	M9999	W/2	34	T99N	T99W	320
53	M9998	Lots 3 & 4, S2NW, SW	2	T96N	R96W	320

The BLM's Field office of jurisdiction has established drainage cases involving potentially drained Tract No. M9999.

The BLM's North Dakota Field Office has received Applications for Permit to Drill (APDs) to develop the Bakken Pool involving potentially drained Tract No. M9998

If any of the subject tracts are unleased, it is recommended that the BLM recommends to the BIA to offer those unleased tracts for leasing.

This study is current as of September 30, 2012.

REFERENCES CITED:

EOG Resources, 2012, Application for Increased Density, Clarks Creek-Bakken Pool, McKenzie County, North Dakota: North Dakota Industrial Commission website:
<https://www.dmr.nd.gov/oilgas/FeeServices/wfiles/c16/C16805.pdf>

Heck, T. J., and others, 2002, Overview of the petroleum geology of the North Dakota Williston Basin: North Dakota Geological Survey website:
<https://www.dmr.nd.gov/ndgs/Resources/WBPetroleum.asp>

Pollastro, R.M., Cook, T.A., Roberts, L.N.R., Schenk, C.J., Lewan, M.D., Anna, L.O., Gaswirth, S.B., Lillis, P.G., Klett, T.R., and Charpentier, R.R., 2008, Assessment of undiscovered oil resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, 2008: U.S. Geological Survey Fact Sheet 2008-3021, 2 p.

Summary of Drainage Analysis on Subject Tracts

33) Tract M9999: Mr. Y describes this tract as being located in the W/2 of Section 34, T.99 N., R. 99 W.

Information on wells located within approximately 0.5 mile of the tract is provided below.

ZZ 99-99-99-2H (API No. 99-999-99992): This horizontal well was drilled from a surface-hole location 760 feet FSL and 124 feet FWL in the SW/4SW/4 of Section 34, T. 99 N., R. 99 W. to a bottom-hole location 9,372 feet north and 2,602 feet west from the wellhead in the NW/4NE/4 of Section 28, T. 99 N., R. 99 W. The well was spud on January 31, 2010, and completed in the Bakken Formation on August 2, 2010. The well is active and has produced 269,903 stock-tank barrels of oil through September 2012, from a perforated interval 10,811-20,580 feet (9,769 feet of perforations). The well has an EUR of approximately 404,295 stock-tank barrels of oil, with a corresponding estimated drainage area of 483 acres and a drainage radius of 935 feet.

ZZ 99-99-99-1H (API No. 99-999-99991): This horizontal well was drilled from a surface-hole location 736 feet FSL and 221 feet FWL in the SW/4SW/4 of Section 34, T. 99 N., R. 99 W. to a bottom-hole location 9,222 feet north and 872 feet west from the wellhead in the NE/4NE/4 of Section 28, T. 99 N., R. 99 W. The well was spud on March 11, 2010, and completed in the Bakken Formation on August 23, 2010. The well is active and has produced 267,173 stock-tank barrels of oil through September 2012, from a perforated interval 11,175-19,200 feet (8,025 feet of perforations). The well has an EUR of approximately 439,922 stock-tank barrels of oil, with a corresponding estimated drainage area of 526 acres and a drainage radius of 1,161 feet.

ZZ 99-99-3H (API No. 99-999-99993): This horizontal well was drilled from a surface-hole location 748 feet FSL and 173 feet FWL in the SW/4SW/4 of Section 34, T. 99 N., R. 99 W. to a bottom-hole location 5,454 feet south and 1,879 feet east from the wellhead in the SE/4SW/4 of Section 3, T. 98 N., R. 99 W. The well was spud on January 8, 2010, and completed in the Bakken Formation on June 5, 2010. The well is active and has produced 142,657 stock-tank barrels of oil through September 2012, from a perforated interval 11,439-15,770 feet (4,331 feet of perforations). The well has an EUR of approximately 314,760 stock-tank barrels of oil, with a corresponding estimated drainage area of 376 acres and a drainage radius of 1,288 feet.

ZZ 99-34H (API No. 99-999-99934): This horizontal well was drilled from a surface-hole location 221 feet FSL and 554 feet FEL in the SE/4SE/4 of Section 34, T. 99 N., R. 99 W. to a bottom-hole location 4,477 feet north and 1,527 feet west from the wellhead in the NW/4NE/4 of Section 34, T. 99 N., R. 99 W. The well was spud on January 9, 2009, and completed in the Bakken Formation on May 6, 2009. The well is active and has produced 128,885 stock-tank barrels of oil through September 2012, from a perforated interval 10,651-14,810 feet (4,159 feet of perforations). The well has an EUR of approximately 214,992 stock-tank barrels of oil, with a corresponding estimated drainage area of 257 acres and a drainage radius of 981 feet.

ZZ 99-99-2H (API No. 99-999-99929): This horizontal well was drilled from a surface-hole location 270 feet FSL and 565 feet FEL in the SE/4SE/4 of Section 34, T. 99 N., R. 99 W. to a bottom-hole location 4,749 feet south and 565 feet east from the wellhead in the SE/4SW/4 of Section 2, T. 98 N., R. 99 W. The well was spud on November 26, 2008, and completed in the Bakken Formation on April 29, 2009. The well is active and has produced 75,792 stock-tank barrels of oil through

September 2012, from a perforated interval 11,356-15,525 feet (4,169 feet of perforations). The well has an EUR of approximately 208,356 stock-tank barrels of oil, with a corresponding estimated drainage area of 249 acres and a drainage radius of 955 feet.

ZZ 99-3H (API No. 99-999-99939): This horizontal well was drilled from a surface-hole location 257 feet FSL and 198 feet FEL in the SE/4SE/4 of Section 3, T. 98 N., R. 99 W. to a bottom-hole location 4,461 feet north and 1,863 feet west from the wellhead in the NW/4NE/4 of Section 3, T. 98 N., R. 99 W. The well was spud on December 5, 2009, and completed in the Bakken Formation on March 3, 2010. The well is active and has produced 154,043 stock-tank barrels of oil through September 2012, from a perforated interval 10,862-15,054 feet (4,192 feet of perforations). The well has an EUR of approximately 244,837 stock-tank barrels of oil, with a corresponding estimated drainage area of 268 acres and a drainage radius of 1,011 feet.

ZZ 9-9-99-4H (API No. 99-999-99994): This horizontal well has a proposed surface location 945 feet FNL and 1,154 feet FWL in Lot 4 of Section 3, T. 98 N., R. 99 W. The well is in confidential status as of the date of this report and it is unknown to the author if the well has been spud. It is uncertain at this time if this well will potentially impact the subject tract.

ZZ 9-9-99-3H (API No. 99-999-99939): This horizontal well has a proposed surface location 977 feet FNL and 1,177 feet FWL in Lot 4 of Section 3, T. 98 N., R. 99 W. The well is in confidential status as of the date of this report and it is unknown to the author if the well has been spud. It is uncertain at this time if this well will potentially impact the subject tract.

Findings: There are currently producing well(s) within approximately 0.5 mile of the tract. There may be potential for partial drainage of the subject tract by the ZZ 99-99-99-8H and ZZ 99-6H wells.

The wellbore locations of the ZZ 99-99-99-9H, ZZ 99-99-7H, and Moccasin Creek 99-6H producing wells are within approximately 0.5 mile of the tract, and those wells comply with the standard 200-foot heel and toe setback requirements from spacing unit boundaries established by the Oil and Gas Commission for the Bakken and Three Forks Formations to protect offset tracts from drainage.

The Office of jurisdiction has established drainage cases for this tract.

