

**DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
BUREAU OF FORESTRY**

**FY 2009-10 OIL & GAS LEASE SALE
STATE FOREST ENVIRONMENTAL
REVIEW**

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STATE FOREST ENVIRONMENTAL REVIEW

PURPOSE

The purpose of this report is to describe the FY 2009-10 Oil and Gas Lease Sale currently scheduled to occur on Tuesday January 12, 2010 at 2 pm. The project review criteria include a description of the project, the proposed lease area, project assessment related to a number of ecological, operational and stakeholder considerations as well as any actions necessary to ensure that the lease sale upholds the principles associated with sustainable ecosystem management.

The Bureau of Forestry typically conducts an environmental review for any project on State Forest lands that may or will disrupt or otherwise modify the existing land use. Planning for the FY 2009-10 Oil and Gas Lease Sale began approximately ten (10) months ago at the direction of the Governor's Office as part of the FY 2009-10 Commonwealth budget process. Based on the preliminary results of this review and subsequent discussions within the agency, the Department determined it was adequately prepared to meet the terms of the budget legislation enacted in mid-October for FY 2009-10 (July 1, 2009 through June 30, 2010). The final compilation of lease sale tracts incorporates both the preliminary results as well as more-detailed analyses and surface use restrictions that led to the final Environmental Review and current proposal, which seeks to minimize environmental and social impacts while returning the mandated \$60 million needed for the Commonwealth budget. This lease sale is a direct result of the budget agreement and fiscal code for FY 2009-10.

For most projects, the appropriate district forester or district staff completes the environmental review. As a result of size and scope of this project, the Bureau of Forestry utilized a planning process for the FY 2009-10 Oil and Gas Lease Sale, which was identical to that used for the September 2008 lease sale, and consolidated the results into a single document. The environmental review and all associated information will be made available to the public via the Internet.

BACKGROUND

Exploration and development of natural gas resources has been ongoing for more than 60 years on State Forest land as part of the array of resources, uses, and values of the State Forest. Since 1947, DCNR has held 73 lease sales offering the oil and gas industry the opportunity to access State Forest lands in a controlled manner while providing the mechanism for the recovery of hydrocarbon resources. As a result of this comprehensive history, approximately 1,400 wells have been drilled on *fee simple* State Forest lands. Currently, there are approximately 700 producing wells.

DCNR lease sales consistently have been predicated by oil and gas industry nominations. Industry expresses an interest in natural gas exploration on State Forest land by submitting written nominations specifying certain tracts of land for consideration in an upcoming lease sale. The Bureau of Forestry reviews and acknowledges these confidential nominations while periodically offering nominated tracts of State Forest land for lease by competitive bid. DCNR last held an oil and gas lease sale in September 2008.

Industry interest in leasing State Forest land has significantly increased since the initial Marcellus Shale-focused lease sale in 2008. Currently, 5 million acres of State Forest land has been nominated (i.e., tracts have been nominated more than once by separate companies). State Forest land is attractive to outside parties due to the subsurface geology as well as the size and contiguous nature of our State Forests. Large blocks of land with a single land owner are heavily sought after due to the ease associated in dealing with one entity rather than many as is the case throughout most of the state.

Arguably, the biggest development in domestic natural gas plays in recent years has been the Appalachian-based Middle-Devonian aged Marcellus Shale. Over the last eighteen (18) months, numerous companies have experienced success drilling moderately deep Marcellus Shale wells throughout portions of Pennsylvania. A large majority of the exploration and development activity in the Marcellus Shale has occurred in two distinct regions within the Commonwealth - the southwestern and northeastern corners.

The Marcellus Shale is the basal member of the Hamilton Group and is characterized as thick, organic-rich black shale ranging in depth from approximately 5,500 – 8,500 feet below the surface throughout a majority of Pennsylvania. Regionally uniform, the Marcellus stretches from New York to West Virginia and into portions of Kentucky. The organic composition (total organic carbon as high as ten percent [10%]) of this shale has long been thought to be the source of natural gas found within numerous sandstone reservoirs throughout Appalachia.

The known geologic parameters of the Marcellus lend itself to supplying large quantities of natural gas in north-central Pennsylvania. Much of the Marcellus fairway happens to be coincident to State Forest land. Additionally, State Forest lands in north-central Pennsylvania are also prospective for the potential Tuscarora, Utica and Trenton-Black River reservoirs many geoscientists believe exist in this region. Nominations for potential leasing indicate that there is a high level of interest by the oil and gas industry to pursue exploration for the Marcellus Shale, as well as deeper potential reservoirs, beneath State Forest land.

Although this environmental review is based on the Bureau's deliberations on the scope, potential impacts and benefits of these deep gas plays, the legislated directives expressed in this year's budget frame the importance of this comprehensive review. Based on these deliberations, the Department decided to pursue this opportunity under a portion of the State Forests where our management protocols will support natural gas exploration and development as well as satisfy our legal mandates to offer State Forest land for this purpose.

DCNR plans to hold a natural gas lease sale (auction) at which time the Department will accept bids from pre-qualified bidders for the leasing of six (6) tracts of State Forest land, comprising thirty-one-thousand-nine-hundred-sixty-seven (31,967) acres in Cameron, Clearfield, Clinton, Potter, and Tioga counties (*Appendix A-Tract Maps*). The lands contained in the lease sale auction are being proposed for the controlled leasing of subsurface oil and gas rights only.

PROJECT OVERVIEW

Approximately 32,000 acres of State Forest lands are included in the FY 2009-10

Oil and Gas Lease Sale. Although the subsurface natural gas rights provide for the exploration and development of the entire area, only a small portion of the total acreage would be used for well site locations, pipeline development or access roads. Drilling moderately deep to deep natural gas wells is expensive due to the depths of these formations as well as the technologies required to prudently develop the natural gas resources.

Appalachia's oil and gas industry is currently undergoing tremendous growth (a boom). The current boom is best characterized by the need for a lease position quickly followed by a sharp increase in drilling permits. Based on the current market demands, the Bureau of Forestry has estimated that at least ninety percent (90%) of State Forest land will be successfully leased through competitive bidding during the FY 2009-10 Oil and Gas Lease Sale. Operators ante up the first year's rentals through a bonus bid process where the highest-dollar-per-acre rate obtains the lease for an individual tract of State Forest land. The following years' rental payments are fixed per the lease agreement.

It is extremely difficult to predict the number of well sites that will be developed as a result of a successful FY 2009-10 Oil and Gas Lease Sale. Estimates have ranged from zero (0) to more than seven-hundred (700) due to multiple wells per well pad. However, at this time, DCNR is projecting between one-hundred-fifty (150) and three-hundred (300) wells – between twenty-five (25) and fifty (50) well pad sites - will be developed on State Forest land as a result of this lease offering. This estimate is based on:

- The expected nature of the Marcellus reservoirs with “sweet spots” being developed over time;
- An estimated six (6) to eight (8) wells per well pad;
- The estimated drainage area per horizontal well bore (~80-100 acres);
- Drilling costs associated with the depth of the gas likely to be found in the Marcellus Shale or deeper reservoirs; and
- Amount of land excluded from surface activity including non-development areas (18,402 acres w/ overlapping features), viewsheds and other environmental considerations.

Based on the Departments' best estimate of thirty-five (35) to fifty (50) well pad sites, each well pad's “footprint” will be about four (4) to five (5) acres. During drilling, a rig will be onsite for about twenty (20) to thirty-five (35) days per well, after which time a successful well will be fitted with a wellhead and hooked up to a pipeline. Marcellus operators have determined that multiple gas wells collocated on a single well pad site are required to achieve economic gas recovery from the Marcellus Shale. An individual well may produce gas for several decades or more.

ENVIRONMENTAL SAFEGUARDS

DCNR has adopted a multi-level approach for managing potential impacts to the environment when leasing State Forest lands for oil and natural gas exploration and development.

First-level environmental safeguards involved the establishment of “non-development” areas, such as State Parks and State Forest wild and natural areas, where no

surface activity is permitted. Non-development portions of a lease tract state that no surface activity or development will be permitted. More specifically, no well sites, pipelines, roads or related disturbances will be permitted in these areas. Detailed buffer zones have been devised to protect areas of ecological, recreational and aesthetic importance, such as water bodies, roads, trails and buildings. Non-development areas total approximately eighteen-thousand-four-hundred-two (18,402) acres; fifty-seven and six-tenths percent (57.6 %) of the acreage being offered for lease. Please note that this acreage total is cumulative and is not differentiated within overlapping non-development zones (*Appendix B – SFER Maps*).

Site-specific second-level safeguards include, but are not limited to, requiring Pennsylvania Natural Diversity Inventory (PNDI) coordination for disturbances associated with well locations, well spacing and construction specifications for roads and pipelines. These specifications are contained in the *Oil and Gas Lease for State Forest and Park Lands* (*Appendix A*) and are administered on the ground by the Bureau of Forestry's district foresters. Specific environmental and ecological protections and safeguards can be found in the lease agreement.

Third-level environmental safeguards require compliance with all applicable Department of Environmental Protection (DEP) regulations. These laws and regulations are solely administered by DEP and are distinct and separate from DCNR requirements.

