Monongahela National Forest

Review of New Information for Natural Gas Exploration and Development in Marcellus Shale

Summary of Findings

New information and increased public interest on natural gas exploration and development in Marcellus shale prompted a review from the Monongahela National Forest (MNF or Forest) on the potential effects that potential gas exploration and development may have on Forest resources. An interdisciplinary team of MNF specialists and planning staff reviewed the best scientific information available with regard to current gas exploration and development effects on the MNF, and the potential effects of exploration and development in Marcellus shale. Based on this review, the MNF Forest Supervisor has determined that new information related to gas exploration and development in Marcellus shale does not require correction, supplementation, or revision of the Environmental Impact Statement prepared for the 2006 Forest Plan or the environmental analysis of any ongoing project. He has also determined that new information related to gas exploration and development in Marcellus shale does not require amendment or revision of the 2006 Forest Plan at this time.

Introduction

The intent of this review is to provide a reasoned analysis of recent information on the potential effects of natural gas development, particularly related to Marcellus shale, and its relevance to ongoing and pending projects implementing the 2006 MNF Land and Resource Management Plan (Forest Plan). This documentation provides the decision maker a basis for determining whether to correct, supplement, or revise the environmental analysis supporting the Forest Plan, or projects implementing the Plan. New information, agency emphasis, and increased public interest in natural gas development related to Marcellus shale prompted this review.

Forest Plan Direction

Natural gas exploration and development is allowed on much of the MNF. These activities are managed to control impacts through application of Forest Plan standards and guidelines (see Appendix A), and they are supported through the following Forest Plan desired conditions, goals, and objective:

- *Desired Conditions – Exploration, development, and production of mineral and energy resources are conducted in an environmentally sound manner. Although some areas (designated wilderness, campgrounds, administrative sites, areas dedicated to recreation activities in a remote setting, and scenic areas, for example) are not available for exploration and development of federally owned minerals, most areas of the Forest remain available to mineral activities. Exploration and development of private mineral rights are consistent with deed terms and law, and make reasonable use of the land surface. Approved operating plans include appropriate mitigation measures. (p. II-45)*

- *Goal MG01 - Make minerals available for exploration, development and production consistent with other appropriate uses and protection of the environment. Emphasize energy-producing minerals.*

Facilitate orderly and environmentally sound exploration, development, and production of mineral resources through standardized inspection, monitoring, and reporting requirements. (p. II-45)

- *Goal MG02 - Emphasize appropriate mitigation and reclamation of environmental disturbance for all mineral exploration and development proposals. Reduce environmental effects from past mineral-related activity. Restore disturbed land to a productive condition. (p. II-45)*

- *Goal MG03 - Provide for reasonable access to and use of NFS land surface for mineral activities. Allow for and support reasonable use of NFS land for the exercise of reserved and outstanding mineral rights consistent with deed terms and law. (p. II-45)*

- *Goal MG04 – Integrate mineral and geology project planning and implementation in a manner that is consistent with other resource management direction. Include collection and analysis of the appropriate geologic information as a part of Forest project planning and decision-making. (p. II-45)*

- *Objective MG06 - Keep 70 to 80 percent of federally owned oil and gas available for exploration, development and production. (p. II-45)*

The MNF also monitors and evaluates the effects of natural gas development on a regular basis through the following monitoring items in Chapter IV of the Forest Plan:

- *Monitoring Question 20: Are mineral exploration, development and production mitigation measures being followed and are they effective in reducing impacts? (p. IV-9)*

- *Monitoring Question 21: How close are projected estimates of National Forest System land that could be impacted by natural gas development to actual amounts? (p. IV-9)*

Periodically comparing our predictions on the amount of NFS land impacted by mineral activity to actual amounts provides a way to check whether mineral activity could be producing effects outside of anticipated ranges. Such monitoring also provides additional information on progress toward achieving goals MG01, MG02, and MG04. In particular, MG01, MG02, and MG04 refer to mineral operations being conducted consistent with other uses and protection of the environment in ways that appropriately mitigate and reclaim mineral-related environmental disturbance, and in a manner that is consistent with other resource management direction.

New Information

Leasing the federally owned oil and gas estate is a Forest Plan implementation activity that could result in a proposal by the lessee to develop the natural gas within the leasehold area (MNF Forest Plan EIS, Record of Decision, Randy Moore, Regional Forester, July 20, 2006, p 42-43). Recently, a number of groups and individuals—who objected to the latest federal gas lease offerings on the Forest, or who attended a seminar on federal gas leasing and operations in March 2010—voiced concerns that exploration and development of the Marcellus shale, a relatively new Appalachian region natural gas exploration and development effort, will result in unacceptable effects to MNF resources, and these effects have not been analyzed or disclosed. These groups and individuals were concerned that the reasonably foreseeable natural gas development scenario prepared for Forest Plan revision no longer represents potential gas development, and thus the scenario no longer provides a reasonable basis for effects. The following section discusses the adequacy of the Forest Plan and associated NEPA documentation regarding future potential Marcellus shale development under a federal oil and gas lease.

We have heard concerns that Marcellus shale gas exploration and development will result in greater effects to National Forest resources than analyzed and disclosed in previous Forest Plan environmental documents. In particular, concerns that were expressed include:

- The overall area of National Forest land that could be impacted may be larger than predicted because Marcellus gas well sites are generally 4-5 acres in size compared to the estimated average 2-acre well site projected in the Forest's reasonably foreseeable gas development scenario,
- Large volumes of freshwater typically required to complete hydraulic fracturing to release gas from the Marcellus shale could dry up or reduce aquatic habitat in Forest streams, and affect groundwater quantity,
- Disposal of used hydraulic fracturing water that flows back from the well could pollute land, streams, and groundwater if land application of these fluids is allowed to occur or if illegal disposal occurs, and
- Contamination or loss of groundwater quantity due to high pressure hydraulic fracturing.

As a result of these concerns, the aforementioned groups and individuals want the Forest Service to not consent to oil and gas leasing on the MNF, to discard or amend the Forest's foreseeable gas development scenario as a basis for effects, and/or to re-analyze effects of Marcellus shale gas exploration and development on MNF resources.