53) Tract 9998: Mr. Y did not provide a legal description of this tract; thus, its location is unknown to the author. *However, the author believes it is possible this tract should have been cited as "Tract 9998," which is described as Lots 3 and 4, S/2NW/4, and SW/4 of Section 2, T. 96 N., R. 96 W. The author's drainage analysis of Tract 9998 is described below.*

UU 99-3H (API No. 99-999-99399): This horizontal well was drilled from a surface-hole location 500 feet FSL and 454 feet FEL in the SE/4SE/4 of Section 3, T. 96 N., R. 96 W. to a bottom-hole location 4,518 feet north and 390 feet west from the wellhead in Lot 1 of Section 3,

T. 96 N., R. 96 W. The well was spud on December 22, 2011, and completed in the Bakken Formation (Bakken pool) on March 17, 2012. The well is active and has produced 75,686 stock-tank barrels of oil through September 2012, from a perforated interval 11,226–15,178 feet (3,952 feet of perforations). The well has an EUR of approximately 232,045 stock-tank barrels of oil, with a corresponding estimated drainage area of 277 acres and a drainage radius of 1,071 feet.

UU 99-11H (API No. 99-999-99911): This horizontal well was drilled from a surface-hole location 305 feet FSL and 1,949 feet FWL in the SE/4SW/4 of Section 14, T. 96 N., R. 96 W. to a bottom-hole location 9,983 feet north and 18 feet west from the wellhead in the NE/4NW/4 of Section 11, T. 96 N., R. 96 W. The well was spud on March 19, 2012, and completed in the Bakken Formation (Bakken pool) on May 25, 2012. The well is active and has produced 68,451 stock-tank barrels of oil through September 2012, from a perforated interval 11,148–20,836 feet (9,688 feet of perforations). The well has an EUR of approximately 257,688 stock-tank barrels of oil, with a corresponding estimated drainage area of 308 acres and a drainage radius of 628 feet.

UU 99-26H (API No. 99-999-99926): This horizontal well was drilled from a surface-hole location 1,456 feet FSL and 1,954 feet FEL in the NW/4SE/4 of Section 35, T. 97 N., R. 96 W. to a bottom-hole location 8,844 feet north and 260 feet west from the wellhead in NW/4NE/4 of Section 26, T. 97 N., R. 96 W. The well was spud on July 2, 2010, and completed in the Bakken Formation (Bakken pool) on October 12, 2010. The well is active and has produced 202,237 stock-tank barrels of oil through September 2012, from a perforated interval 11,232–19,467 feet (8,235 feet of perforations). The well has an EUR of approximately 388,261 stock-tank barrels of oil, with a corresponding estimated drainage area of 463 acres and a drainage radius of 1,025 feet.

UU 99-34H (API No. 99-999-99349): This horizontal well was drilled from a surface-hole location 1,036 feet FNL and 252 feet FWL in the NW/4NW/4 of Section 27, T. 97 N., R. 96 W.

to a bottom-hole location 9,269 feet south and 3,679 feet east from the wellhead in the SE/4SE/4 of Section 34, T. 97 N., R. 96 W. The well was spud on August 7, 2010, and completed in the Bakken Formation (Bakken pool) on October 25, 2010. The well is active and has produced 154,482 stock-tank barrels of oil through September 2012, from a perforated interval 11,348–20,623 feet (9,275 feet of perforations). The well has an EUR of approximately 349,353 stock tank barrels of oil, with a corresponding estimated drainage area of 417 acres and a drainage radius of 855 feet.

Findings: There are currently producing well(s) within approximately 0.5 mile of the tract. There may be potential for partial drainage of the subject tract by the UU 99-3H well.

The BLM's North Dakota Field Office has received an Application for Permit to Drill (APD) from the SS Corp drill the BB 99-99-00B-01H TF well to develop the Three Forks Formation in this tract, and another APD for the CC 0-11H well to develop the Bakken Formation in this tract. The drilling and completion of either of these proposed wells will protect the Bakken Pool in this tract from drainage.

APPENDIX 2 - SUMMARY OF WELLS' PETOPHYSICAL & DRAINAGE INFORMATION WITHIN 0.5 MILE OF SUBJECT TRACTS

Case No.	Tract No.	Well Name	QTQT	Well Location Sec-Twn-Rng	Net Pay (ft)	Sw(%)	Φ (%)	FVF (rb/stb)	RF (%)	EUR (stbo)	Perfs (ft)	Drainage Area (acs) - Ah	Drainage Radius (ft) - Rd	
33	9999	ZZ 99-99-99-2H (active)	SWSW	34-99-99	42	25	6	1.4	8	404295	9769	483	935	
		ZZ 99-99-99-1H(active)	SWSW	34-99-99	42	25	6	1.4	8	439922	8025	525	1161	
		ZZ 99-99-3H (active)	SWSW	34-99-99	42	25	6	1.4	8	314760	4331	376	1288	
		ZZ 99-34H (active)	SESE	34-99-99	42	25	6	1.4	8	214992	4159	257	981	
		ZZ 99-99-2H(active)	SESE	34-99-99	42	25	6	1.4	8	208356	4169	249	955	
		ZZ 99-3H (active)	SESE	3-98-99	42	25	6	1.4	8	224837	4192	268	1011	
		ZZ 9-9-99-4H (confidential)	Lot 4	3-98-99	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
		ZZ 9-9-99-3H (confidential)	Lot 4	3-98-99	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
53	9998	UU 99-3H (active)	SESE	3-96-96	42	25	6	1.4	8	232045	3952	277	1071	
		UU 99-11H (active)	SESW	14-96-96	42	25	6	1.4	8	257688	9688	308	628	
		UU 99-26H (active)	NWSE	35-97-96	42	25	6	1.4	8	388261	8235	463	1025	
		UU 99-34H	NWNW	27-97-96	42	25	6	1.4	8	349353	9275	417	855	

APPENDIX 3 - HISTORICAL PRODUCTION DATA
Case #33 Tract M9999

ZZ 99-99-99-2H			ZZ 99-99-99-1H		
Sec. 34, T99N-R99W			Sec. 34, T99N-R99W		
API 99-999-99992			API 99-999-99991		
Mo/Year	Days	STBO	Mo/Year	Days	STBO
Jan-10			Jan-10		
Feb-10			Feb-10		
Mar-10			Mar-10		
Apr-10			Apr-10		
May-10			May-10		
Jun-10			Jun-10		
Jul-10			Jul-10		
Aug-10	30	32,584	Aug-10	10	8,131
Sep-10	24	19,047	Sep-10	24	20,978
Oct-10	23	14,306	Oct-10	30	27,481
Nov-10	29	14,124	Nov-10	29	20,033
Dec-10	30	11,189	Dec-10	29	15,603
Jan-11	31	9,921	Jan-11	31	10,791
Feb-11	27	9,214	Feb-11	27	9,433
Mar-11	29	8,776	Mar-11	28	8,563
Apr-11	25	8,631	Apr-11	22	7,868
May-11	16	7,204	May-11	4	1,886
Jun-11	28	7,911	Jun-11	28	10,053
Jul-11	29	7,297	Jul-11	31	9,918
Aug-11	29	7,876	Aug-11	31	9,505
Sep-11	25	7,201	Sep-11	25	6,958
Oct-11	28	12,370	Oct-11	29	6,424
Nov-11	30	12,504	Nov-11	29	11,447
Dec-11	31	11,739	Dec-11	31	8,594
Jan-12	30	10,122	Jan-12	29	7,588
Feb-12	29	9,923	Feb-12	29	8,532
Mar-12	31	9,454	Mar-12	31	8,640
Apr-12	28	7,529	Apr-12	28	8,110
May-12	31	6,800	May-12	31	8,572
Jun-12	30	6,398	Jun-12	30	8,296
Jul-12	31	6,082	Jul-12	31	8,303
Aug-12	31	5,819	Aug-12	31	7,894
Sep-12	30	5,182	Sep-12	30	7,572
Oct-12			Oct-12		
	Total	269,203		Total	267,173