PROJECT AREA DESCRIPTION

DCNR is proposing to hold a natural gas lease sale for the leasing of six (6) oil and gas lease tracts, comprising thirty-one-thousand-nine-hundred-sixty-seven (31,967) acres of State Forest land in Cameron, Clearfield, Clinton, Potter, and Tioga Counties (*Appendix A*). The proposal includes the subsurface oil* and natural gas rights beneath State Forest land in the Elk, Moshannon, Sproul, Susquehannock and Tioga State Forests.

* - *It is highly unlikely that oil will be encountered during routine exploration for natural gas in this region; including the oil rights is standard business practice as the substances are often found together when both are present.*

PROJECT REVIEW ITEMS:

1. Consistency with State Forest Resource Management Plan

The overarching goal for the management of State Forest lands is: To manage state forests sustainably under sound ecosystem management, to retain their wild character and maintain biological diversity while providing pure water, emphasizing opportunities for dispersed recreation, habitats for forest plants and animals, sustained yields of quality timber, and environmentally sound utilization of mineral resources.

Our current policy statement contained in the State Forest Resource Management Plan (2008) states: Geology is a critical component of State Forest management. The mineral resources associated with State Forest lands will be managed for the long-term good of the citizens of the Commonwealth of Pennsylvania. All exploration, development, and utilization will incorporate environmentally and financially sound methods.

Following the September 2008 Lease Sale, DCNR and the Bureau of Forestry decided not to offer additional lands for lease but rather study the Marcellus play and the operational developments and requirements on the 660,000 acres within the Marcellus fairway already subject to valid lease agreements. However, due to projected shortfalls in the Commonwealth budget, the Bureau of Forestry has been mandated to generate \$60 million for the Commonwealth. This lease sale is a direct result of the budget agreement and fiscal code for FY 2009-10. While counter to DCNR's planning following the 2008 Lease Sale, based on the comprehensive Environmental Review and resulting compilation of lease tracts, which incorporates many surface use restrictions designed to minimize environmental and social impacts, the impending sale meets the Bureau's management guidelines and protocols.

In summary, while the decision to conduct this lease sale was based on the legislated requirements to generate bonus bid revenues of \$60 million for inclusion in the FY 2009-10 General Fund, this Oil and Gas Lease Sale conforms to the Bureau's stated policy and goals.

2. Erosion and Sedimentation

Potential surface disturbances associated with oil and gas well activities include well site clearing, well pad construction, access road construction, multi-phase construction of pipeline gathering/marketing systems, site restoration and activities associated with geophysical or "seismic" surveys.

Runoff and erosion with subsequent sedimentation are potential impacts to adjacent and surrounding forests, wetlands and streams. Potential for erosion and sedimentation depends on many factors such as terrain, soil type, rain events and length of time of bare soil exposure. Erosion and sedimentation controls are addressed in *Exhibit "C" (Stipulations for Protection and Conservation of State Forest and Park Lands)* of the

Oil and Gas Lease. More specifically, Section 7 (Siltation) of *Exhibit "C"* designates that a Lessee must have an approved site-specific Erosion and Sedimentation Control Plan that meets the criteria set by DEP's Title 25, Chapter 102 regulations. This plan is required to be available on-location during all exploration and development activities.

Intermittent soil erosion and sedimentation may be expected to occur with surface clearing activities. However, these impacts will be minimized through certain lease provisions as well as adherence to federal and state laws and regulations including Federal Clean Water Act, National Pollutant Discharge Elimination System permit requirements, PA Clean Streams Law, and various DEP regulations.

All earth disturbances of one (1) acre to less than five (5) acres in extent that have a point source discharge to surface waters (channel of conveyance) are required to have a National Pollution Discharge Elimination System (NPDES) permit (25 Pa. Code § 92). The only exceptions to this requirement are earth disturbances that are part of agricultural plowing or tilling, road maintenance and timber harvesting activities. An individual permit (25 Pa. Code § 92.83.9) is required if the activities are in a High-Quality/Exception Value watershed (Chapter 93). These permits necessitate special protection requirements as outlined in Chapter 102, Section 102.4(b)(6).

Oil and natural gas operators proposing earth disturbance activities that are five (5) or more acres at one time over the life of the project, must complete DEP's Notice of Intent (NOI) authorization for the Erosion and Sediment Control General Permit for Earth Disturbance Associated with Oil and Gas Exploration, Production, Processing, or Treatment Operations or Transmission Facilities (ESCGP-1)

DEP regulates and enforces other laws and regulations (provisions) to which an operator is legally bound. These provisions include, but are not limited to, the Oil and Gas Act (Act 223), Oil and Gas Conservation Law (Act 359), Coal and Gas Resource Coordination Act (Act 214), Clean Streams Law (Chapter 91), Solid Waste Management Act (Act 97), and Non-Coal Surface Mining Conservation and Reclamation Act (Chapter 77).

3. Surface Water Quality

Degradation of water quality can result from possible sedimentary, thermal and chemical pollution of surface waters. The potential for sedimentation and the appropriate mitigating environmental controls were discussed above under Erosion and Sedimentation. Additional provisions are included in *Exhibit "C"* (*Section 8 - Waters*) of the lease agreement.

Thermal pollution, or increases in water temperature, can result if vegetation (shade) is removed from streamside or riparian zones. These concerns are addressed in *Section 23 (Drilling Restrictions)* of the oil and gas lease agreement. Specifically, the lease states that no drilling or wellsite clearing is permitted within two-hundred (200) feet of a stream or body of water. Furthermore, no drilling or wellsite clearing is permitted

within three-hundred (300) feet of any exceptional value (EV) stream or body of water. These standoffs exceed the criteria established in the Bureau's Aquatic Buffer Guidelines (Effective January 1, 2007).

Although unlikely, the potential exists for chemical pollution from recovery of drilling fluids (including brine), or from a spill of fluids used in the construction of wells such as gasoline, diesel fuel and various oils and lubricants. Additionally, accidental or unintentional spills of hydrocarbon fluids, although rare, are possible. The adverse impact associated with a pollution event depends on the amount of fluids spilled and released (concentration and time), the surficial geology, and soil type associated with the specific sites. Each permitted well will have a Preparedness, Prevention and Contingency Plan (PPCP) approved by DEP to address these concerns. All applicable laws, regulations and appropriate mitigation strategies apply.

Marcellus wells throughout Pennsylvania have (to date) not been found to produce reservoir-brine. The formation is considered "dry". Fluids encountered during well drilling and completion activities must be handled, treated, and disposed of according to DEP regulations (i.e. DEP-Chapter 78, Chapter 95, Chapter 16; Act 223-Sections 204 through 210, 215; EPA UIC 40 CFR Parts 144, 146, & 147).

The necessary consumption of large amounts of fresh water in the "fracing" process generates large amounts of contaminated flow-back waters from the wells, which may contain a number of constituents, both dissolved and solid, generated by contact with the shale formation and as initial additives to the frac fluid, that need to be disposed of in a proper manner to ensure the environmental integrity of the surface waters on state forest lands. All handling, recycling, and disposal of frac waters are highly regulated by DEP, Bureau of Waster Water Management, DEP, and Bureau of Oil & Gas Management and by the Susquehanna River Basin Commission, as the agencies with primacy in regard to this issue. The Commonwealth Lease Agreement requires compliance with all applicable laws governing waste frac water reuse and disposal as listed above.

The flow-back waters are typically contained within metal tanks as they evolve from the well bore at the well site. As the tanks are filled they are transported to facilities that may process the fluid by filtration and recycling of the water, filtration and disposal of the water in regulated waste water treatment plants and reuse of the waters in new well completion activity. At this time the Department does not support the construction and maintenance of large open pit waste holding ponds on its lands and requires that all fluid be tanked. The technology is rapidly evolving to recycle and reuse the water and dispose of any solids in proper landfill settings, which the department is carefully and continuously monitoring. The Department stands ready to adapt its lease provisions and operational restrictions to new technology as it is proven by the industry.

4. Air Quality

Exploration, development, and production activities associated with drilling, completing, and producing natural gas wells have the potential to temporarily contribute

internal combustion engine exhaust, dust, smoke, and other gaseous pollution to the atmosphere. The use of machinery and/or heavy equipment will produce emissions such as carbon monoxide, nitrogen oxide, and sulfur dioxide. Equipment operated or transported along dirt/gravel road or pad sites may result in temporary increases in dust or particulate matter. These emissions are covered by the Air Pollution Control Act (P.L. 2119, 35 P.S. 4001, et seq.) as well as *Exhibit "C" (Section 1-Environmental Quality Control)* of the lease agreement.

Compression facilities will be required within the leased premises. Today's compressors typically utilize electricity, natural gas, or a combination thereof (e.g., gas-powered generators) as operating fuel. Compressors are generally housed within a shed-like structure equipped with proper sound-proofing and ventilation devices. Limited emissions produced from compression facilities are not expected to have an adverse effect on air quality due to the clean-burning fuel used for power as well as the open, non-populated landscapes where these facilities will be located.

