

The Case for Maryland's Proposed Comprehensive Gas Development Plan Program

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EXECUTIVE SUMMARY

Maryland is to be applauded – and emulated – for its efforts to proactively account for and manage the cumulative impacts of natural gas development before they occur. It is critical to do so as part of responsible public policy. One need only look to neighboring Pennsylvania for a cautionary tale, where as much as one third of the entire state has been leased for natural gas exploration. The cumulative impacts of that exploration and the development of accompanying infrastructure will be enormous, but are not well understood.

Need for landscape level planning

The Nature Conservancy (TNC) has done considerable early work on the potential cumulative impacts of natural gas development in Pennsylvania and has called for the adoption of comprehensive planning. In addition, in an analysis of leading best management practice for shale gas development, TNC has identified landscape level planning as the set of BMPs with the most scientific support.

Early analyses of natural gas development activity in Pennsylvania by researchers at The Pennsylvania State University and the United States Geological Survey have also identified significant landscape consequences and point to the need for landscape level planning.

More than a dozen natural gas pipeline projects were going into service in the Northeast United States by the end of 2012. Industry analysts say that perhaps ten times more pipeline expansions than what is already in place are needed to meet demand. That level of development would have obvious potential impacts – permanent habitat fragmentation and more - on the land and natural resources. Landscape level planning is key to avoiding and minimizing the impacts of getting shale gas to market.

A 2012 assessment of undiscovered natural gas resources by USGS shows that there is significant potential for additional shale gas development in Maryland beyond what is currently contemplated, underscoring the need for landscape level planning.

Support for tighter regulations and better planning

There is broad support for the concept of comprehensive planning among industry leaders, national and international NGOs, government agencies, and other institutions, investors, and among the general public. Significant endorsements of the concept are found in reports from The U.S. Secretary of Energy Advisory Board Shale Gas Subcommittee, the International Energy Agency (IEA), the European Commission, investor groups, the Pennsylvania Marcellus Shale Advisory Commission, and the Office of Pennsylvania Governor Tom Corbett. In addition, industry experts and the public have demonstrated strong support for landscape level planning in published surveys.

Significantly, IEA suggests that landscape level planning carries with it a compelling economic rationale – that such planning and optimization can save exploration and production companies as much as five percent of overall development costs. Several industry leaders – officials of leading natural gas exploration companies – have expressed strong

support for landscape level planning as being in the industry's interest from both an economic standpoint and in supporting the industry's social license to operate.

The How – emerging practice of landscape level planning

There are at least six examples of detailed emerging standards/practices – by Federal/state governments, individual companies, an industry trade association, and an industry risk management company - that embrace comprehensive planning. Some of the governmental requirements are voluntary; some are mandatory. However, the industry movement toward greater detail in defining and recommending landscape level planning should signal the direction for public policymakers to take.

Implementation

Maryland's capacity to require landscape level planning will rest on robust natural resource inventory data, GIS capacity, and appropriate skill sets among agency employees tasked with responsibilities under such a requirement. Thus, an initial recommendation is to conduct a gap analysis that looks at how well appropriate departments are positioned to undertake, manage, and enforce the requirement.

Next, experience in Pennsylvania and elsewhere indicates that a successful comprehensive planning requirement implies an iterative process and intensive communication and collaboration with industry and stakeholders – to arrive at win-win solutions that protect natural resources and allow responsible energy development. A careful review of organizational capacities and crafting of appropriate internal and external guidance documents and procedures is recommended.

Iterative processes must be transparent to industry, stakeholders, and the public to win industry confidence and stakeholder and public understanding and support. Explanations of planning requirements, detailed record-keeping, and publicly available data on the process and outcomes are essential. In addition, it is essential to ensure an ongoing commitment to measuring, monitoring, and reporting results of the planning requirement.

A commitment to continuous improvement has been recognized in several of the reports cited in this document. Maryland should commit to and design continuous improvement processes as an early step in the development and promulgation of planning (and other regulatory) requirements.

Conclusion

There is a critical need and extensive support for comprehensive landscape-level planning in the development of shale gas resources, and robust recommendations for and an emerging practice of it. Maryland has the opportunity to take a national leadership position in demonstrating how smart planning can achieve environmental and business “win-wins” that will go a long way to ensuring responsible production of shale gas – and citizen acceptance of it.