ZZ 99-99-3H			ZZ 99-34H		
Sec. 34, T99N-R99W			Sec. 34, T99N-R99W		
API 99-999-99993			API 99-999-99934		
Mo/Year	Days	STBO	Mo/Year	Days	STBO
Jan-10			Apr-09		
Feb-10			May-09	24	12604
Mar-10			Jun-09	27	7771
Apr-10			Jul-09	30	5851
May-10			Aug-09	31	5532
Jun-10	18	11477	Sep-09	30	5079
Jul-10	22	10533	Oct-09	26	3426
Aug-10	29	10481	Nov-09	30	4191
Sep-10	24	6863	Dec-09	31	3953
Oct-10	31	6623	Jan-10	24	2403
Nov-10	29	5430	Feb-10	27	3712
Dec-10	31	4854	Mar-10	1	4728
Jan-11	31	4926	Apr-10	29	4299
Feb-11	28	4022	May-10	30	4029
Mar-11	30	3876	Jun-10	30	3584
Apr-11	28	4893	Jul-10	31	3820
May-11	31	4149	Aug-10	31	3530
Jun-11	24	3810	Sep-10	25	2521
Jul-11	31	3468	Oct-10	31	3067
Aug-11	25	5032	Nov-10	30	2692
Sep-11	30	6034	Dec-10	28	2438
Oct-11	29	6389	Jan-11	31	2708
Nov-11	30	5250	Feb-11	28	2211
Dec-11	31	4842	Mar-11	31	2345
Jan-12	30	4266	Apr-11	30	2241
Feb-12	29	3758	May-11	23	1235
Mar-12	31	3712	Jun-11	29	1693
Apr-12	28	3314	Jul-11	30	2139
May-12	31	3286	Aug-11	31	2006
Jun-12	30	3079	Sep-11	30	2005
Jul-12	31	2980	Oct-11	29	1971
Aug-12	31	2756	Nov-11	30	2025
Sep-12	30	2554	Dec-11	30	1899
Oct-12			Jan-12	31	1930
	Total	142,657	Feb-12	29	1725
			Mar-12	31	1781
			Apr-12	30	1710
			May-12	31	1710
			Jun-12	30	1638
			Jul-12	31	1652
			Aug-12	31	1590
			Sep-12	25	1441
			Oct-12		
				Total	128,885

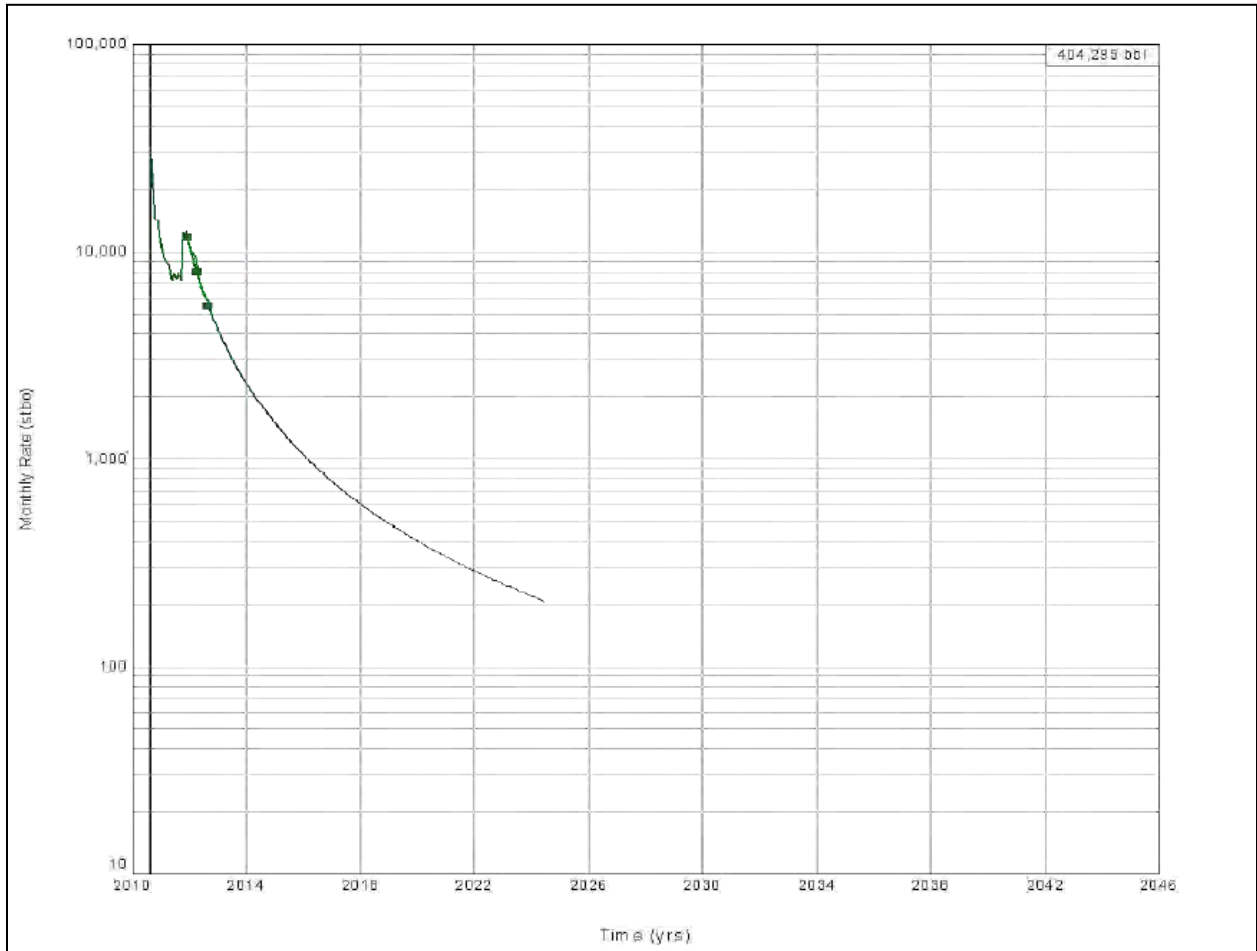
ZZ 99-99-2H			ZZ 99-3H		
Sec. 34, T99N-R99W			Sec. 3, T98N-R99W		
API 99-999-99929			API 99-999-99939		
Mo/Year	Days	STBO	Mo/Year	Days	STBO
Apr-09	5	1957	Jan-10		
May-09	31	7855	Feb-10		
Jun-09	28	4454	Mar-10	30	16726
Jul-09	31	4012	Apr-10	30	10985
Aug-09	31	3698	May-10	30	9705
Sep-09	30	2988	Jun-10	28	6998
Oct-09	31	2323	Jul-10	25	5552
Nov-09	20	1663	Aug-10	31	5633
Dec-09	10	997	Sep-10	30	4606
Jan-10	22	3696	Oct-10	31	4246
Feb-10	26	2759	Nov-10	30	3706
Mar-10	31	2030	Dec-10	31	3425
Apr-10	30	1810	Jan-11	31	2988
May-10	31	1764	Feb-11	28	2115
Jun-10	30	1719	Mar-11	31	2121
Jul-10	30	1321	Apr-11	30	1955
Aug-10	20	1985	May-11	10	3438
Sep-10	30	1910	Jun-11	27	7419
Oct-10	31	1656	Jul-11	31	5695
Nov-10	26	1418	Aug-11	31	5720
Dec-10	31	1527	Sep-11	30	4761
Jan-11	31	1440	Oct-11	31	4986
Feb-11	28	1252	Nov-11	30	4833
Mar-11	31	1328	Dec-11	31	4728
Apr-11	30	1253	Jan-12	31	4423
May-11	26	990	Feb-12	29	3796
Jun-11	30	1120	Mar-12	31	3698
Jul-11	31	1164	Apr-12	30	3710
Aug-11	31	1117	May-12	30	3452
Sep-11	30	1087	Jun-12	29	3282
Oct-11	30	1019	Jul-12	31	3443
Nov-11	30	1075	Aug-12	30	2968
Dec-11	31	1059	Sep-12	30	2930
Jan-12	31	1015	Oct-12		
Feb-12	29	924		Total	154,043
Mar-12	31	973			
Apr-12	30	941			
May-12	31	934			
Jun-12	30	878			
Jul-12	31	891			
Aug-12	31	915			
Sep-12	30	875			
Oct-12					
	Total	75,792			