The potential emissions resulting from all phases of natural gas exploration, development, and production will be well within the acceptable environmental standards. Excessive dust resulting from use of dirt and gravel roads will be handled using normal Forest District procedures. The use of water and/or other similar suppression mechanisms/treatments on a periodic basis greatly reduces dust levels.

5. Water Quantity

The Bureau was established, in part, to protect those watersheds integral to the growth and viability of the Commonwealth. Municipalities and other forest users rely on the State Forests not only for a source of water but also to provide the necessary protections for other downstream users. A decline in water quantity can be detrimental to aquatic communities, local fisheries and potable water sources.

Pennsylvania's surface waters are monitored and regulated by DEP's Bureau of Watershed Management (BWM). Act 220 was created in 2002 to provide for the identification of a "significant hydrologic unit where existing or future demands exceed or threaten to exceed the safe yield of available water resources" also known as Critical Water Planning Areas (CWPAs). The demand on water resources were assessed on several criteria which include the following: Size of Hydrologic Unit; Time Horizon; Existing and Future Demands including Population Projections; Withdrawal and Non-Withdrawal Uses; and Safe Yield of Available Resources including developing Watershed Water Budgets, Water Quality, Aquatic Resource Uses and Other Critical Uses.

Act 220 created a statewide water withdrawal and use registration and reporting system. More specifically, Act 220 requires any person, organization, or entity that withdraws or uses 10,000 or more gallons of water per day, over a 30-day period, from one or more points of withdrawal in a watershed operated as a system, to register and then periodically report their water withdrawal and usage to DEP. Annual reporting, of

withdrawals and use, is also required (DEP, Sept. 2007). Additional reporting and/or filing is required by the Susquehanna River Basin Commission (SRBC) and the Delaware River Basin Commission (DRBC).

The SRBC has exercised its authority to review, approve, control, and monitor any consumptive use within the river basin specifically relating to surface water withdrawals, as well as groundwater withdrawals, for oil and gas completion operations (*Please note: due to the absence of an Ohio River Basin Commission, DEP applies the SRBC standards and protocols for those water withdrawals contained within this river basin – e.g., Tract 416*). Working in conjunction with DEP, an operator must have a SRBC-approved water source(s) for use during completion operations prior to an oil and gas permit being issued. The water permitting process is explicit and complex. More specifically, the SRBC requires that certain biological and hydrologic assessments and surveys are completed and included within the permit application. Based on the hydrologic characteristics of a given (surface) watercourse, the SRBC may typically allow a fraction (e.g., 10%) of the seven (7) day, ten (10) year average-discharge (e.g., stream flow) (Q7-10) for a surface withdrawal from a stream. Similar protocols, such as a seventy-two (72) hour aquifer test, are required for permitting groundwater withdrawals.

Unlike Appalachia's conventional oil and natural gas reservoirs, the Marcellus Shale requires the use of massive induced hydraulic fractures (fracs) for the strata to produce economic quantities of natural gas. In addition to proppant (typically sand used to keep the fractures open), Marcellus fracs contain massive amounts of water and gel. This is known as a "slick-water frac". The water when mixed with the non-toxic gel forms a jello-like substance that is forced down the well bore and into the underlying rock at very high pressures. This process does not pose any threat to the surface attributes as fracing is completely underground.

Frac techniques are currently being honed and tweaked to determine what method(s) produce the best results for the least amount of capital investment. To date, the preferred frac technique(s) uses approximately three- to five-million (3-5,000,000) gallons of water to perform. Water use is dependent on the number of frac stages as well as the size of a given stage. These variables are determined on a well by well basis once formation heterogeneities and rock mechanics are properly delineated and accounted for. The most commonly utilized source(s) of water are typically surface streams and/or commercial suppliers with on-site storage via frac tanks or centralized impoundments. Regulation and compliance are subject to the provisions of Act 220 as well as Act 223 (Chapter 4, pg 73a-81).

The SRBC, as part of the water withdrawal permitting process, that the applicant submit a signed "surface access agreement" (between applicant and surface owner) clearly stating that the applicant has the express permission of the landowner to utilize said surface lands as a "take-point" for obtaining water from a surface stream. This provision is required regardless of ownership (i.e., public or private). Therefore, although DCNR has no regulatory authority to approve or deny a water withdrawal application, the opportunity exists to approve all proposed take-points prior to a withdrawal permit being

issued. Therefore, by default, surface landowners have been given “defacto” regulatory authority.

Future water withdraws will be coordinated with the appropriate agencies (i.e., DEP, SRBC, PAFBC) to ensure that the watershed and associated wetlands will not be negatively impacted.

6. Groundwater

The Bureau maintains strict protocols that govern the protection and sustainable use of the groundwater resources beneath State Forest lands. *Exhibit “C” (Section 17-Water Wells)* of the lease agreement provides the Lessee with the option to drill and develop water wells, subject to the written approval of the Bureau, for use in natural gas exploration and development on that lease tract. Water well development for this purpose is subject to Act 610 (P.L. 1840) which provides for the orderly development of ground water resources.

Wells developed under the above lease provision are not intended to provide the massive volume(s) of water required for a Marcellus Shale frac. Although the original intention of this provision was to provide a Lessee with access to water for use in traditional frac process associated with shallow Upper Devonian natural gas development, a properly sited groundwater well, exuding a consistent and sustainable yield, may be able to supplement water withdrawals from surface waters and/or commercial sources. These water wells may also be drilled and developed for dust suppression or other uses such as potable water source for drilling crews.

Chapter 4 of Act 223 (pg 73-81) specifies DEP’s casing requirements for the protection of groundwater resources. All drilling, casing, cementing, and well completion practices (including fracs) are to be carried out in such a manner that protects fresh ground water. A lessee’s well casing program must be designed in accordance with 25 PA Code § 78.81 – 78.86 and 25 PA Code § 78.62 and § 78.63 while accounting for a) Burst Strength, b) Tension, and c) Collapse. All top-hole water must be kept free of pollution or contamination by additives, brine, oil, and anthropogenic-induced conditions.

Future water withdraws will be coordinated with the appropriate agencies (i.e., DEP, SRBC, Army Corps) to ensure that groundwater/aquifers and associated wetlands will not be negatively impacted.

7. Soils

Surface disturbances associated with oil and gas well activities include well site clearing, well pad construction, centralized impoundment construction, access road construction, pipeline construction and site restoration activities associated with geophysical surveys. Potential problems associated with these activities include soil compaction or chemical pollution associated with spills or mishandling of industrial fluids.

Compaction, resulting from repeated use by heavy equipment, affects soil moisture regimes and drainage thereby affecting vegetative productivity. Equipment is present during the construction phase of gas well development and is typically removed following the successful completion of a natural gas well. The lease requires preparation of an Erosion and Sedimentation Control Plan as outline in Item 2 above however the following procedures are highly recommended:

Soil Compaction Mitigation – Test topsoil and subsoil for compaction at regular intervals in areas disturbed by construction activities; Conduct tests on the same soil type under similar moisture conditions in undisturbed areas to approximate pre-construction conditions; Use penetrometers or other appropriate devices to conduct compaction tests.

Topsoil Segregation – Prevent the mixing of topsoil with subsoil by stripping topsoil from the full work area and subsoil storage area; Maintain separation of salvaged topsoil and subsoil throughout all construction activities; In areas where topsoil has been segregated, plow the subsurface before replacing the segregated topsoil; Perform appropriate soil compaction mitigation.

Pollution from fluid spills could impact soil productivity and depending on extent, could reach groundwater resources. The potential for chemical spills, subsequent mitigation, and groundwater protection are discussed above in Items # 3 and #6 respectively.

8. Unique and Unusual Geologic Features

DCNR's Bureau of Topographic and Geologic Survey published a two-volume book titled "Outstanding Scenic Geologic Features of Pennsylvania" (1979). This comprehensive work documents outstanding geologic and topographic features throughout the Commonwealth. These sites have been incorporated into the Pennsylvania Natural Heritage Program (PNHP) and Pennsylvania Natural Diversity Inventory (PNDI) information systems. All activities associated with oil and gas development undergo a PNDI review prior to the commencement of earth moving activities. Surface use of these areas for gas activities will be avoided.

9. Aesthetics

The aesthetic qualities of the State Forest system play a key role in attracting forest users. State Forests provide a large serene wooded landscape for public use and enjoyment.

Non-development areas have been delineated to preserve certain aesthetic features of the State Forest system. Surface disturbance is prohibited in any area that has been designated as non-development. For example, all State Forest wild and natural areas are non-development.

Development and construction of well sites, roads and other related infrastructure may negatively impact the visual aspect of some portions of the State Forest. Viewscapes (or viewsheds) are the scenic portions of the landscape that can be seen primarily from a transportation corridor (i.e., road or trail). Any visual impact will depend on proximity of gas wells to viewshed features such as vistas, public use roads, trails, State Parks, or other high-use areas.