In the discussion that follows, we review the projected impacts, based on the reasonably foreseeable development scenario, and examine how foreseeable Marcellus shale gas exploration and development may bear on projected impacts to MNF land and resources.

Evaluation

The Forest Plan revision process provided the opportunity to determine if National Forest resource impacts from natural gas exploration and development have been occurring as predicted. Disturbance – including earth disturbance, vegetation clearing, and conversion from forested to herbaceous vegetation types – and associated effects were considered during Forest Plan revision for the projected reasonably foreseeable amount of natural gas leasing and development in the Monongahela National Forest Final Environmental Impact Statement (FEIS) for Forest Plan Revision (September 2006).

A comparison of predicted versus actual natural gas development on the Forest indicated substantially less development has occurred than predicted for the period 1991 through June 2006 (FEIS, p. 3-368). After adding in new surface disturbances for the period June 2006 through fiscal year (FY) 2010, a comparison of predicted and actual surface-disturbing gas activities shows about 20 percent of the projected number of wells have been drilled, and 6 percent of the anticipated acres of surface disturbance, 8 percent of the anticipated road miles, and 30 percent of the anticipated gas pipeline miles have been actually proposed and authorized since 1991. Therefore, disturbance from gas development has been and continues to occur at levels considerably less than predicted in 1991 and reassessed in 2006.

At a site-specific scale, gas well site disturbed area and clearing size were examined to determine how their size compared to acreage estimates used to generate earth-disturbance projections. The Forest Plan revision effects analysis used an earth disturbance estimate of an average 2 acres per well site. Findings of the report "Evaluating the Effects of Gas Well Development on the Resources of National Forest Lands" prepared in 2007 by Northern Research Station scientist Mary Beth Adams (unpublished. February 1, 2007) indicate that gas well sites on the Forest range in size from an estimated 0.4 acres to 2.5 acres, with an average size of about 1.25 acres. These findings on well site size are another indication that earth disturbance from gas development is occurring at levels less than predicted.

Future Activity within Federally-Issued Leases

Prior to forwarding lands to the Bureau of Land Management (BLM) to be offered in a lease sale, the Forest staff verify that such leasing has been adequately addressed in the Forest Plan's NEPA document, identify conditions of surface occupancy from the Forest Plan, and determine that operations would be allowed somewhere on the proposed lease area, except where stipulations prohibit all surface occupancy (MNF, Record of Decision, Randy Moore, Regional Forester, July 20, 2006, p 42-43). This process has been used on the MNF for more than two decades for the purpose of providing consent to the BLM to lease federally owned oil and gas. Approximately 107,600 acres or 19 percent of the federally owned oil and gas is currently leased on National Forest System (NFS) land within the MNF.

Once a lease has been issued, proposals to conduct operations within the lease area undergo a site-specific analysis according to the National Environmental Policy Act (NEPA). Surface use plans for proposed activities within the lease must be reviewed and approved by the Forest Service before the proposed use of NFS land is authorized (FEIS, p 3-372). This process for authorizing use of NFS land within a leased area has been used on the MNF for more than two decades.

Reasonably Foreseeable Development Scenario (RFDS). Oil and gas leasing regulation provides direction on the conduct of analyses (36 CFR 228.102 Subpart E). This direction requires a projection analysis of "...the type/amount of post leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program" (36 CFR 228.102 (c)(2) and (3)). The oil and gas RFDS is speculative, but is based primarily on geology, namely the potential for oil and gas resource occurrence based on credible geologic and mineral production information, along with past and present oil and gas activity. This RFDS is also developed with consideration of other important factors such as economics, technology, and physical limitations on access, and existing or anticipated infrastructure and transportation. Existing laws, regulation and certain administrative limits, such as congressionally designated wilderness being unavailable for federal oil and gas lease, are assumptions included in the RFDS. Although the RFDS has its basis in oil and gas resource potential, it focuses on development potential within the MNF proclamation boundary and purchase units over the life of the Forest Plan (10-15 years). Surface uses necessary to implement the anticipated gas exploration and development on the MNF are included in the RFDS. The RFDS is not a "worst case scenario" based on well-spacing law.

The MNF Forest Plan utilized the RFDS as a basis for determining potential effects to National Forest resources from gas leasing and development. The RFDS describes typical operator activities associated with natural gas exploration and developments that are expected to continue over the planning period. These activities include:

- Obtaining an oil and gas lease,
- Conducting preliminary investigations, most commonly by geophysical exploration using seismic shot hole or vibroseis methods,
- Exploratory drilling,
- Development and production, and
- Plugging wells and decommissioning facilities that are not part of economical production (FEIS, p 3-367).

In the RFDS, planned and potential gas developments were projected to result in the following activities per decade:

- Clearing about 130 acres for 66 gas well sites, each about 2 acres,
- Clearing about 138 acres for an estimated 19 miles of new road to access projected well drilling, and
- Clearing about 473 acres for 78 miles of gas pipeline from an estimated 41 producing wells (out of the 66 drilled wells); rights-of-way may be up to 50 feet wide.

It was assumed that some of the 66 wells would not yield gas. Consequently, it was also assumed that an estimated 50 acres would begin reverting back to forested land shortly after drilling. Cleared areas from producing wells would remain open, supporting herbaceous vegetation, throughout gas production of probably up to 30 years. Due to the intermingled private and federal land and mineral ownership, one half to two thirds of this predicted surface disturbance could be a result of privately owned gas (FEIS, pp 3-367 to 3-368).

Potential for Marcellus Shale Gas and the Surface Resource Uses Projected in the RFDS. If Marcellus shale gas exploration and development occur in the planning period, they are expected to result in surface uses within the amount and type projected in the RFDS as explained below.

The Character of Marcellus Shale within the MNF. There is much uncertainty regarding the presence and amount of economically recoverable Marcellus shale gas resources within the MNF. Reports range from no natural gas resources of note from tests for Marcellus shale gas in existing wells (Oriskany sandstone/ Huntersville chert) within the Forest, to discovery of Marcellus shale gas on private land or outside of the MNF boundary.