Case #53 Tract M9998

UU 99-3H			UU 99-11H		
Sec. 3, T96N-R96W			Sec. 14, T96N-R96W		
API 99-999-99399			API 99-999-99911		
Mo/Year	Days	STBO	Mo/Year	Days	STBO
Jan-10			Jan-10		
Feb-10			Feb-10		
Mar-10			Mar-10		
Apr-10			Apr-10		
May-10			May-10		
Jun-10			Jun-10		
Jul-10			Jul-10		
Aug-10			Aug-10		
Sep-10			Sep-10		
Oct-10			Oct-10		
Nov-10			Nov-10		
Dec-10			Dec-10		
Jan-11			Jan-11		
Feb-11			Feb-11		
Mar-11			Mar-11		
Apr-11			Apr-11		
May-11			May-11		
Jun-11			Jun-11		
Jul-11			Jul-11		
Aug-11			Aug-11		
Sep-11			Sep-11		
Oct-11			Oct-11		
Nov-11			Nov-11		
Dec-11			Dec-11		
Jan-12			Jan-12		
Feb-12			Feb-12		
Mar-12	15	5,065	Mar-12		
Apr-12	30	18,118	Apr-12		
May-12	31	15,192	May-12	31	3,472
Jun-12	30	10,497	Jun-12	30	21,724
Jul-12	31	10,690	Jul-12	31	15,897
Aug-12	31	9,754	Aug-12	31	13,991
Sep-12	30	6,370	Sep-12	30	13,367
Oct-12			Oct-12		
	Total	75,686		Total	68,451

UU 99-26H			UU 99-34H		
Sec. 35, T97N-R96W			Sec. 27, T97N-R96W		
API 99-999-99926			API 99-999-99349		
Mo/Year	Days	STBO	Mo/Year	Days	STBO
Jun-09			Jun-09		
Jul-09			Jul-09		
Aug-09			Aug-09		
Sep-09			Sep-09		
Oct-09			Oct-09		
Nov-09			Nov-09		
Dec-09			Dec-09		
Jan-10			Jan-10		
Feb-10			Feb-10		
Mar-10			Mar-10		
Apr-10			Apr-10		
May-10			May-10		
Jun-10			Jun-10		
Jul-10			Jul-10		
Aug-10			Aug-10		
Sep-10			Sep-10		
Oct-10	23	20403	Oct-10	6	4763
Nov-10	30	19446	Nov-10	1	0
Dec-10	31	14318	Dec-10	0	0
Jan-11	31	11818	Jan-11	13	2856
Feb-11	27	8322	Feb-11	28	17070
Mar-11	31	7268	Mar-11	31	13904
Apr-11	30	7374	Apr-11	30	9782
May-11	31	8473	May-11	31	7592
Jun-11	26	7034	Jun-11	17	5345
Jul-11	15	2709	Jul-11	28	11972
Aug-11	31	11115	Aug-11	24	9694
Sep-11	30	9684	Sep-11	30	8733
Oct-11	31	8978	Oct-11	26	6979
Nov-11	30	7335	Nov-11	29	7763
Dec-11	31	7294	Dec-11	31	7830
Jan-12	31	7260	Jan-12	29	6517
Feb-12	29	6392	Feb-12	28	6681
Mar-12	31	6163	Mar-12	31	3763
Apr-12	30	2524	Apr-12	30	3315
May-12	31	7291	May-12	31	2361
Jun-12	30	5696	Jun-12	30	0
Jul-12	31	5312	Jul-12	31	4508
Aug-12	31	5097	Aug-12	31	4874
Sep-12	30	4931	Sep-12	30	8180
Oct-12			Oct-12		
Total		202,237	Total		154,482

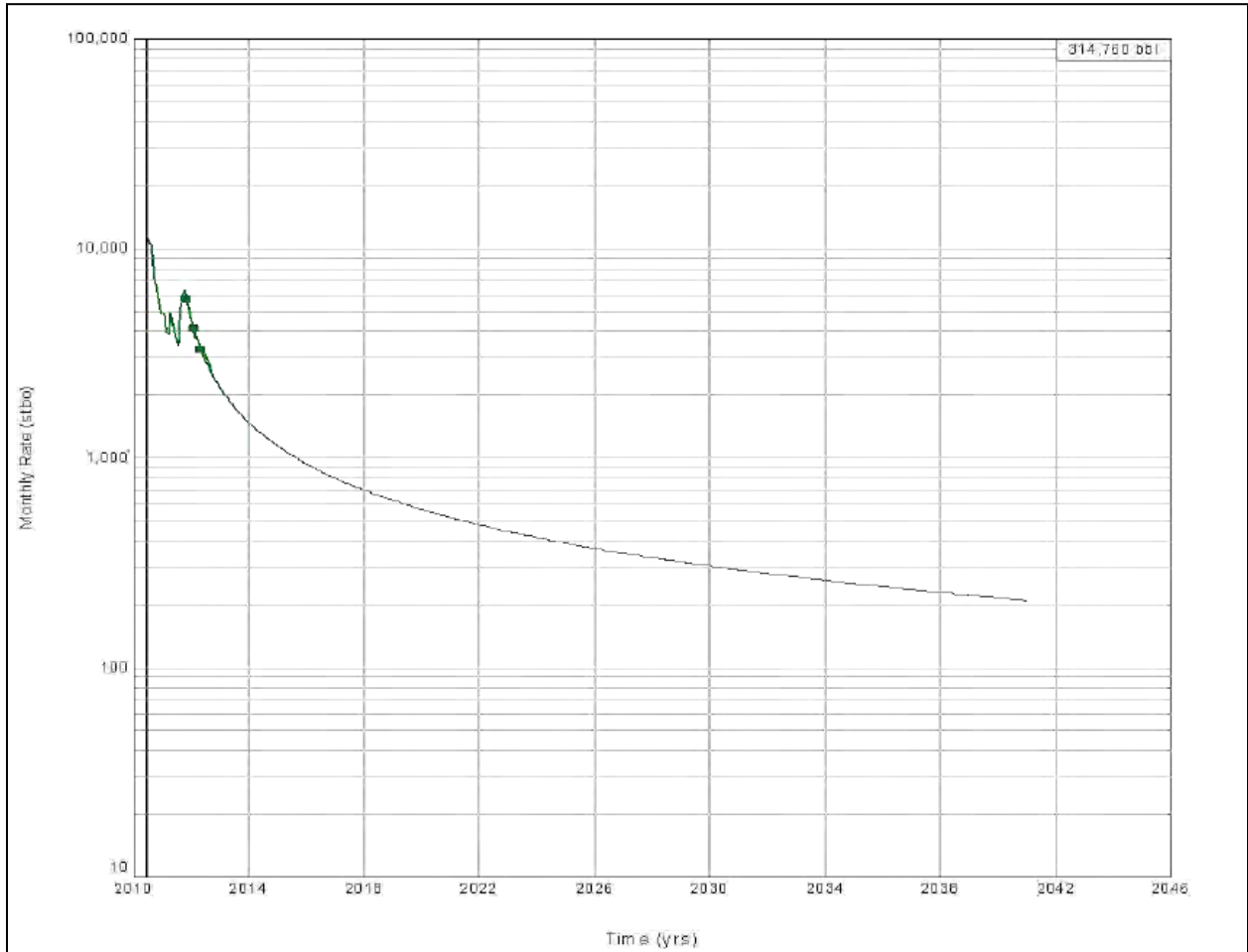
APPENDIX 4 - DECLINE-CURVE ANALYSES



Decline curve analysis for the ZZ 99-99-99-2H well located in Section 34, T. 99 N., R. 99 W.