Impact on publicly viewed areas has been considered prior to implementing forest management activities associated with natural gas exploration. Viewsheds have been specifically investigated throughout the lease sale analysis process. Any future well site will minimize, to the extent possible, any adverse affect on the visual experience of the State Forest user as well as the aesthetic values of the viewshed. Important viewsheds (i.e., Historic Route 6 viewshed) have been identified and zoned as areas of special consideration where surface disturbance is extremely limited and reviewed on a case-by-case basis.

The landscapes where most activity may occur have been actively managed in the past. These areas typically contain roads, trails, pipelines, and log landings as well as a variety of forest conditions. The regional landscapes contain forest stands of varying species composition and ages, reflecting the Bureau of Forestry's past forest management activities.

DCNR has several control measures contained within the lease agreements to minimize visual impacts. Well site spacing is limited to the derivative-based formula (as outlined below in *Item 16*), whereas the total number of permissible well pads has been predetermined and clearly stated within the lease agreement. All applicable buffers, as designated in Oil and Gas Lease Agreement as well as the Aesthetic Buffer and Aquatic Habitat guidelines (roads, trails, and streams) shall be adhered to unless the a written waiver is applied for and subsequently granted by the District Forester (certain buffer variances require a SFER).

The District Forester will maintain a record of all such requests and specifically notate whether or not said waiver was granted (or denied) and the reason for doing so. Existing openings, roads and rights-of-way will be utilized wherever possible. Any impacts on visual resources from seismic activity should be slight and temporary.

10. Noise and Light Levels

Noise levels will temporarily increase as a result of activities associated with the exploration and development of Marcellus Shale (or deeper) gas on State Forest lands. Potential impacts include temporary increases in noise levels as a result of seismic exploration, construction of well sites, compressors, roads or pipelines, well drilling, and truck traffic.

Adverse impacts from an increase in noise levels depend on distance from noise source, weather, topography and vegetation. The primary increases in noise level will result from well drilling, compression facilities, truck traffic, and road and pipeline

construction. Seismic and maintenance activity may also result in localized, very short term increases in the ambient noise level within the State Forests.

Noise level will be a considered throughout the well location approval process by the appropriate program area(s) within the Bureau of Forestry. Wherever possible, well site locations will be located in a manner to alleviate temporary increases in background noise levels in high use areas such State Park campsites or State Forest Picnic Areas.

The use of lighting may temporarily impact the night sky as a result of drilling activities. Natural gas drilling is a twenty-four (24) hour per day activity that requires proper illumination for the health and safety of the drilling crews. This impact should occur in a limited fashion and last no longer than the time required to properly drill and complete a natural gas well (i.e., two or three weeks).

In those areas where current pipeline infrastructure may be lacking, well flaring, immediately following completion activities, will be required. Well flaring is the method by which an operator burns natural gas during frac flowback whereby frac water is flowed back to the surface (via the wellbore) in an attempt remove as much water as possible from target formation as quickly as possible. During a flare, a vertical stack is placed away from the wellhead and any produced gas is burned. The stack and corresponding flame is very similar to a super-sized candle burning for a prolonged (i.e., up to two weeks) period of time.

Coordination with the operator(s) will be required to minimize or eliminate (light-induced) impacts during Dark Sky events. These strategic planning activities will require the involvement of both the bureaus of Forestry and State Parks.

11. Archeological Sites and Historic Sites

The Pennsylvania Historic and Museum Commission maintains information relevant to the Commonwealth's significant historic and archeological sites. Information on the known locations of these sites on State Forest lands has been shared with the Bureau of Forestry. The Bureau has initiated a system to identify these sites and notify the Commission of any action that may disrupt these resources.

All earth disturbance activities associated with oil and gas development undergo an archeological review prior to siting. Use of these sites for natural gas activities will be avoided as provided by law. Discovery of potential new sites or artifacts will be forwarded to the Historic and Museum Commission for their review and documentation.

12. Recreation Sites and Opportunities

Natural gas (Marcellus Shale or deeper) exploration and development activities could affect some recreational experiences on State Forest lands. Increased noise levels and potential visual impacts could affect the recreational experiences of State Forest visitors'. Any potential impact directly depends on the visitor's activity and location within the State Forest as well as their expectation of a particular experience.

Although it is not anticipated, some roads may be temporarily closed during drilling operations or other peak periods of heavy use to reduce potential safety hazards. Actions to limit road access will be made on a case-by-case basis at the discretion of the District Forester. Drilling periods on any given well are anticipated to last three to four weeks under normal conditions. At the end of the drilling period, if roads are closed, they will be reopened.

Areas under lease will be open for traditional uses; however the immediate well site (4 to 5 acres) will be closed to the public during drilling operations. If a well is successful, only the immediate surrounding area will continue to be restricted to the public. Public access is restricted to the well location during the drilling and completion phase of operations. The well site is normally occupied twenty-four (24) hours a day, seven (7) days a week during well drilling. The lessee (operator) provides the necessary security during these operations at no cost to DCNR.

Historically, the natural gas drilling season on State Forest lands typically lasted from mid-March through November 1. This seasonal window allowed Lessees to explore for and develop natural gas reserves prior to the on-set of Pennsylvania's major hunting season(s) and inclement weather. There may be instances where, due to equipment limitations, timing to avoid ecological impacts, logistical snafus, or due to an acceptable operational plan that limits road impacts and preserves the hunting traditions, that a Lessee is permitted to operate beyond the November 1 date. These types of exceptions will be reviewed on a case-by-case basis. Furthermore, actions to limit hunter access to reduce potential safety hazards will be made where necessary.

DCNR has implemented several measures to minimize impacts on the recreating visitor. State Parks and State Forest Wild and Natural Areas are "non-development areas" and, therefore, are excluded from all surface activity. As mentioned above, a buffer system has been developed to protect parks, natural and wild areas, streams, roads, trails, and other recreational features.

Additional areas of special consideration have been delineated using a GIS-based analysis. The Recreational Opportunity Spectrum (ROS) delineates certain recreational experiences available to a forest user based on current, existing surface use. Two (2) such delineations exist with those areas designated by ROS as Semi-Primitive Non-Motorized. These areas have been zoned "non-development" (2,856 acres) or "area of special consideration" (7,546 acres) thereby protecting these unique recreational experiences. The major difference between these zoning classes within the same ROS designation is a result of the presence of existing haul roads or other anthropogenic features.

ROS Semi-Primitive Non-Motorized Class Definition

Semi-Primitive Non-Motorized areas are normally 500 acres in size or larger and located at least one-half (1/2) mile from all non-gated (open to the general public) roads, railroads, and trails with motorized use. Accessible only by foot or equine, there is no motorized use by the public although administrative use may be conducted by motor vehicle. Interaction between forest visitors is low resulting in the high probability of

experiencing isolation, remoteness, independence, and closeness to nature. These areas are sought after by visitors seeking self-reliance and the possibility of challenge and risk. Openings in the forest canopy may be the result of either natural or anthropogenic occurrences. Management goals for this ROS class include providing a non-motorized semi-primitive recreational experience as well as necessary forest management.

Other recreation-based areas of special consideration specifically pertain to those hiking trails previously identified as either State Forest Hiking Trails or National Scenic Trails. The following guidelines apply.

State Forest Hiking Trails (SFHTs)

DCNR-Forestry gave special recognition to a discreet number of hiking trails that were designated primarily for foot travel only. Currently, there are eighteen (18) trails totaling seven-hundred-ninety-one (791) miles carrying this designation. A large majority of the SFHT mileage is located on State Forest land; however these trails also traverse other public and private lands. SFHTs are subject to a 100-foot “non-development” buffer on both sides of the trail. Any proposed disturbance activity within a SFHT buffer zone requires written approval prior to commencement.

National Scenic Trails (NST)

The National Park Service designates the National Scenic Trail (NST) system. Currently, there are sixty (60) miles of NSTs on State Forest land. All sixty (60) miles are encompassed within three (3) trails: Appalachian, North Country, and Laurel Highlands. NSTs are subject to a two-hundred (200) foot aesthetic/non-development buffer zone on both sides of the trail.

13. Public Health and Safety

Public health and safety concerns center on fire hazard, pollution potential, and well blowouts. Safety requirements are contained in the DCNR Oil and Gas Lease; more specifically, Section 24 (*Drilling Operations*) and Section 18 (*Deep Well Control Insurance and Safety*).

Public access is restricted to the well location during the drilling and completion phase of operations. The well site is normally occupied twenty-four (24) hours a day, seven (7) days a week during well drilling. The lessee (operator) provides the necessary security during these operations at no cost to DCNR.

If and when economic natural gas production is established, public access will continue to be restricted to the immediate area around the well and its equipment until production ceases. Vandalism has been minimal throughout the history of the natural gas leasing program. Although isolated, lessees are encouraged to document, to the best of their ability with pictures and prose, any vandalism that occurs and provide said documentation to the District Forester.

State and Federal regulations require compliance with the U.S. Department of Labor’s Occupational Health and Safety Administration (OSHA)

(<http://www.osha.gov/SLTC/etools/oilandgas/index.html>). Specific OSHA standards for oil and natural gas drilling, servicing, and storage can be found here: <http://www.osha.gov/SLTC/oilgaswelldrilling/standards.html>. The Federal Environmental Protection Agency (EPA), through the Underground Injection Control Program (Safe Drinking Water Act, 42 U.S.C.A. Section 300 F et seq.; 40 CFR Part 147), provides protection for the protection of public drinking water.