Economic Marcellus shale gas discovery depends in part on the ability to force the Marcellus shale layer to release a sufficient amount of the gas trapped within the tightly bound shale to recover the costs of drilling and releasing the gas profitably. Although discovery of economic Marcellus shale gas is reportedly occurring around and near the Forest, the complex folding and faulting of rock layers, combined with the thickness of Marcellus shale within the Forest, are expected to have a bearing on the likelihood and rate of Marcellus shale gas exploration within the Forest such that it is foreseeable to proceed slowly, if at all.

Obtaining a sufficient quantity of Marcellus shale natural gas from a well depends on the well bore's ability to extend into and have contact with a large amount of the Marcellus shale formation containing natural gas. If the Marcellus shale layer is discontinuous due to faulting, or difficult to follow with a well bore due to folds in the strata, as is the case within the MNF, establishing contact with extensive areas of gas bearing portions of the Marcellus formation will be difficult and costly, if possible at all. Faulting present within the Forest also provides a conduit for any gas that may have been present in the Marcellus shale to escape, resulting in no gas or a "dry hole." The drilling history in the Forest for the deeper (than Marcellus) Oriskany sandstone/Huntersville chert provides evidence for the effects of folding and faulting on the potential and risk for discovering economic quantities of gas. Thus, the geologic setting of the MNF is expected to slow, delay, or possibly even preclude exploration and development of Marcellus shale gas within the Forest.

A review of the available information on completed Marcellus shale gas wells, their reported gas flows (final open flow data), and production records on Marcellus pay zone gas wells finds data supporting a lack of or delayed exploration and development.

Figure 1 uses data obtained from West Virginia Geological and Economic Survey (WVGES) to show the Marcellus shale gas situation in West Virginia. All but a few of the completed Marcellus pay zone gas wells are outside of or west of the MNF. Even though the shale formation that contains the Marcellus is thicker in the MNF area compared to other parts of West Virginia (hence could have the potential to contain and yield more natural gas), the majority of Marcellus exploration and development has occurred in areas where folding and faulting is less frequent and lower in magnitude (West Virginia Geological and Economic Survey, 02/2011)

Comparing gas flows from completed, vertically drilled (approximately vertical in contrast to wells with approximately horizontal bore holes) Marcellus pay zone wells in a similar geologic setting to the MNF with those in less folded and faulted portions of West Virginia, one finds gas flow rates away from the MNF to be on the order of four to eight times that of Marcellus shale wells close in proximity and in geologic setting to the MNF (West Virginia Geological and Economic Survey, 02/2011). No horizontal wells have been drilled in the MNF's geologic setting, therefore, gas flows or production capability from horizontal Marcellus shale wells is unknown (West Virginia Department of Environmental Protection Office of Oil and Gas, 02/2011).

The combination of low natural gas prices, high drilling and completion costs, paucity or otherwise limited availability of natural gas pipelines to transport gas to markets, and uncertainties associated with potential for successfully finding natural gas in the MNF's geologic setting act together to slow, delay or possibly preclude development of Marcellus shale gas development in the foreseeable future on the MNF. Marcellus shale gas exploration and development that would occur is expected to produce impacts to surface resources similar to and within anticipated ranges analyzed in MNF 2006 Forest planning documents.

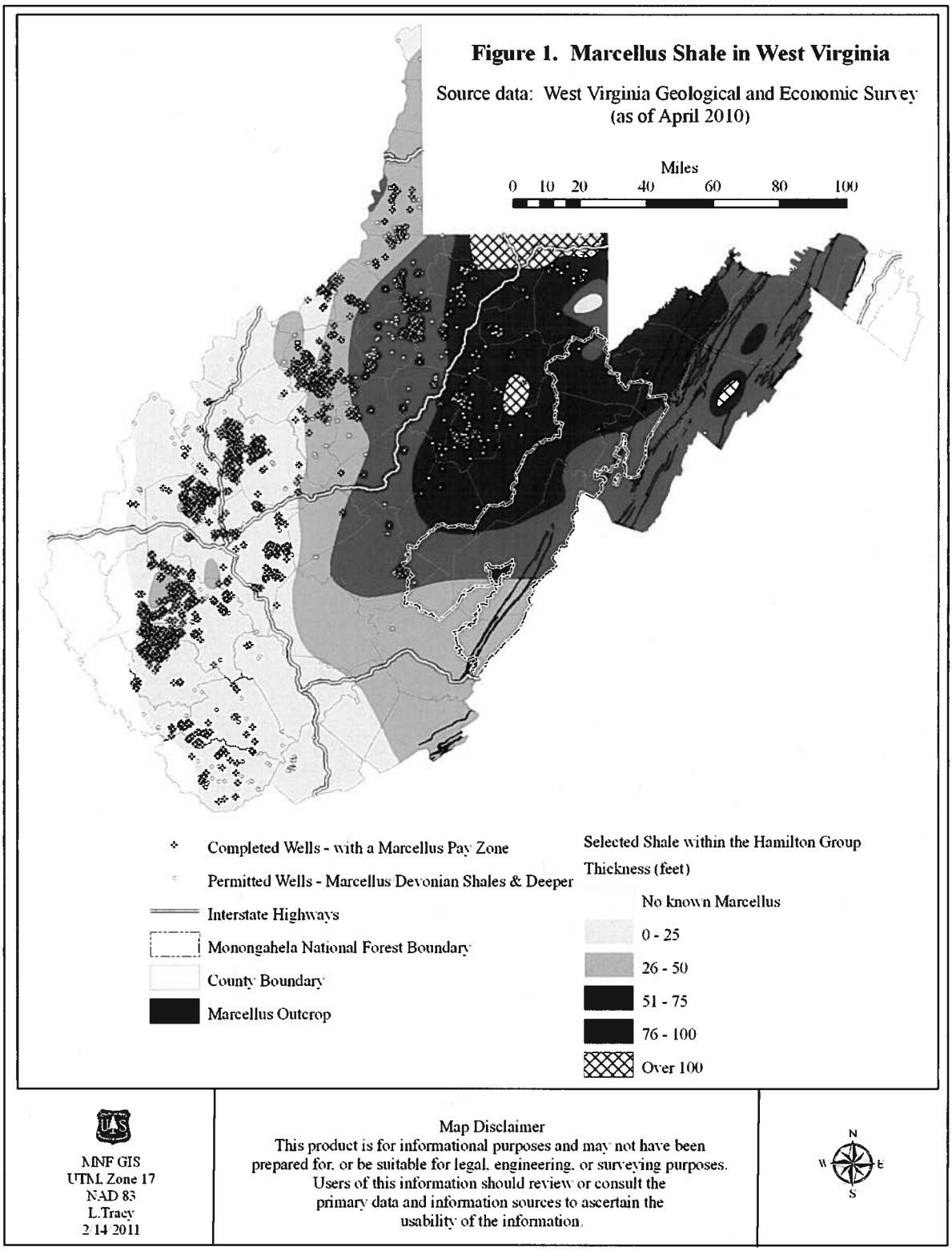
Figure 1. Marcellus Shale in West Virginia
Source data: West Virginia Geological and Economic Survey (as of April 2010)
Miles
0 10 20 40 60 80 100
Completed Wells - with a Marcellus Pay Zone
Permitted Wells - Marcellus Devonian Shales & Deeper
Interstate Highways
Monongahela National Forest Boundary
County Boundary
Marcellus Outcrop
Selected Shale within the Hamilton Group
Thickness (feet)
No known Marcellus
0 - 25
26 - 50
51 - 75
76 - 100
Over 100
MNF GIS
UTM Zone 17
NAD 83
L.Tracy
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This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
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Surface Resource Use Projection. Given the character of Marcellus shale and the complex geology within the MNF, it is reasonable to expect only limited exploration for Marcellus shale gas during the planning period. However, if economically recoverable resources are discovered, additional Marcellus shale gas development could follow.