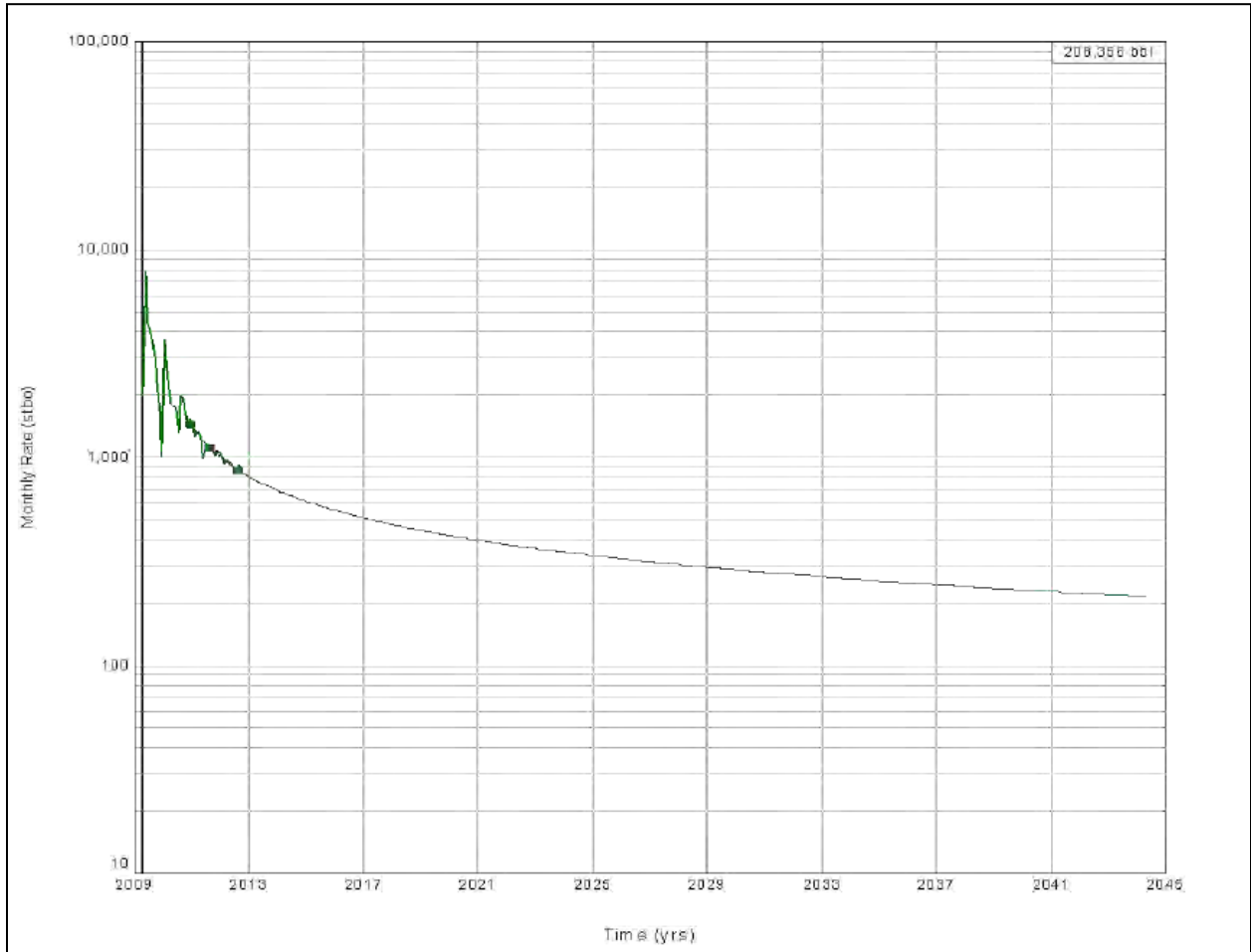
Decline curve analysis for the ZZ 99-99-99-1H well located in Section 34,
T. 99 N., R. 99 W.



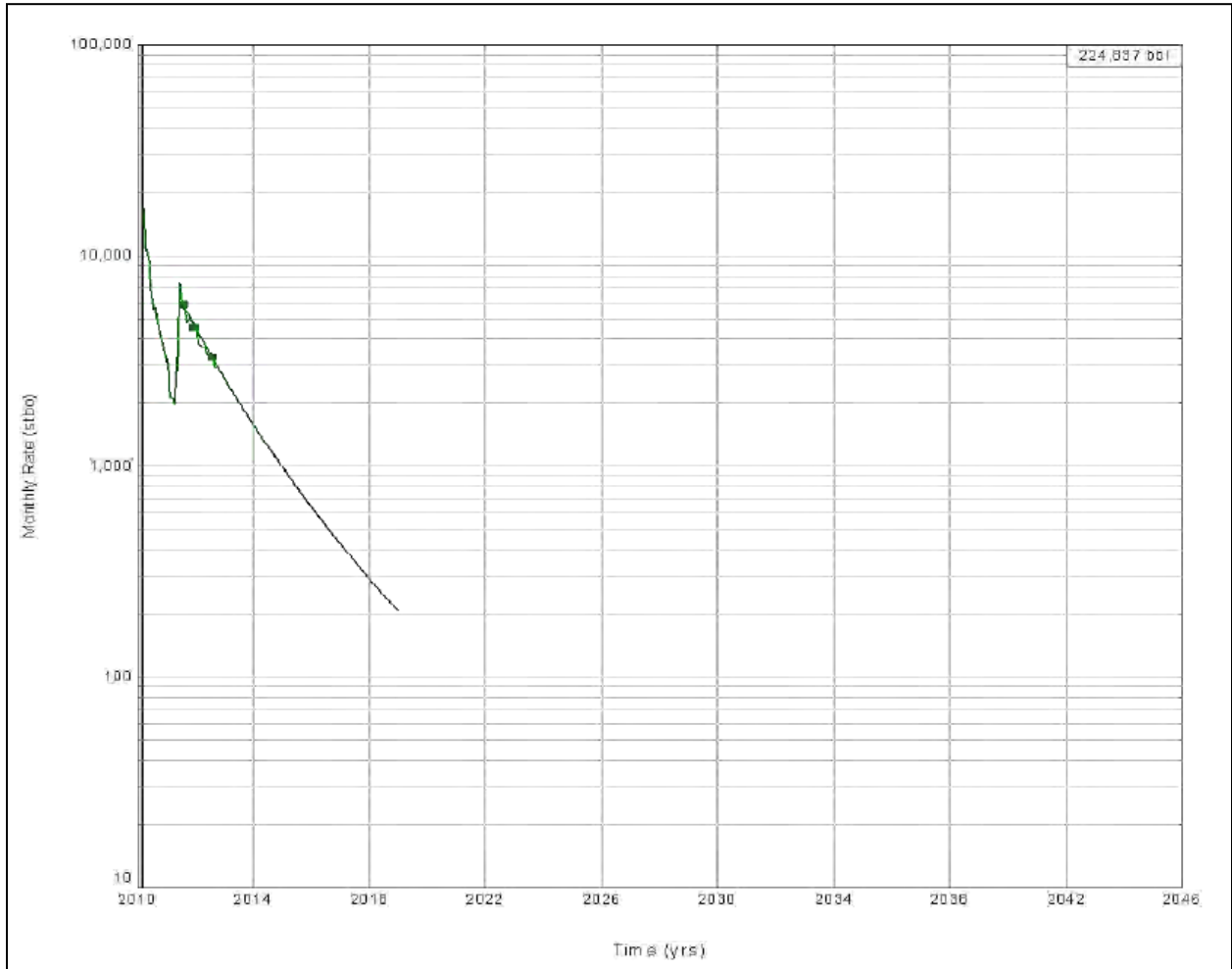
Decline curve analysis for the ZZ 99-99-3H well located in Section 34, T. 99 N., R. 99 W.