Further safeguards that ensure the protection of public health and safety involve specific rules and regulations of the PA-Department of Labor and Industry (37 Pa. Code, Chapter 11 and 13), PA-Department of Transportation (PA Vehicle Code Title 75, Chapter 49 and 189; 67 Pa. Code, Chapter 403), and the PA-Department of Environmental Protection (Solid Waste Management Act, Act 97, 35 P.S. §6018.101 et seq.; Oil and Gas Act, Act 223, 25 Pa. Code Chapter 78)

A DEP-issued oil and/or natural gas well permit is the primary authorization for exploration and development activities. The well permit addresses well location; notice to landowners, owners of water supplies, coal owners and gas storage operators; distance restrictions for existing building, streams, springs and wetlands, and public resources. As referenced above in *Item 3*, each operator must have a DEP-approved Preparedness, Prevention and Contingency (PPC) Plan for every permitted oil and/or natural gas well which addresses many health and safety issues.

14. Transportation & Pipelines

The State Forest system is home to an extensive road network. There are approximately 2,500 miles of State Forest public-use roads and many hundreds of miles of administrative, logging, and gas well access roads. There are two general concerns dealing with the roads and transportation: 1) a major increase in the number of roads, and 2) the capability of the existing State Forest roads to handle the increased heavy truck traffic. Other related concerns include: traffic congestion, impacts to the road, potential road closure, and State Forest visitors safety with such an increase in traffic.

Pennsylvania's State Forest road network is adequate in accessing most areas of the State Forest system. Short access roads may need to be developed in situations where well site locations are not reasonably adjacent to existing access roads. New access roads will be constructed in conjunction with existing roads and right-of-ways, using this infrastructure wherever possible. Access roads will be built using current design standards (see Oil and Gas Lease - *Exhibit "E": Oil and Gas Lease Access Road Specifications for State Forest Lands*). Deviations from these specifications will require the written approval of the District Forester.

Existing State Forest road infrastructure can properly handle heavy truck traffic associated with natural gas exploration and development. Occasionally, State Forest roads may require slight improvement (i.e., additional road base material) to maintain a good running surface. Any improvements, when necessary, will be made at the sole expense of the Lessee to the satisfaction of the District Forester.

The types of trucks used for gas exploration are similar to that of the logging industry. There will be a noticeable increase in truck traffic due to the nature of this type of drilling and completion operations. Specifically, heavy hauling due to the transporting of water for completion operations is a large portion of the anticipated truck traffic (approximately 800 truck trips for a *single* well). Generally, heavy truck hauling will not be permitted from November 1 to March 30 (no-haul period). Any exceptions to the “no-haul period” must be made in writing to District Forester; upon review of said request, District Forester will respond appropriately in writing.

Additional limitations on vehicular use, including but not limited to heavy hauling, during certain times of the year may be necessary to protect the integrity of the roads or nearby ecologically significant areas such as vernal pool breeding areas. These restrictions typically occur during late-winter and early-spring (break-up), however road use may be limited at any time of the year based on due cause at the discretion of the District Forester. Bridge crossings are subject to all posted weight limits as well as the approval of the District Forester. There may be instances where the Lessee may be required to improve certain bridges or similar crossings to support vehicular traffic, especially heavy hauling. Such improvements will be completed only as necessary, and within Department standards, at the sole expense of the Lessee.

In the event that State Forest lands are used as “draft points” for obtaining water from streams, the draft point and associated roads may require significant improvements and upgrades to meet Department standards prior to the commencement of this activity. These instances will be considered on a case by case basis.

Safety concerns may necessitate that certain roads be closed to public access during drilling operations or other periods of heavy use to reduce potential safety hazards. In some situations, gates will be used or installed to limit access to the drilling sites. Signage warning of heavy track traffic must be sufficiently posted to assure public safety on State Forest roads. Road access limitations will be at the discretion of the District Forester on a case-by-case basis. Normal Bureau of Forestry protocols will remain in effect. Any vehicles traveling in excess of twenty-five-miles-per-hour (25 mph) may be subject to the issuance of a traffic citation.

Appropriate safety measures will be utilized wherever possible to protect the usage of the forest roadway by recreation-based user groups (hiking, biking, horseback riding, etc.). Certain State Forest roads have been designated as Joint-Use (JU). Prior written permission must be obtained before to using such roads. Reducing conflict between State Forest stakeholders on JU roads means activities, such as snowmobiling, horseback riding, and timber harvesting, need to be considered, and the appropriate safety measures taken, to minimize road-based conflict. Any JU road is subject is the necessary criteria outlined in the *Joint-Use Road Plowing Strategy* (November 1, 2005). Recreation safety and activities are highly important; however, in-line with timber management activities, natural gas exploration takes precedence over recreational activity in our working forests. Generally conflicts are minimal and often easily resolved.

Areas contained with a given lease tract will be accessible to the public and open for traditional uses. However, the localized well site (4-5 acres in size) and any associated facilities (i.e., centralized water impoundments) will be closed to public access during operations. If a well is successful, the actual well site infrastructure remaining on site is off limits to the public thereby lessening public safety concerns and benefits the continuous function of the well site operation. Development activities on a given well are anticipated to last approximately two (2) months under normal conditions. At the end of the drilling period, any roads that were temporarily closed will be reopened.

Natural gas that is discovered and produced as a result of this lease sale will require new pipeline infrastructure construction. All pipeline activity is governed by the Oil and Gas Lease Agreement (*Section 29 – Oil and Gas Pipelines*). Gathering systems or marketing lines are permissible under the terms of the agreement. No rights for developing major transmission pipelines are granted in the lease agreement and, thereby, require a standard right-of-way application, project review, and the resulting SFER.

Typically, gathering and/or marketing pipelines are placed in and along existing corridors to minimize surface impact as well as construction and development costs. Gathering lines (steel or poly-flex pipe of varying diameter) have historically been placed along access roads - in adjacent ditches or beneath the road itself. This practice of pipeline placement is preferred by the Department. All pipeline corridors or similar routes developed for the purpose of moving natural gas to market are subject to the approval of the District Forester. Although the lease agreement explicitly grants a lessee the right to move recoverable volumes of natural gas from off the leased premises, major transmission lines are not subject to this expressed right.

Non-Lease Sale Related Pipeline Activity

Independent of whether or not State Forest land is offered for lease, DCNR will undoubtedly face requests for the construction of new major natural gas transmission lines. The recent flurry of Marcellus Shale leasing and subsequent exploration is occurring in areas that are deficient in pipeline infrastructure. Existing natural gas transmission lines currently have little to no additional capacity available for new natural gas reserves being brought to market.

In an effort to reduce the number of trucks used in water hauling, operators are beginning to design and engineer water pipelines and centralized water impoundments. It is anticipated that these water lines may either be run coincident to necessary gas pipelines within same corridor or along existing roads or right-of-ways in those instances where long-term facilities may be needed (i.e., servicing central water impoundments). For temporary use, above-ground irrigation-type water lines may be used to transport water from a centralized water impoundment to a specific well pad for a series of completion operations. Water management plans such as this will not only limit the number of trucks on the road, thereby reducing wear and tear as well as maintenance, but will also result in significant cost savings to the operators over time. Prior to laying water lines,

PNDI coordination will occur to minimize the impact to species of special concern.

15. Energy Needs/Use

Machinery used in the construction, exploration and development phases of natural gas exploration will consume fuels (primarily diesel fuel). Types of machinery typically used in natural gas development include: tractor-trailers, tri-axle trucks, front-loaders, skid-steers, bulldozers, drilling rigs, personal vehicles, water trucks and generators. Fuel quantities required for these activities are unknown and will vary between operators.

The FY 2009-10 Oil and Gas Lease Sale proposal may add significant quantities of natural gas to the Northeastern U.S. corridor. The Northeast is the largest consumer of natural gas in the United States. Estimated ultimate recovery (EUR) from one (1) Marcellus Shale well is thought to be approximately two-billion-five-hundred-million-cubic-feet of natural gas (2.5 Bcf/well). The average U.S. household that uses natural gas to heat and cool a two-thousand-square foot (2,000 sq/ft) home consumes approximately 120,000 cubic feet per year. Thus, a single well may provide the natural gas necessary to meet the heating and cooling needs to over three-hundred-thousand (300,000) homes.

16. Existing/Potential Land Use

The Pennsylvania State Forest system represents one of the largest expanses of public forestland in the eastern United States. These forests provide an abundance of high quality forest products, varied recreational opportunities, wildlife/plant habitat, and watershed protection and use. The principles associated with ecosystem management draw upon the overarching goal of forest sustainability which, in turn, assures the array of resources, uses, and values of the state forest for current and future generations.