How would surface resource use associated with exploration and development of Marcellus shale gas compare to surface use projected in the RFDS?

Marcellus shale exploration and development has not occurred to date on Monongahela NFS land. However, we have had an indication on how such exploration and development may occur based on similar activities in other areas. A Marcellus shale well site, on the order of 4-5 acres, would be used to accommodate 6-8 well bores that would be drilled horizontally in different directions into the Marcellus shale formation. The best information available indicates that within the Forest, individual well sites would be spaced so that no more than one well site would occur in approximately 640 acres.

Typical operating activities such as obtaining a lease, conducting preliminary investigations, exploratory drilling, development and production, and plugging wells and decommissioning facilities that are not part of economical production, would still be expected to occur (FEIS, p. 3-367). In addition, surface uses associated with projected levels of Marcellus shale exploration and development are expected to be within predicted amounts in the current RFDS. For example, projected well spacing would be the same as that of the RFDS used in the Forest Plan revision, and this spacing leads to a similar projection of acres of use, or less, for access roads and pipelines (an estimated 13.5 acres, if pipeline rights-of-way are an average of 50 feet wide).

Given that only 6 percent of the anticipated number of acres of surface disturbance has occurred in the last two decades, the Forest Plan revision analysis has considered and analyzed effects on more than 690 acres of disturbance per decade than has actually been occurring. This means that surface disturbance associated with the limited amount of anticipated Marcellus shale exploration and development, in combination with that of any other gas drilling, would still be expected to fall within Forest Plan revision-analyzed amounts. As such, we conclude that the overall area of NFS land that could be impacted by gas exploration and development, including that of Marcellus shale gas, is not expected to exceed predicted and analyzed amounts during the planning period. Forest staff will continue to monitor any new gas exploration and development on a regular basis to ensure this conclusion is valid.

How are MNF resources protected from potential impacts from drilling and producing Marcellus Formation gas?

People have expressed concerns about a variety of potential surface-impacting activities on an oil and gas lease area associated with Marcellus shale exploration and development. However, Forest Service and Bureau of Land Management (BLM) regulations (36 CFR 228 E and 43 CFR 3160); authority in the lease (BLM form 3100-11, Section 6 Conduct of Operations); the additional conditions attached to a lease (USDA Forest Service Standard Stipulations, and included Oil and Gas Lease Stipulation/Notifications, Monongahela National Forest, West Virginia); and the NEPA process of reviewing, approving, and applying mitigation to proposals

to address site-specific concerns raised and anticipated for Marcellus shale gas, as well as other foreseeable gas exploration and development, provide environmental protections and surface use controls to ensure that any proposed operations could be designed and mitigated to comply with the MNF Forest Plan standards.

Summary of Environmental Protections applicable to proposed gas developments on a federal lease:

1. Federal oil and gas leases contain environmental protection requirements as in Section 6 of the standard lease term:

   "Conduct of operations – Lessee shall conduct operations in a manner that minimizes adverse impacts to the land, air and water, to cultural, biological, visual, and other resources, and to accomplish the intent of this section. To the extent consistent with lease rights granted, such measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of interim and final reclamation measures."

2. Environmental protections to which proposed lease operations are subject include a wide range of laws and regulations, including the Endangered Species Act, Archaeological Resources Protection Act, Federal Water Pollution Control Act, Clean Water Act, Clean Air Act, National Environmental Policy Act, as well as all the other environmental protection laws and regulations applicable to NFS land. For example, when an operation is proposed on a federal lease, the Forest Service, under a federal law such as Archaeological Resources Protection Act, can control or prohibit surface occupancy, when justified, without a lease stipulation.

3. In addition to the environmental analysis conducted prior to leasing, a site-specific environmental analysis under NEPA is required for proposed lease operations within the MNF. The leaseholder cannot construct a road, drill a well, or conduct ground-disturbing operations without approval from the federal government. The leaseholder must submit an Application for Permit to Drill (APD), including Drilling Plan and Surface Use Plan of Operations, which must be reviewed and approved by the BLM and the Forest Service, respectively, before ground-disturbing operations can occur.

4. Proposed lease operations are subject to environmental protection requirements in BLM regulations, including Onshore Oil and Gas Onshore Orders. BLM regulation Onshore Oil and Gas Order No. 1 contains environmental protection requirements for the Drilling Plan and Surface Use Plan of Operations in the APD. For example, Drilling Plan requirements include that "The Drilling Plans must be in sufficient detail to permit a complete appraisal of the technical adequacy of, and environmental effects associated with, the proposed project" (Onshore Oil and Gas Order No. 1, Section III.D.3). BLM regulation Onshore Oil and Gas Order No. 2 contains environmental protection requirements for Drilling Operations, including, "The proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, abnormally pressured zones, and any prospectively valuable deposits of minerals" (Section III.B).