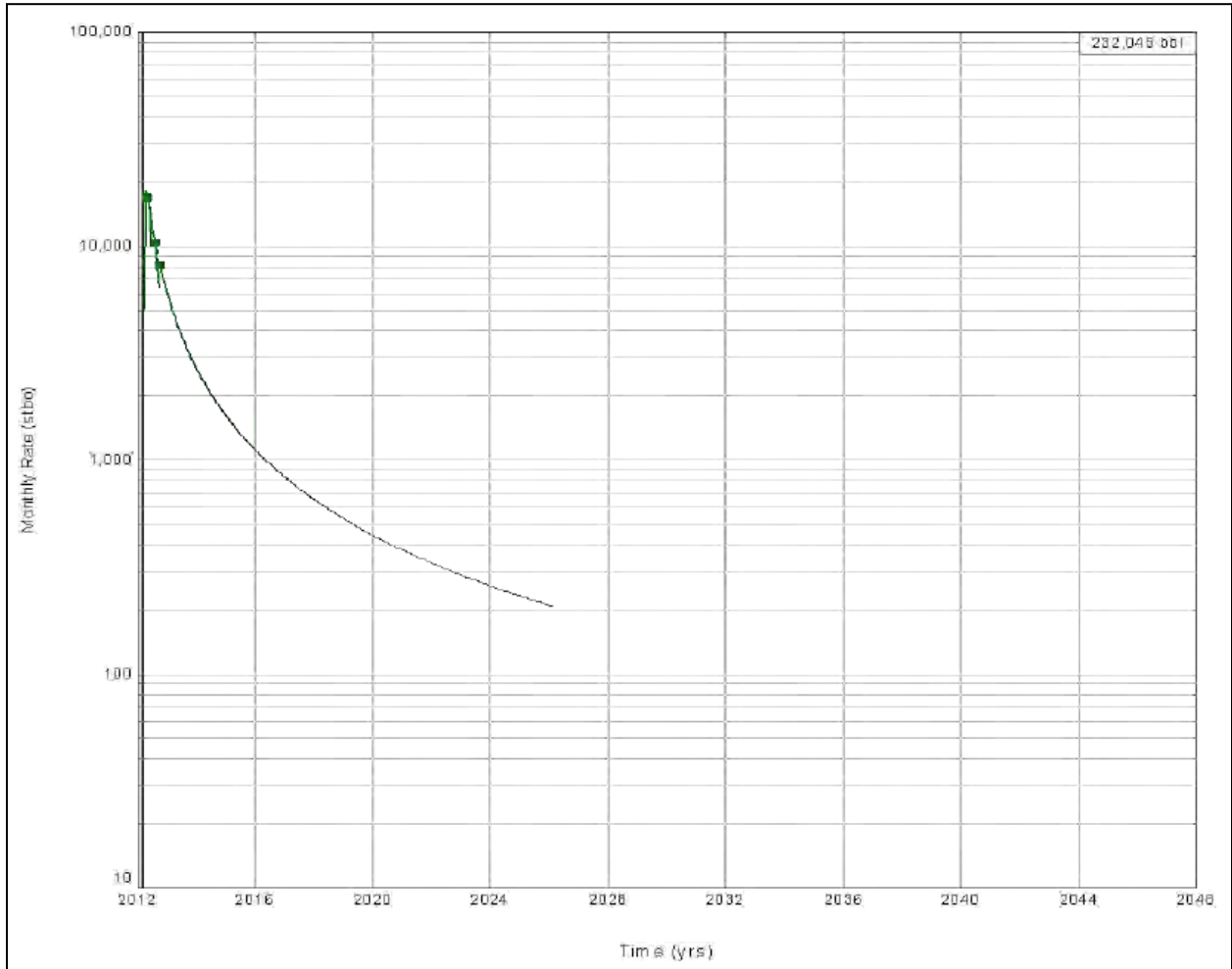
Decline curve analysis for the ZZ 99-34H well located in Section 34, T. 99 N., R. 99 W.



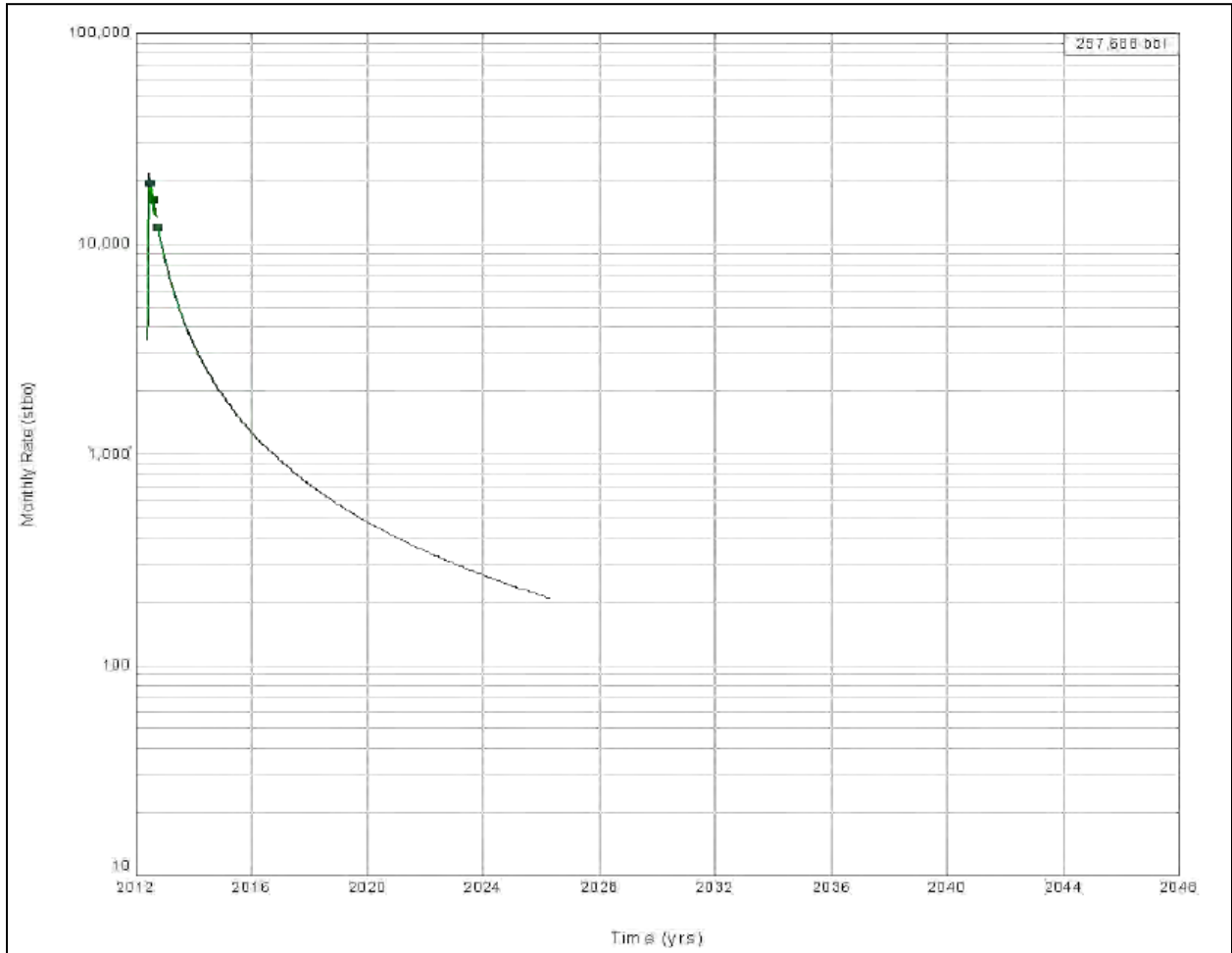
Decline curve analysis for the ZZ 99-99-2H well located in Section 34, T. 99 N., R. 99 W.