This region of Pennsylvania lies well within the Marcellus Shale fairway. Private landowners have been leasing property in these areas for the last few years. In light of the increase in natural gas leasing on private lands, the selected lease tracts are highly marketable and saleable. The portions of State Forest that are being offered for lease may help the private landowners capitalize on their previous decision to lease their land. DCNR has implemented several measures to minimize forest fragmentation effects through its multi-level management approach. The design of the FY 2009-10 Oil and Gas Lease Sale was intentional in that those areas included in the upcoming lease minimize the potential for environmental impact while maximizing the potential return to meet the required revenue goals contained within the FY 2009-2010 budget.

Two (2) of the major concerns associated with the FY 2009-10 Oil and Gas Lease Sale are impact on existing uses of the State Forests and the potential for additional forest fragmentation. Any temporary impact on the existing use of the State Forest was addressed, specifically, the sections for Recreation Sites & Opportunities (*Item 12*), Public Health and Safety (*Item 13*), and Transportation and Pipelines (*Item 14*). In summary, temporary closures and restrictions may be needed to minimize user conflicts. The need for these controls will be at the discretion of the District Forester.

Historically, there were attempts made to explore for and develop shallow natural gas reservoirs (Upper Devonian) in this region. These attempts failed as no commercial production from the Upper Devonian sandstones exist in these areas. Forest fragmentation is most closely associated with close-spaced drilling (forty acres or less). Therefore, since there is little likelihood that economic quantities of natural gas exist in these sandstones, fragmentation of this nature is unlikely to be seen.

The planning process was used in the September 2008 Oil and Gas Lease Sale was repeated for this current sale. This approach consisted of several key components that provided for proper assessment and analysis of on-the-ground attributes of the State Forest system. These analyses were completed using field-based reconnaissance assessments and ArcGIS-based methodology, modeling, and analysis which are ultimately captured by comprehensive lease tract analysis whose results are captured in a series of maps (*Appendix B*).

These key components include, but are not limited to, aesthetic/buffer zones, geologic/spacing assessments, viewshed delineation, important recreation zones, and silvicultural/ecological considerations; all of which are summarized as follows: *Standardized Management Protocols*

WILD AREA MANAGEMENT ZONE: Those areas that have been designated or are pending designation by the Department as State Forest Wild Areas. A Wild Area is defined as an extensive area which the general public will be permitted to see, use and enjoy for such activities as hiking, hunting, fishing and the pursuit of peace and solitude. No development of a permanent nature will be permitted so as to retain the undeveloped character of the area and conserve ecological resources. The guidelines governing the administration of Wild Areas are as follows:

- (1) Campsite leases will be prohibited.
- (2) No new public access roads will be constructed. Existing roads will remain open only where there is a public need. All motorized conveyances or vehicles shall be prohibited with the exception of licensed vehicles, which may be operated only on open public roads.
- (3) Forest trail use will be restricted to foot travel, horseback riding and bicycling. Handicapped persons, in hand or electrically powered wheelchairs, or in other electrically powered vehicles adapted for this use, may operate such conveyances on designated trails.
- (4) Buildings and other improvements will be restricted to the minimum required for public health, safety and interpretive aids.
- (5) **Leases, mineral development, and new rights-of-way will be prohibited; however, subsurface oil and gas rights may be leased where no surface use or disturbance of any kind will take place on the Wild Area.**
- (6) Overnight camping will be limited to the backpack primitive type.

NATURAL AREA MANAGEMENT ZONE: Those areas that have been designated or are pending designation by the department as State Forest Natural Areas. Natural Areas are defined as an area of unique scenic, historic, geologic or ecological value, which will be maintained in a natural condition by allowing physical and biological processes to operate, usually without direct human intervention. These areas are set aside to provide locations for scientific observation of natural systems to protect examples of typical and unique plant and animal communities, and to protect outstanding examples of natural interest and beauty. The guidelines governing the administration of Natural Areas are as follows:

- (1) No human habitation will be permitted, except that primitive type, backpack camping may be permitted in designated areas only.
- (2) Access for all but essential administrative activities will be restricted to foot travel and non-motorized watercraft, except in designated areas.
- (3) Buildings and other improvements will be restricted to the minimum required for public health, safety and interpretive aids.
- (4) Timber harvesting will not be permitted except as may be required for the maintenance of public safety.
- (5) **Leases and mineral development are prohibited; however, subsurface oil and gas rights may be leased where no surface use or disturbance of any kind will take place on the Natural Area. New rights-of-way are prohibited except for designated utility corridors in the Bucktail Natural Area.**

LIMITED RESOURCE MANAGEMENT ZONE: Applied to areas where management alternatives are limited due to site quality or topographic constraints. Recreation, aesthetics, water, and soil retention are the primary values. Topography can be an inhibiting factor that restricts or prohibits natural gas exploration and development practices on these areas (e.g., steep slope). This zone is typically not part of the commercial forest land base. Natural gas exploration and development is usually not practical.

Approximately twelve-thousand eight-hundred fifty-five (12,855) acres have been delineated as *Non-Development-Steep Slope*. No surface disturbance will be permitted.

AESTHETICS / BUFFER MANAGEMENT ZONE: Applied to areas where connectivity, aesthetics and water quality conservation are the primary values. These areas encompass a wide array of lands and are associated with linear features such as roads, trails, and streams or encompass significant features of State Forest lands. Appropriate forest community types within this zone are considered part of the commercial forest land base, however, natural gas exploration and development is typically excluded from certain areas. It is fair to anticipate requests for “waiver of buffer zone” (specifics in *Section 23* of lease agreement). Any request for encroachment will be

reviewed on a case-by-case basis to minimize impact. All requests are subject to the written approval of the district forester. This management zone includes the following areas:

- A. Palustrine Wetlands and Frost Pockets
- B. Parks and Picnic Area
- C. Campsite Leases
- D. Roads
- E. Natural Areas
- F. Fire Hazard Areas
- G. Trails
- H. Sensitive Areas

AQUATIC HABITAT BUFFERS: Areas around wetlands, vernal ponds, spring seeps, streams, lakes, ponds and impoundments should be designated as aquatic habitat buffers. These guidelines provide a standard set of operating procedures to be followed when conducting management activities in or near aquatic habitats on State Forest land. Management efforts should focus on providing connectivity, wildlife habitat and protecting water quality. The specific guidelines (see *Aquatic Buffer Appendix*) are organized as follows:

- A. Streamside Forests
 - Wilderness Trout Stream and Wild Rivers
 - Exceptional Value (EV) Streams and Scenic Rivers
 - High Quality (HQ) and All Other Perennial Streams
 - Intermittent or Ephemeral Streams
- B. Lakes, Ponds, and Impoundments
- C. Vernal Ponds
- D. Spring Seeps
- E. Wetlands

2010 Oil & Gas Lease Sale Management Protocols

WELL SITE SPACING: Derivative-based well spacing will be applied throughout the lease tracts. Recent developments in drilling technology, known as

horizontal drilling, have made it possible to develop well pad sites in a manner that reduces surface impact exponentially. Previous well spacing was fixed through the lease agreement using hard spacing requirements – or the acceptable distance between wells (e.g. 40 acres, 320 acres, or 640 acres). The new derivative-spacing formula will take the total acreage of a tract divided by a reasonable drainage radius (per well). The result is the number of permissible well pad sites permitted on that lease tract. For example:

$$1,300 \text{ acres} / 260 \text{ acres per well} = 5 \text{ acceptable well pad sites}$$

Access roads and necessary pipelines will be constructed along existing roads and rights-of-way wherever possible. Extensive consideration was given to the appropriate well spacing needed for economic recovery of natural gas from the Marcellus Shale (or deeper). The methodology used in the derivative-spacing formula appears to minimize the potential impacts to the surface while maintaining the engineering integrity required to economically recover the natural gas reserves without waste (i.e., Oil and Gas Conservation Law).

Beginning with the 2010 lease sale, two (2) additional stipulations will be included DCNR's standard lease agreement:

Centralized Water Impoundments – these facilities will be reviewed, approved, and managed as a “well pad site” due to the size, spatial extent, and prolonged use of the impoundment. An impoundment will count against the maximum number of allowable pad sites expressed in the lease agreement (Section 2X.XX)

Maximum Surface Disturbance – in most instances, well pad sites typically consume 3.7 to 5 acres of surface lands although the Bureau recognizes that certain variables may require that a larger area is used for a particular pad site. As a result, the lease agreement will specify the total number of acres that can be disturbed by well pad sites (to include central impoundments as above). For example:

$$5 \text{ acceptable well pad sites} \times 5 \text{ acres} = 25 \text{ acres of total surface disturbance}$$

In this case, the lessee can build 5 well pads and/or impoundments, **or** disturb a total of 25 acres of surface lands, **whichever occurs first**. Pipelines, access roads, and other facilities will not count towards this threshold.

VIEWSHED DELINEATION: ArcGIS was utilized for performing viewshed analysis for those areas that contain historic and/or important viewsheds (i.e., Historic Route 6). Digital elevation models (DEM) were used to clearly define those high-points on the surface where an observer stationed along and/or within a defined area. The results were applied to the lease tracts and implemented as an Area of Special Consideration – Viewshed.