5. Proposed lease operations are subject to environmental protection requirements in Forest Service regulations, including the 36 CFR 228E regulations that implement the Federal Onshore Oil and Gas Leasing Act of 1987. For example, Forest Service oil and gas regulation surface use requirements at 36 CFR 228.108 require environmental protections relating to access facilities, cultural and historical resources, fire prevention and control, fisheries, wildlife and plant habitat, soil erosion and sedimentation, safety, management of wastes, watershed protection, and reclamation.

6. Federal oil and gas leases on the MNF are conditioned such that proposed lease operations are subject to standards in the Forest Plan. Federal leases contain the following special notification:

   Operations under this lease will be consistent with the standards found in the Monongahela National Forest Land and Resource Management Plan (Forest Plan), as revised or amended, and are hereby incorporated into this lease in its entirety. Forest Plan standards include restrictions on location, timing and methodology of oil and gas lease operations, and requirements for special surveys that provide for protection of National Forest land and resources. A copy of the Monongahela National Forest Land and Resource Management Plan is available for inspection from:

   USDA Forest Service
   200 Sycamore Street
   Elkins, West Virginia 26241

7. In addition, proposed federal lease operations are subject to West Virginia laws and regulations governing oil and gas operations, including those requirements for environmental protection and regulation.

<u>Examples of how the environmental protections would work to control effects from Marcellus shale gas drilling and development on federal oil and gas leases on the MNF</u>

With regard to concerns associated with large volumes of freshwater required for horizontal well hydraulic fracturing, the Forest Service has complete authority for approving, not approving, or approving with conditions, the source, timing or method of freshwater withdrawal on NFS land. The MNF Forest Plan standards that condition leases (Oil and Gas Lease Stipulation/ Notifications, Monongahela National Forest, West Virginia, Special Notification #1) provide direction to use the Forest Plan in reaching a decision on the proposed surface use. For example, a proposal to operate on a federal lease would be evaluated with consideration given to the Forest Plan soil and water goal SW30, "Maintain surface and ground water sources to support healthy riparian and aquatic habitats, wetlands, channel function, and downstream uses". Additional protection of surface and groundwater quantity is found in West Virginia Division of Environmental Protection (WVDEP) Industry Guidance on Gas Well Drilling/Completion, for Large Water Volume Fracture Treatments (WVDEP Office of Oil and Gas, 03/2011) that addresses issues of water use and withdrawal statewide. This State-issued guidance, coupled with the requirement to submit an addendum to the State well work permit application showing proposed water source(s) location(s) and volume, provides for protection of water and aquatic

resources not on NFS land from being substantially adversely impacted by large volume water withdrawals.

Similarly, the Forest Service has authority to approve, not approve, or approve with conditions, proposals for disposal of used hydraulic fracturing water on NFS land with a federal oil and gas lease area as part of completing the site-specific or project level NEPA analysis. This means a proposal to operate on a federal lease, including the proposed method of fluid disposal, would be evaluated for effects with consideration given to the Forest Plan direction and standards. WVDEP's Industry Guidance (WVDEP Office of Oil and Gas, 03/2011) provides direction that is applicable statewide as well, including a prohibition on applying Marcellus shale formation hydraulic fracturing flowback fluids on the land (WVDEP Office of Oil and Gas, 7/30/2010), and a discussion of options such as underground injection control, recycling fracture treatment flowback fluids, and disposal at approved, publicly owned treatment facilities. Operators must submit an addendum to the State well work permit application for large volume water use (greater than 210,000 gallons) that identifies the proposed water disposal method to be reviewed and approved as part of the Well work permitting process.

People are also concerned about possible impacts to groundwater from Marcellus shale well drilling and hydraulic fracturing. On NFS land, the BLM has authority to review the drilling plan portion of an application for a permit to drill (APD) on the federal oil and gas lease area, in order to assure that the drilling plan meets national standards for well control and protection of fresh water zones (43 CFR 3160, Onshore Oil and Gas Order No. 1). A proposal to drill a well on a federal oil and gas lease must address protection and/or isolation of all usable water zones in the well casing design (43 CFR 3160, Onshore Oil and Gas Order No. 2, Section III.B.). As part of the Forest Service's role in review and approval of a Surface Use Plan of Operation, effects to groundwater will be considered, analyzed and documented as part of the NEPA completed on a proposal to operate on a federal lease. The review and analysis of the proposed casing design provides the opportunity to take a hard look at potential for impacts to groundwater, and the authority to approve the casing design or not provides the mechanism for assuring the casing design addresses potential groundwater quality impacts. Thus, this authority provides the means for conditioning the drilling permit to ensure casing design and integrity of the installed casing is adequate to protect fresh groundwater resources from contamination or loss of quantity due to hydraulic fracturing. Hydraulic fracturing for deep gas wells has been occurring on MNF land for several decades with no known instances of groundwater contamination or reports of reduction in flow.

Determination

It is my determination that the new information related to potential natural gas exploration and development in Marcellus shale does not require correction, supplementation, or revision of the Environmental Impact Statement prepared for the 2006 Forest Plan or the environmental analysis of any ongoing project for the following reasons:

- The Environmental Impact Statement for the 2006 Forest Plan revision was prepared in 2006 and was based on the best available scientific information.

- There has been little natural gas exploration and no development or production in the Marcellus shale of NFS land since the 2006 Forest Plan revision.

- The impacts to NFS land and resources predicted in the MNF Forest Plan revision RFDS continue to represent foreseeable impacts during the planning period, even with the possibility of limited Marcellus shale gas exploration and development.

- Based on the findings in the **Evaluation** section (above), at this time there is no justifiable reason to discard as a basis for effects, or amend the Forest's foreseeable gas development scenario, and/or re-analyze effects of Marcellus shale gas exploration and development on MNF resources. The MNF FEIS contains the appropriate level of NEPA analysis and documentation to support current federal oil and gas leasing decisions.

It is also my determination that new information related to potential natural gas exploration and development in Marcellus shale does not require amendment or revision of the 2006 Forest Plan at this time for the following reasons:

- The Forest Service has the authority to address environmental concerns, including those associated with Marcellus shale gas drilling and development, when a proposal is made to drill or develop gas resources within a lease.