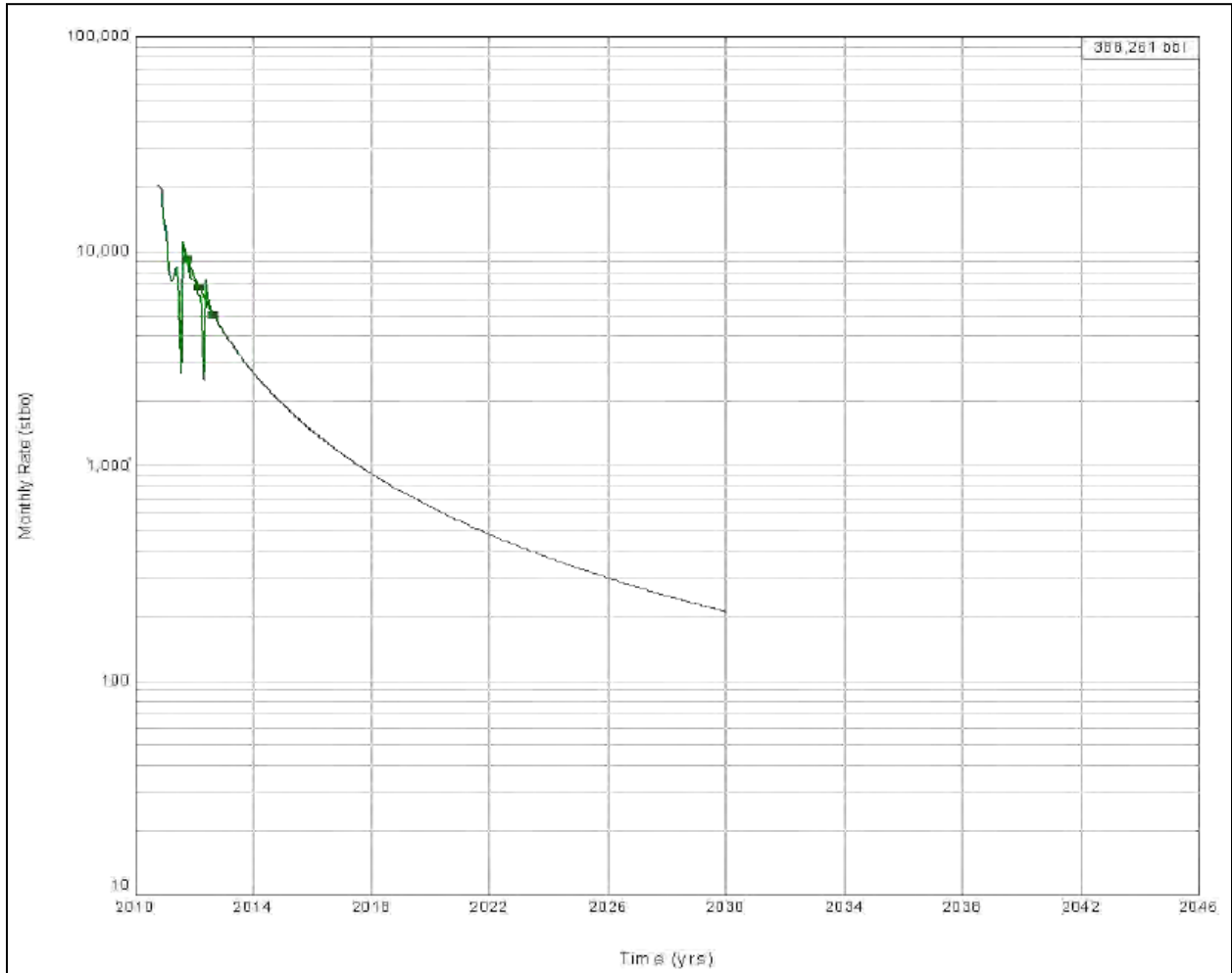
Decline curve analysis for the Moccasin Creek 99-3H well located in Section 3, T. 98 N., R. 99 W.



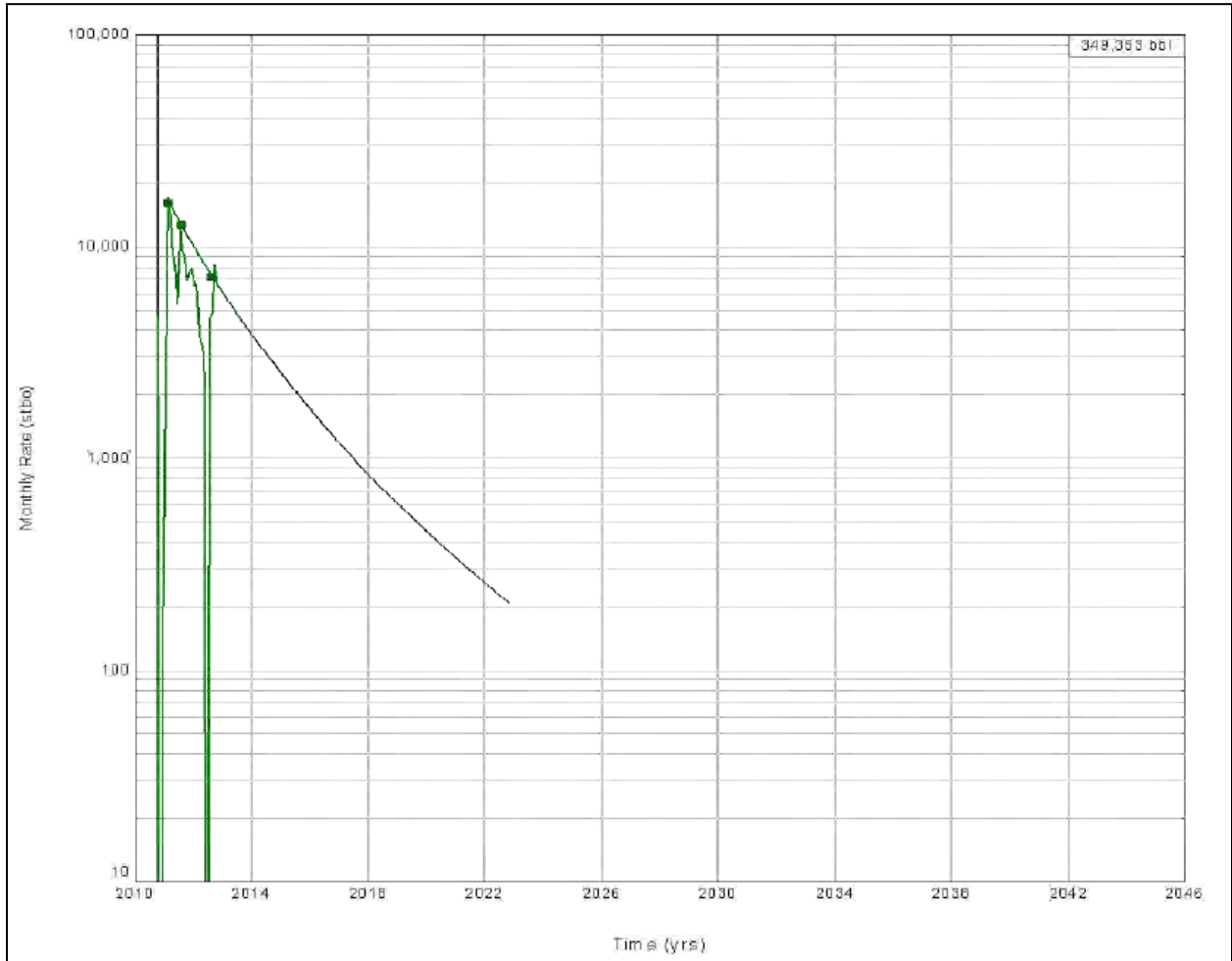
Decline curve analysis for the UU 99-3H well located in Section 3, T. 96 N., R. 96 W.



Decline curve analysis for the UU 99-11H well located in Section 14, T. 96 N., R. 96 W.