Approximately six-thousand six-hundred seventy-nine (6,679) acres have been appropriately delineated as *Area of Special Consideration - Viewshed*. A

significant portion of this area is also contained within the *Non-Development-Steep Slope* areas.

RECREATION ZONES: The basis for the delineated recreation zones contained within a lease tract is the Recreation Opportunity Spectrum (ROS). ROS is an inventory system built on the premise that people expect certain types of recreational experiences on public land, and that land managers should be able to direct people to appropriate places for those experiences. ROS allows the land manager to provide recreational opportunities across a spectrum, or continuum, of 5 land-use classes so that the user may find satisfying recreational experiences in a variety of recreation activities.

Zones that meet the appropriate criteria to be considered “Semi-Primitive, Non-Motorized” have been delineated as such and subsequently have been classed into either *Non-Development - Recreation* or *Area of Special Consideration - Recreation* according to the Department’s standard ROS guidelines. Approximately ten-thousand four-hundred two (10,402) acres meet these criteria. There were no “Primitive” zones contained within the lease tracts.

HIGH VALUE TIMBER CONSIDERATIONS: An ArcGIS-based analysis was performed to properly assess where DCNR’s high-value timber is located in relation to the lease tracts. Using the current typing layer(s) for the applicable forest districts, those areas that comprised of Northern Hardwood Forest (BB), Site Class 1 and/or Black Cherry – Northern Hardwood Forest (BC) criteria have been delineated based on these criteria:

BB **Northern Hardwood Forest** : Dominant trees usually include *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *A. saccharum* (sugar maple), *Prunus serotina* (black cherry)—at less than 40% relative cover, *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *B. papyrifera* (paper birch), *Q. rubra* (northern red oak), and *Fraxinus americana* (white ash). This type may contain scattered *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock), but combined conifer cover does not exceed 25% of the canopy. *Rhododendron maximum* (rosebay) may be locally abundant. Other common shrubs include *Hamamelis virginiana* (witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum lantanoides* (witch-hobble), *Ilex montana* (mountain holly), *Amelanchier laevis* (smooth serviceberry), *A. arborea* (shadbush), and *Carpinus caroliniana* (hornbeam). The herbaceous layer is generally sparse and reflects a northern affinity; common components include *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Thelypteris novaboracensis* (New York fern), *Dryopteris carthusiana* (fancy fern), *Lycopodium lucidulum* (shining clubmoss), *Gaultheria procumbens* (teaberry), *Mitchella repens* (partridge-berry), *Aralia nudicaulis* (wild sarsaparilla), *Medeola virginiana* (Indian cucumber-root), and *Maianthemum canadense* (Canada mayflower).

Related types: If combined relative cover by conifers approaches or exceeds 25%, please read description for the “Hemlock (white pine) - northern hardwood forest.” If cover by *Prunus serotina* (black cherry) approaches or exceeds 40% of

canopy, please read description for the “Black cherry - northern hardwood forest” type.

Range: Glaciated NE, Glaciated NW, Pocono Plateau, Unglaciated Allegheny Plateau.

BC *Black Cherry - Northern Hardwood Forest: (Allegheny Hardwoods)*. This type is characterized by at least 40% *Prunus serotina* (black cherry) and is most characteristic of the Unglaciated Allegheny Plateau. Common associates are *Acer rubrum* (red maple), *A. saccharum* (sugar maple), *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Quercus* spp. (oaks), usually *Q. rubra* (northern red oak). *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock) may be present (at less than 25% relative cover). Shrubs include *Viburnum lantanooides* (witch hobble), *Acer pensylvanicum* (striped maple), *Rubus allegheniensis* (Allegheny blackberry), *Ilex montana* (mountain holly), *Hamamelis virginiana* (witch-hazel), and *Amelanchier arborea* (shadbush). Common herbaceous species include *Dennstaedtia punctilobula* (hayscented fern), *Thelypteris novaboracensis* (New York fern), *Dryopteris intermedia* (common wood fern), *Lycopodium* spp. (ground pine), *Aster acuminatus* (wood aster), *Viola* spp. (violets), *Medeola virginiana* (Indian cucumber-root), *Uvularia sessilifolia* (wild-oats), *Brachyelytrum erectum* (brachyelytrum), *Maianthemum canadense* (Canada mayflower), and *Oxalis acetosella* (common wood-sorrel).

Related types: The “Northern hardwood forest” may contain *Prunus serotina* (black cherry) as a component, but it does not generally exceed 40% relative cover. This type is most characteristic of the Unglaciated Allegheny Plateau.

Range: Glaciated NE, Glaciated NW, Unglaciated Allegheny Plateau.

Site Class 1 (SCI): SC1 is characterized by moist, well-drained, fairly deep soils that usually occur in protected coves, along streams, or in bottomlands that remain moist throughout the year. On northern exposures, Site 1 may extend higher up a slope than on southern exposures because of more favorable soil moisture conditions. In addition to the usual beech-birch-maple-cherry of northern and Allegheny hardwoods, white pine, hemlock, ash and basswood are generally present. In the oak types where red oak and white oak along with hemlock form the major portion of the stand, the presence of tuliptree (yellow poplar) and ash indicates Site 1. Dominant and co-dominant trees have a projected merchantable main stem of > 50 feet at maturity (> three 16-foot logs). Total tree heights average > 80 feet at maturity.

Additionally, those areas that have gone through extensive regeneration projects and are now protected by the installation and maintenance of deer exclosures have been delineated. Based on the input from the District Forester, certain projects were retained and integrated into appropriate lease agreement as an area of special consideration.

The results of the stand analysis were compiled on a tract by tract basis and classed as either *Area of Special Consideration – Timber*, *Area of Special Consideration – Timber-Black Cherry Stand*, or *Area of Special Consideration – Regeneration Project*. Although these areas, totaling approximately three-thousand one-hundred ninety (3,190) acres, two-thousand eight-hundred eighteen (2,818) acres, and six-hundred eighty-eight (688) acres respectively, are not entirely off-limits, natural gas exploration and development activity will require careful coordination between the Department and the Lessee. In some instances, avoidance measures will be required. All Lessees will pay stumpage rates as prescribed in the lease agreement (Exhibit C – Section 9).

ECOLOGICAL CONSIDERATIONS: The Pennsylvania Natural Diversity Inventory was queried to determine where ecological conflicts might occur in the future should a Lessee wish to explore for natural gas. More specifically, an ArcGIS-based analysis was performed for those areas contained in or immediately adjacent to the lease tracts. Given the developing comprehensive nature of these databases, the information assembled and delineated as having *ecological importance* are not intended to serve as restrictions (except as outlined below) but rather a notification that conflicts may exist within portions of a given lease tract. These conflicts may require a survey to determine species or habitat presence, and that monitoring, mitigation or avoidance measures be required as a result of exploration and development activities. This proactive approach serves as a communication tool between Lessor and Lessee whereby the Lessee is made aware that, in advance of obtaining a lease, additional consideration will be given to activities that disrupt habitats, plants, or wildlife prior to approving development activities.

The survey results were placed into two (2) categories and displayed accordingly in the SFER Map Appendix. Generalized categories for the five (5) State Forest districts are as follows:

Non-Development - Ecological: an area of ecological significance where no surface development will be permitted due known flora and/or fauna complexes

Area of Special Consideration – Ecological: an area known to contain plants or animals of significance or special interest

** *Examples of Important species include: bald eagles (Haliaeetus leucocephalus), timber rattlesnake (Crotalus horridus), wood rats (Neotoma magister), or water shrew (Sorex palustris alibarbis).*

** *Examples of Plant Assemblages include: creeping snowberry (Gaultheria hispidula), northeastern bulrush (Scirpus ancistrochaetus), or great-spurred violet (Viola selkirkii)*

The inclusion of this pre-lease survey data is in no manner construed as a waiver of the PNDI requirement for permitting a natural gas well or constructing any ancillary facilities (i.e., pipelines, roads, etc.). The results of the survey have been compiled on a tract by tract basis and classed as *Non-Development – Ecological (913 acres)* or *Area of Special Consideration – Ecological (14,635 acres)*.

17. Protected Animals and Plants

Certain animal and plant species have been listed and given protected status by the U.S. Fish and Wildlife Service, the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission and the Pennsylvania Department of Conservation and Natural Resources.

The Pennsylvania Natural Diversity Inventory (PNDI) information system contains information on known locations of listed species as well as significant natural communities and other ecological features. PNDI is a public/private partnership between DCNR, the Western Pennsylvania Conservancy, PA-Fish and Boat Commission and PA-Game Commission. All activities associated with oil and gas development undergo a PNDI review prior to a well permit being issued.

All potential lessees have been notified through the tract analysis maps (see Item 16 above), as well as specific language in the lease agreement, of known areas of special consideration for plants, animals, and habitats. The lessee will perform a PNDI screening using the PNDI ER Tool. The entire earth disturbance area will be included in the screening, which will include the pad site and any associated impoundments, pipelines and/or access roads. If potential impacts exist as a result of the screening, the lessee will coordinate with the agency/agencies listed on the PNDI Receipt. If requested, a survey should be performed during the appropriate time of year for target species. The project will require PNDI clearance before any earth disturbance activity commences. Projects that will have an adverse effect on any of the important species or critical habitats should be avoided. Where there is potential to impact a species of special concern or their habitat, the lessee may be required to provide necessary avoidance buffers, mitigation, habitat enhancement, and/or monitoring.