- The MNF Forest Plan standards and guidelines, which are incorporated into, and therefore binding on, federal oil and gas leases, provide the direction for controlling impacts to NFS land and resources to acceptable levels (see Appendix A).

- The monitoring items in Chapter IV of the Forest Plan are adequate for tracking effects or changes to Forest resources from natural gas exploration and development. The MNF will continue to monitor whether or not estimates of National Forest resource impacts associated with gas development, which provide the basis for effects analysis related to a variety of National Forest resources, are exceeding predicted amounts.

I therefore conclude—based on the information I considered in the Forest Plan, Environmental Impact Statement, Record of Decision, planning record, resource monitoring, and research presented in this document—that a correction, supplement, or revision to the environmental documentation for the 2006 Forest Plan or an amendment, revision, or correction of the 2006 Forest Plan is not necessary at this time.

Clyde N. Thompson
Forest Supervisor

3/28/11
Date

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Appendix A - Forest Plan/Natural Gas Development Tables

The table below shows the Management Prescription areas on the Forest and whether they allow surface occupancy for federal gas leasing exploration and development.

Forest Plan Management Prescriptions and Federal Natural Gas Leasing

Management Prescription	Management Emphasis	Surface Occupancy Allowed for Federal Gas Leasing?
3.0 – Vegetation Diversity (196,900 acres or 21% of Forest)	Age class diversity, sustainable timber, variety of habitat and forest scenery	Yes
4.1 – Spruce and Spruce-Hardwood Ecosystem Restoration (155,700 acres or 17% of Forest)	Active and passive restoration of spruce-hardwood communities, spruce research, recovery of T&E and other rare species	Yes
5.0 – Designated Wilderness (116,000 acres or 13% of Forest)	Preserve wilderness attributes and natural environment	No*
6.1 – Wildlife Habitat Emphasis (286,400 acres or 31% of Forest)	Enhance wildlife habitat through vegetation management, active restoration of oak communities	Yes
6.2 – Backcountry Recreation (96,400 acres or 10% of Forest)	Variety of non-motorized recreation opportunities in a semi-primitive setting and largely natural environment	No
8.0 – Special Areas (73,600 acres or 8% of Forest)	Preservation of unique ecosystems or areas for scientific or recreational purposes, research areas, biodiversity	Variable
• 8.1 – SKSR National Recreation Area (57,200 acres)	A variety of recreational settings and opportunities; conservation of scenic, scientific, historic and other values	Yes, (Roughly 32,000 acres) No, in SPNM areas (Roughly 25,000 acres)
• 8.2 – National Natural Landmarks (2,460 acres)	Preservation of nationally significant ecological and geological natural areas	No
• 8.3 – Scenic Areas (2,470 acres)	Preservation of outstanding beauty and visual quality areas for public enjoyment	No
• 8.4 – Ecological Areas (3,080 acres)	Preservation of rare ecosystems to enhance biodiversity and provide for scientific or recreation activities	No
• 8.5 – Research Areas (6,840 acres)	Areas set aside for research purposes, includes Fernow Experimental Forest	No
• 8.6 – Grouse Management Areas (8,570 acres)	Establish and maintain habitat suitable for ruffed grouse and other species that need an early successional component in habitat	Yes

*Federal oil and gas is not available for leasing.

Forest Plan Direction Providing Resource Protection from Gas Exploration and Development

The following tables, presented by resource area, provide a variety of examples of how Forest-wide management direction in the Plan would reduce potential impacts from natural gas exploration and development, including in Marcellus shale.

Soils (pp. II-9 through II-11)

Management Direction Type, Number and Description
Goal SW01 - Maintain, restore, or improve soil quality, productivity, and function. Manage soil disturbances from management activities such that they do not result in long-term loss of inherent soil quality and function.
Standard SW03 - Disturbed soils dedicated to growing vegetation shall be rehabilitated by fertilizing, liming, seeding, mulching, or constructing structural measures as soon as possible, but generally within 2 weeks after project completion, or prior to periods of inactivity, or as specified in contracts. Rip compacted sites when needed for vegetative re-establishment and recovery of soil productivity and hydrologic function. The intent is to minimize the time that soil is exposed on disturbed sites or retained in an impaired condition.
Standard SW03 - Erosion prevention and control measures shall be used in program and project plans for activities that may reduce soil productivity or cause erosion.
Standard SW08 - Management actions that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions.
Guideline SW11 - Soil stabilization procedures should take place as soon as practical after earth-disturbing activities are completed or prior to extended periods of inactivity. Special revegetation measures may be required.
Guideline SW14 - Mulch should be applied on severely eroded areas, or areas with high potential for erosion, such as new road cut and fill slopes.
Guideline SW15 - Topsoil should be retained to improve the soil medium for plant growth on areas to be disturbed by construction. Topsoil should be salvaged from an area during construction and stockpiled for use during subsequent reclamation, or obtained from an alternate site. On some areas, soil material may have to be added to obtain vigorous plant growth. Soil to be used for this purpose should have chemical tests made to determine its desirability for use.
Guideline SW19 - Management activities that may result in accelerated erosion and loss of organic matter should have one or more of the following practices applied to mitigate potential effects: a) Limiting mineral soil exposure, b) Appropriately dispersing excess water, c) Ensuring sufficient effective groundcover, d) Stabilizing disturbed soils through revegetation, mulching, or other appropriate means, e) Preventing or minimizing excessive compaction, displacement, puddling, erosion, or burning of soils, and f) Preventing or minimizing the initiation or acceleration of mass soil movement (e.g., slumps, debris flows, or landslides).