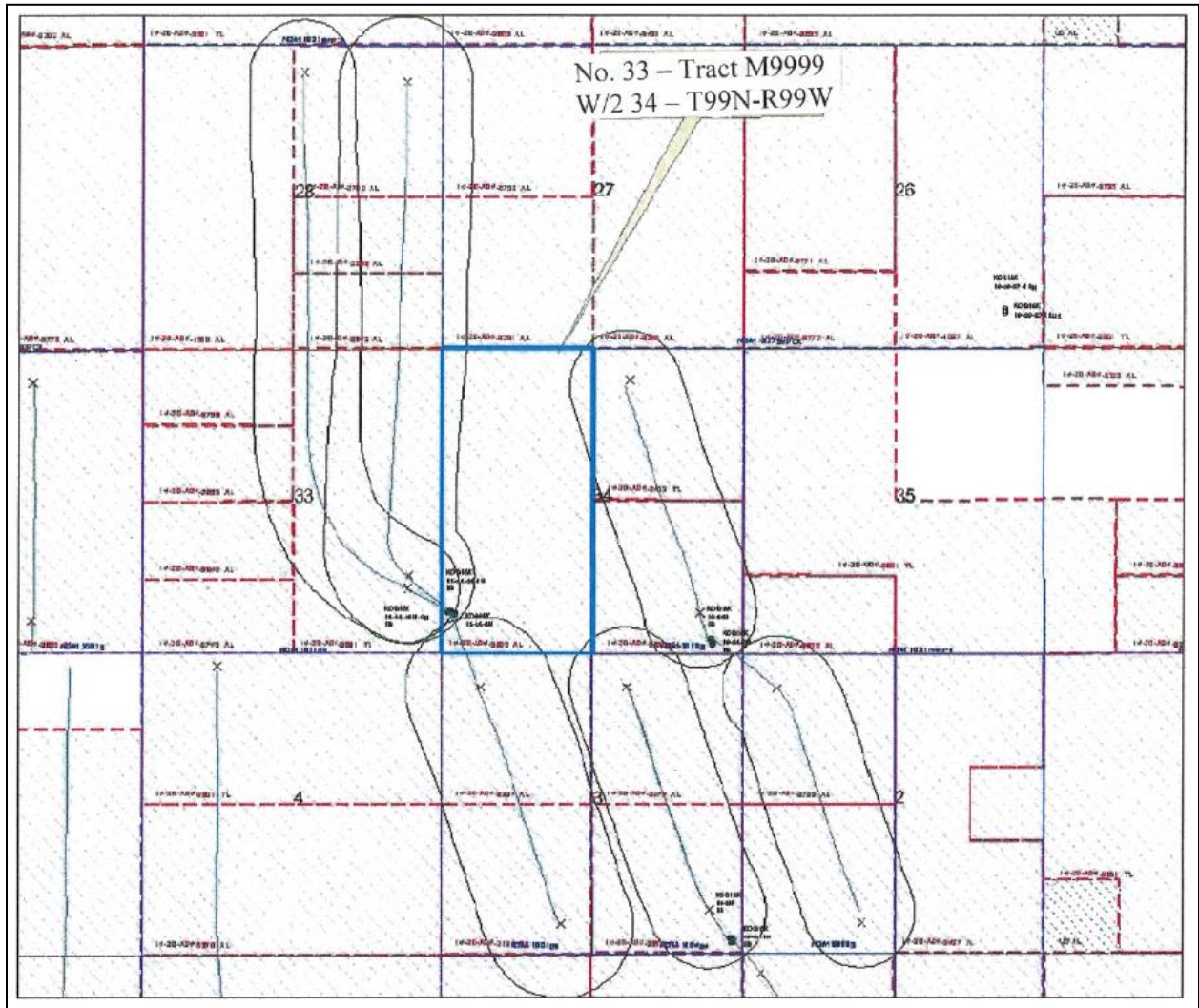


Decline curve analysis for the UU 99-26H well located in Section 35, T. 97 N., R. 96 W.

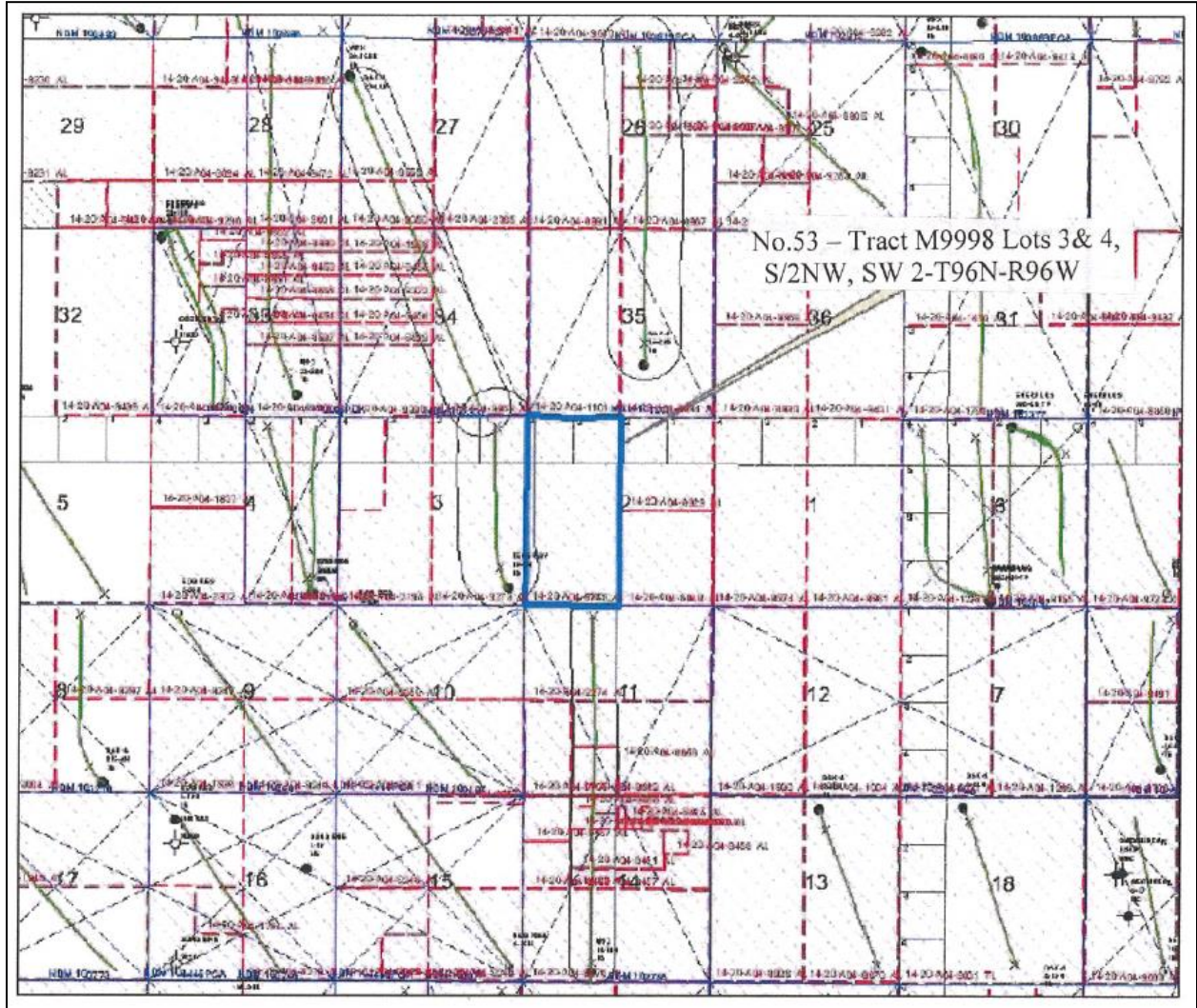


Decline curve analysis for the UU 99-34H well located in Section 27, T. 97 N., R. 96 W.

DRAINAGE AREA MAPS OF CURRENTLY PRODUCING WELLS



Map showing well locations and calculated drainage areas of producing wells within approximately 0.5 mile of Tract No. 33 (M9999), T. 99 N., R. 99 W.



Map showing well locations and calculated drainage areas of producing wells within approximately 0.5 mile of Tract No. 53 (M9998), T. 96 N, R. 96 W.