The likelihood that purposeful damage to, or destruction of, a species of special concern and their habitat is unlikely; however, the possibility of inadvertent impacts could occur during construction and development of wells sites, centralized impoundments, road and pipelines. Bureau of Forestry personnel will do their best to educate the lessee and their contractors on best management practices in avoiding inadvertent impacts to species or their habitats.

18. Habitat Diversity and Interspersion

Habitats are classified as either terrestrial, wetland, aquatic or riparian. The Bureau's management strategies, in most cases, are designed to optimize diversity within and between these habitats, primarily by promoting various habitat components. Habitat is species dependent. Any management activity, including no activity, will affect some species positively, some will not be affected, and still others will be negatively impacted.

Aside from critical plant and animal species, which are covered in *Item 17*, the maintenance and/or restoration of eco-regional biological diversity is a key consideration in resource management efforts on State Forest lands.

Wildlife and plant habitat will be protected and managed through the implementation of the multi-level management approach. Environmental safeguards have been established through a tiered approach to ensure the protection of critical habitats and species. First-level environmental safeguards involved the establishment of “non-development” areas, such as State Parks and State Forest wild and natural areas, where no surface activity is permitted. Non-development portions of a lease tract state that no surface activity or development will be permitted. More specifically, no well sites, pipelines, roads or related disturbances will be permitted in these areas.

Additional habitat protections have been outlined above. Please refer to *Environmental Safeguards* and *Existing/Potential Land Use (Item 16)* for specifics.

19. Biological Productivity

Vegetation will be cleared due to construction of well sites, roads, and pipelines. Specific clearing areas cannot be delineated at this time; however, approximately four (4) to five (5) acres may require clearing for a well site. Additional clearing areas will be associated with the development of necessary access roads and/or pipelines. No clearing will take place in non-development areas.

Most of the considerations, impacts, and mitigation efforts covered in *Protected Animals and Plants (Item 17)* and *Habitat Diversity and Interspersion (Item 18)* apply specifically to biological productivity. Although the clearings will result in a temporary loss of forest cover, well site and pipelines will be re-vegetated to benefit targeted wildlife species and decrease the impact of invasive species invasion.

20. Vegetation

The Bureau of Forestry is very active in the effort to control and prevent the spread of invasive species on State Forest land. Invasive plant or animal species can be transported by natural methods (i.e., animal excretion), vehicles, by spraying or mowing, during construction or through erosion controls where planting non-native mixes, mulching, or using imported soil are applied. Therefore, an appropriate re-vegetation plan has been established for natural gas related disturbances.

The Lessee will pay double-stumpage for all timber harvested as part of natural gas exploration and development activity. All timber to be removed is marked and tallied by a management forester within the appropriate forest district. Additionally, the Lessee will be required to follow the *Invasive Plants and Revegetation Guidelines (Exhibit D)* of the lease agreement. Protocols call for implementation and adherence including, but not limited to, the following:

- Lessee shall make provisions to monitor for invasive species within the area disturbed by the construction activity for a period of five (5) years following construction or until invasive plants are not observed on-site for two consecutive years, whichever is longer.

-- Post-construction invasive species surveys along access roads shall be limited to areas where gravel was placed or the existing road was widened for Lessee use. After a period of two growing seasons, any new invasive populations will be assumed to be the result of outside sources other than Lessee construction materials and equipment. Control and monitoring of invasive species found along access roads within two growing seasons post-construction will continue until populations are eradicated.

-- The results of all Lessee annual invasive surveys shall be summarized into a report that shall include the following elements: methods, a summary of invasive species detected, abundance of each species, number of new populations per species, number of eradicated populations by species, and management recommendations for management and control. Report and raw electronic observation data shall be submitted to District Forester. Submission of any electronic data should occur simultaneously with the report submission. Data recording and management should be consistent year to year so data can be easily compared by grid cell number. The department reserves the right to audit the findings of the Lessee's reports and as a result of any audit, Department may require alternate methods of management and control.

-- Management and control of established invasive plant populations shall be planned on a species by species basis to determine the best method of control. Lessee and/or its consultant shall submit a "Management and Control Plan" to District Forester no less than three (3) months after the conclusion of all construction activity.

Revegetation of disturbed areas will be completed using DCNR-accepted standards and in a manner that promotes the management goals of the Bureau of Forestry as well as the applicable forest district. The lessee shall utilize a native grass and herb mix for cover and stabilization wherever possible within the disturbed work areas. The required seed mix will provide for immediate stabilization and reduce the chance of invasive species establishment. The grass and herb mix shall be applied at fifteen pounds (15 lbs) per acre.

Additionally, seeds necessary to establish a cover crop will be mixed in with the native grass and herb mix. The cover crop will either be oats or barley (spring months) or wheat or grain rye (fall months). This can be applied at the same time with the mix below and can be done with the hydro-seeder. The cover crop should be applied at thirty pounds (30 lbs) per acre.

The detail components of the native grass and herb mix as well as shrub planting are listed below:

Native Grass and Herb Mix

- 20% Little Bluestem PA ecotype (*Andropogon scoparius*)
- 10% Big Bluestem variety "Niagara" (*Andropogon gerardii*) (genetic origin is NY)
- 15% Virginia Wild Rye PA ecotype (*Elymus virginicus*)
- 10% Indiangrass PA ecotype (*Sorghastrum nutans*)

- 10% Deertongue variety "Tioga" (*Panicum clandestinum*)
- 5% Switchgrass variety "Shelter" (*Panicum virgatum*) (genetic origin is WV)
- 5% Partridge Pea PA ecotype (*Chamaecrista fasciculata*)
- 3% Showy Tick Trefoil PA ecotype (*Desmodium canadense*)
- 5% Ox-eye sunflower PA ecotype (*Heliopsis helianthoides*)
- 2% Autumn bentgrass PA ecotype (*Agrostis perennans*)
- 2% Woolgrass PA ecotype (*Scirpus cyperinus*)
- 3% Soft Rush PA ecotype (*Juncus effuses*)
- 5% Pennsylvania smartweed PA ecotype (*Polygonum pennsylvanicum*)
- 5% Common Milkweed PA ecotype (*Asclepias syriaca*)

All re-vegetation plans or other specific vegetative treatments shall be performed to the satisfaction of the District Forester. Local requirements may dictate that alternative treatments or strategies be developed to meet local management goals.

21. Non-Native Species

The Bureau of Forestry is very active in the effort to control and prevent the spread of invasive species on our lands. Invasive plant or animal species can be moved by vehicles, by spraying or mowing, during construction and through erosion controls where planting non-native mixes, mulching, or using imported soil are applied.

Non-Native Species specifics are addressed in greater detail in *Vegetation (Item 20)* above. Additional criteria for non-native species are also addressed in *Invasive Plants and Revegetation Guidelines (Exhibit D)* of the lease agreement.

22. Other

Economic Considerations

It is not possible for DCNR to predict at this time how many leases will be successfully obtained nor how many wells will be drilled as a result of the new leases. The Commonwealth receives money from three (3) unique revenue streams when leasing subsurface oil and gas rights. These distinct payments are:

Bonus Bid: The first year's rentals, which are set at a minimum bid of two-thousand dollars (\$2000) per acre, are used in determining the winning bidder. The highest dollar-per-acre-bid obtains a given lease. Any combination of higher/lower bids and acreages will affect this estimate accordingly.

Annual Rentals: After the first year, leased acreage requires a twenty-dollar, per-acre, per-year (\$20/acre/year) rental, payable in advance of that year, for years two, three, and four of the lease. Years five (5) and beyond requires a thirty-five-dollar, per acre, per year (\$35/acre/year) rental, payable in advance.

Royalties: Royalty is paid on the natural gas produced from each individual well. The royalty rate for the 2010 Oil and Gas Lease Sale offering has been established at sixteen-percent (18%) of the gross volume of natural gas produced and metered at the well head. Market rates per thousand cubic feet (Mcf) of natural gas prevail. A sharp increase in market rate may cause revenues to rise albeit temporarily regardless of the decline in production.

All revenues from oil and gas activities (except pipeline rights of way) are required to be deposited in the Oil and Gas Lease Fund. By law, these funds are earmarked for recreation, conservation, and flood control projects.

**** Please note – \$60,000,000 generated from the bonus bid payments described above will be allocated to the General Fund and will not be deposited into the Oil and Gas Lease Fund.**

23. Permits

Natural gas exploration and development are subject to the substantial conditions of the DCNR oil and gas lease (*see Lease Appendix*). Additionally, all oil and natural gas exploration and development activities within Pennsylvania are subject to DEP permitting requirements.

Lessees are required to abide by all applicable Federal, State, and Local laws, rules and/or regulations. DCNR has no responsibility to aid an operator in obtaining the necessary permits. Furthermore, DCNR is not required to obtain any permits to allow these activities to occur.