Stream Channels, Lakes, and Wetlands (pp. II-11 through II-14)

Management Direction Type, Number and Description
Goal SW29 - Maintain or restore riparian and floodplain function, including floodwater retention and storage.
Goal SW30 - Maintain surface and ground water sources to support healthy riparian and aquatic habitats, wetlands, channel function, and downstream uses.
Goal SW31 - Maintain, enhance, or restore vegetation conditions that provide: a) Ecological functions of riparian, wetland, and aquatic ecosystems. b) Canopy conditions that regulate riparian and stream temperature regimes for native and desired non-native fauna and flora. c) Natural recruitment potential for large woody debris and other sources of nutrient inputs to aquatic ecosystems. d) Bank and channel stability and structural integrity. e) Habitat and habitat connectivity for aquatic and riparian-dependent species and upland species that use riparian corridors. f) Buffers to filter sediment.
Standard SW34 - No programmed timber harvest shall occur within the channel buffers identified in the table in SW37. Tree removal from the buffers may only take place if needed to meet aquatic or riparian resource management needs, or to; a) Provide habitat improvements for aquatic or riparian species, or threatened, endangered, sensitive, and locally

rare species; b) Provide for public or worker safety; c) Construct or renovate an approved facility; d) Construct temporary road, skid road, or utility corridor crossings; e) Conduct aquatic or riparian-related research, or f) Allow for cable yarding.
Standard SW36 - When stream crossing structures are removed, stream channels shall be restored to their near-natural morphology (width, depth, and gradient associations for streambeds, bands, floodplains, and terraces). Disturbed soil shall be stabilized.
Standard SW43 - Channel buffers shall not be available for commercial mineral material development.
Standard SW44 - New roads are allowed within channel buffers but are restricted to essential crossings. Construction of roads parallel to the channel shall be avoided within the channel buffer.
Standard SW45 - New roads within the channel buffer shall be designed to minimize impacts on aquatic and riparian resources.
Guideline SW51 - Ground disturbance should be avoided within seeps, vernal pools, bogs, fens, and other wetlands during project implementation. These areas should be managed to protect wet soils and rare plants and provide wildlife watering sources using the following protection: a) No new system roads or skid roads should be located within these areas except at essential crossings. Such crossings should be designed to minimize disturbance to the extent practical. b) Logs should not be skidded through these areas. Keep slash and logs out of them. c) Where available, a canopy of 60-100 percent crown closure should be maintained within and adjacent to these areas, unless a more open canopy is needed for TEP species or RFSS management. d) Mast trees or shrubs may be planted in seeps if mast plants are currently lacking.
Guideline SW59 - Where private minerals are explored or developed within channel buffers, work with mineral developers to minimize disturbance to aquatic and riparian resources.
Guideline SW61 - Work with special use permittees to mitigate effects from their operations to soil, water, and aquatic resources within channel buffers.
Guideline SW62 - Stream crossing construction on temporary and permanent roads should be completed as soon as practical, with mitigation as needed to minimize the potential for sedimentation.

Vegetation (pp. II-18 through II-20)

Management Direction Type, Number and Description
Standard VE13 - For management actions that have been identified by the Forest as likely to cause a negative effect on RFSS populations, negative effects shall be avoided or minimized to the maximum extent practical while still accomplishing the purpose of the project or action. Unavoidable negative effects shall be mitigated to the extent practical and consistent with the project purpose.
Guideline VE14 - Rare communities should be identified during project analysis. Management actions should avoid rare communities unless management is necessary to maintain, enhance, or restore a particular community. Conservation and management measures for rare communities should be determined on a case-by-case basis.
Standard VE22 - Projects that may contribute to the spread or establishment of noxious weeds shall be designed to include measures to reduce the potential for spread and establishment of noxious weed infestations.
Guideline VE25 - Special use permits should include language where appropriate to reduce the risk of NNIS invasion and spread.
Standard VE32 - Unless specifically registered for aquatic use, ground application of pesticides shall be conducted such that they do not enter surface waters, wetlands, or sink holes.

Wildlife and Fish (pp. II-29 through II-31)

Management Direction Type, Number and Description
Standard WF13 - For management actions that have been identified by the Forest Service as likely to cause a negative effect on RFSS or Birds of Conservation Concern populations, negative effects shall be avoided or

minimized to the maximum extent practical while still accomplishing the purpose of the project or action. Unavoidable negative effects shall be mitigated to the extent practical and consistent with the project purpose.
Standard WF14 - For protection of cold water fisheries, apply the following to the channel buffers of perennial trout streams (stocked and native) during the period of October 1 to June 1: a) Potential sediment-producing ground disturbance exceeding two consecutive days shall only be initiated after consultation with a Forest fisheries biologist. b) Potential sediment-producing ground disturbance allowed during this period shall employ additional erosion control measures, seeding or mulching, applied concurrently with the activity.

Minerals and Geology Resources (pp. II-45 through II-48)

Management Direction for Mineral and Geology Resources		
Type	**Number**	**Direction Description**
General Mineral Exploration and Development		
Goal	MG01	Make minerals available for exploration, development and production consistent with other appropriate uses and protection of the environment. Emphasize energy-producing minerals. Facilitate orderly and environmentally sound exploration, development, and production of mineral resources through standardized inspection, monitoring, and reporting requirements.
Goal	MG02	Emphasize appropriate mitigation and reclamation of environmental disturbance for all mineral exploration and development proposals. Reduce environmental effects from past mineral-related activity. Restore disturbed land to a productive condition.
Goal	MG03	Provide for reasonable access to and use of National Forest System (NFS) land surface for mineral activities. Allow for and support reasonable use of NFS land for the exercise of reserved and outstanding mineral rights consistent with deed terms and law.
Goal	MG04	Integrate mineral and geology project planning and implementation in a manner that is consistent with other resource management direction. Include collection and analysis of the appropriate geologic information as a part of Forest project planning and decision-making.
Objective	MG06	Keep 70 to 80 percent of federally owned oil and gas available for exploration, development and production.
Standard	MG07	Surface-disturbing exploration (including core drilling) is allowed except where prohibited by other Forest plan direction or as a result of site-specific analysis.
Standard	MG08	Site-specific mitigation measures shall be applied as needed to help protect other resources.
Standard	MG09	Mineral exploration and development may be restricted to prevent unacceptable impacts to developed recreation sites, administrative sites, threatened and endangered species, or specially designated areas.
Standard	MG10	Applicants for private and federal mineral development proposals must submit an operating and rehabilitation plan for review.
Standard	MG11	Adequate sanitary, waste disposal and storage facilities must be provided during construction and operation to prevent possible contamination from human waste, oil, fuel, lubricants, and litter.
Standard	MG12	Mineral development and exploration near functioning stream channels shall comply with direction found in the Soil and Water section.
Standard	MG13	Roads no longer needed for operations shall be closed to vehicular traffic, unless other use is approved by the Forest. Bridges and culverts shall be removed if the road is not in the Forest Transportation System. Cross drains, dips, or waterbars shall be installed. In visually sensitive areas, the road surface shall be shaped to as near a natural contour as practicable and be stabilized.

Management Direction for Mineral and Geology Resources		
Type	**Number**	**Direction Description**
Standard	MG14	Removal of timber on reserved and outstanding minerals is controlled by the deed. All other merchantable timber that must be cut for mineral development shall be marked by the Forest Service and sold to the operator at current market rates. All cut merchantable timber must be removed from NFS land or stockpiled in an area agreed upon by the Forest.
Standard	MG15	Reclamation shall include revegetating the site with native or desirable non-native, non-invasive species to control erosion and improve the visual quality of the site.
Standard	MG16	Waste rock, stumps, and soil shall be disposed of in approved locations.
Standard	MG17	The top 6 inches of soil shall be stockpiled and protected during the operation, and spread over the site as part of the revegetation and rehabilitation of the site.
Standard	MG18	The Forest Service has the responsibility to ensure that an archeological survey is made on sites where proposed mineral activity could affect cultural resources. If cultural resources are discovered, the operator shall assume the cost of evaluation and mitigation by a qualified archeologist. Archeologists conducting survey, evaluation, and/or mitigation for an operator must first secure a Special Use permit from the Forest Service.
Standard	MG19	When mineral developments are located within 500 feet of the boundary of a developed recreation area, seasonal restrictions shall be implemented to mitigate potential user safety hazards and user conflicts
Guideline	MG20	Mining sites should not be located on poorly drained soils as defined by the Soil Survey Report. If sites must be located on poorly drained soils, suitable mitigation measures should be instituted, and identified in the operating plan.
Guideline	MG21	The search for and development of mineral resources should be accomplished in a manner compatible with the resource values, environmental concerns, and management prescription for the area affected.
Guideline	MG23	Mineral activity areas should be secured against unauthorized visitors, using reasonable security measures such as gates and/or fencing. Signing and gating should be in accordance with the Manual of Uniform Traffic Control Devices.
Guideline	MG24	Mineral sites should avoid areas from which potable water supplies are being drawn. Intensive investigation may be required in limestone outcrop areas.
Guideline	MG25	Unmerchantable slash created by road or site clearing within 100 feet of any road open to public vehicular traffic should be disposed of by lopping and scattering. Slash should not be piled and should lie within 3 feet of the ground. The Forest Supervisor may approve other uses for the slash. Sensitive view areas may require more intensive treatment of slash or treatment over a larger area.
Guideline	MG26	Use vegetative screening or structural design to visually blend project activities into the landscape.
Oil and Gas Leasing - Recreation		
Standard	MG27	Gas pipelines and gas well sites are not allowed within developed recreation areas.
Standard	MG28	Gas well sites are not allowed within 300 feet of a developed recreation area or Scenic Area.
Standard	MG29	No new gas/oil road construction is allowed within developed recreation areas. Road use by construction and gas drilling and development vehicles shall not be allowed during the primary recreation use season, which is determined for each developed recreation area.
Standard	MG30	Within 500 feet of the boundary of developed recreation areas or any designated Scenic Area, construction and gas drilling and development activities are not allowed during the primary recreation use season, which is determined for each developed recreation area. Routine and emergency maintenance of gas developments is allowed.
Standard	MG31	Construction, gas drilling, and development are not allowed within concentrated use areas designated by Forest Supervisor Order during the primary recreation use season, which is determined for each concentrated use area. Routine and emergency maintenance of gas developments is allowed.

Management Direction for Mineral and Geology Resources		
Type	**Number**	**Direction Description**
Oil and Gas Leasing – Other Resources		
Standard	MG32	Gas well sites are not allowed in a wetland.
Standard	MG33	Pipelines are not generally allowed within a wetland. If a wetland cannot be avoided, pipeline construction may be allowed as long as the subsurface drainage patterns can be preserved and maintained. Any pipeline that crosses a wetland shall cross in a way that minimizes disturbance to the wetland.
Standard	MG34	Cave or groundwater contamination from gas or oil operations shall be avoided or mitigated.
Standard	MG35	Gas well sites are not allowed on administrative sites.
Standard	MG36	Within eligible river corridors with a Wild or Scenic classification, federal oil and gas leases may be issued only if subject to a stipulation that prohibits surface occupancy.
Oil and Gas Development		
Standard	MG37	Gas development activities shall not block or obliterate trails or campsites. These facilities shall be relocated to be at least 300 feet away from gas developments.
Standard	MG38	Drilling pits shall be located outside of channel buffers. Pits shall be obliterated after pit contents are removed.
Standard	MG39	Land application of drill pit liquids may be allowed, but only at Forest Service approved locations.
Standard	MG40	The pit liner shall only be left, and its solid contents encapsulated, with Forest approval.
Standard	MG41	Pipelines are allowed within channel buffers but shall be limited to essential crossings. Construction of pipelines running parallel to the stream shall be avoided.
Standard	MG42	No gas well sites are allowed within the buffer of any perennial water body. For all other (non-perennial) water bodies, every effort shall be made to locate gas well sites outside of the buffer. When circumstances make it impossible to keep the well site disturbed area outside of the buffer of non-perennial water bodies, special protection measures must be applied at the project level.
Standard	MG43	For well sites that have the potential to impact water quality, a plan that identifies emergency measures to prevent and contain accidental spills of contaminant must be prepared and submitted as part of the well drilling plan of operation.
See also Soil and Water Goal SW01, Soil and Water Standards SW03, SW04, SW43; Vegetation Standards VE13, VE22, VE23; TEP Standards TE06, TE18, TE19, TE20, TE33, TE39, TE46, TE47, TE49, TE50, TE52, TE53, TE58, TE59 TE66 TE67 TE71; Recreation Standard RC28, Heritage Resources Standards HR05, HR06, HR09; Roads and Facilities Standard RF04, Soil and Water Guidelines SW11, SW15, SW16, SW19, SW59; TEP Species Guideline TE77, Heritage Resources Guideline HR12, Lands and Special Uses Guideline LS33.		