1. NEED FOR LANDSCAPE LEVEL PLANNING

Maryland is to be applauded for its efforts to proactively account for and manage the cumulative impacts of natural gas development before they occur. It is critical to do so as part of responsible public policy. One need only look at neighboring Pennsylvania for a cautionary tale. With at least 25% of the land area of the state – and as much as one third - leased for drilling, tens of thousands to possibly hundreds of thousands of wells are predicted to be drilled there over the next seven decades. The ultimate impact from that scale of development on Pennsylvania's cherished landscape is unknown.¹ The need for landscape level planning has been clearly identified by a growing body of scientific studies.

a. The Nature Conservancy

The Nature Conservancy's *Pennsylvania Energy Impacts Assessment*² looks prospectively at the possible harm to Pennsylvania's forests from development of natural gas, wind, wood biomass, and associated electrical and gas transmission lines. The Assessment estimates – conservatively - that by 2030, 60,000 wells could be drilled in Pennsylvania, resulting in up to 90,000 acres of forest clearance and disruption of forest ecosystems in an additional 220,000 adjacent acres. These lands contain 40% of Pennsylvania's globally rare and threatened species. Moreover, nearly 80% of the state's most intact brook trout watersheds could see at least some Marcellus gas development during the next 20 years.

The Assessment³ - soberingly - finds that the impact from pipeline development in Pennsylvania is likely to exceed the impact from well pads and roads. Close to 17,000 miles of gathering and transport lines could be built in Pennsylvania in the next two decades, resulting in the clearing of up to 134,000 acres of forest and damage to an additional 950,000 acres of forest.

Pennsylvania's forest cover totals 17 million acres. So TNC's conservative estimate translates into damage to between 3% and 8% of the state's forest from gas development. Because many of the state's largest and most intact – and sensitive – forest patches could be fragmented, the results of damaging what could be viewed as a relatively small percentage of the total forest could be disproportionately severe.

Based on their analysis of 28 Best Management Practices (BMPs) related to natural gas development impacts, TNC found that the BMPs with the strongest scientific support include landscape-level planning and shared infrastructure; avoidance of sensitive areas, aquatic habitats, and core forest areas; and road design, location, and maintenance.⁴

¹ <http://www.johnhanger.blogspot.com/2012/05/pa-drilling-for-marcellus-gas-to.html>

² http://www.nature.org/media/pa/pa_energy_assessment_report.pdf

³ <http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/ng-pipelines.pdf>

⁴ <http://extension.psu.edu/natural-resources/natural-gas/webinars/evaluating-the-scientific-support-of-conservation-best-management-practices-bmps-for-shale-gas-extraction-in-the-appalachian-basin>

TNC recommends that landscape level planning should be central to any set of Shale Gas BMPs.

b. Penn State University

A May 2012 study from researchers at Penn State University⁵ looked at early trends in land cover change and forest fragmentation from gas drilling in Pennsylvania. Researchers found that most of Pennsylvania's shale gas development is taking place on private land. While this was not a surprise, the study points out that between 45% and 62% of well pads are on agricultural land, whereas 38% to 54% are being built on forest land. This level of activity on agricultural lands is higher than expected, since 60% of the state is covered with forests.

The study looked at land conversion, i.e. the industrialization of previously agricultural or forest land. Relying on the number of drilling permits granted as of June 2011, researchers estimated that at least 1,600 to 2,600 acres of agricultural land and 1,300 to 2,200 acres of forest land would eventually be industrialized. Accounting for existing pads and development of all permits would result in at least 403 miles of new roads, which, along with pipelines, would significantly fragment forest cover.

With this kind of intense development taking place on private lands, the authors called for a regional strategy to help guide infrastructure development, so that habitat loss, farmland conversion, and the risks to waterways can be better managed.

c. U.S. Geological Survey work in PA

The U.S. Geological Survey is documenting landscape change resulting from construction of well pads, new roads and pipelines for natural gas and coal bed methane exploration in Pennsylvania's Bradford and Washington counties. This work will help develop an understanding of the cumulative impacts of that development and the potential consequences for ecosystems and wildlife, human health, water quality, invasive species and socioeconomic impacts.

The study, *Landscape Consequences of Natural Gas Extraction in Bradford and Washington Counties, Pennsylvania, 2004 to 2010*,⁶ found that between the two counties natural gas extraction sites resulted in 8,155 acres of disturbance, including the construction of roads and pipelines. This quantitative look at the levels of landscape disturbance, forest fragmentation and loss, and other changes to land use and land will be sharpened with continuation of USGS' work.⁷ What is clear now is that landscape disturbance will affect ecosystems, human health, and water quality – and profoundly

⁵ <http://link.springer.com/article/10.1007%2Fs00267-012-9841-6>

⁶ <http://pubs.usgs.gov/of/2012/1154>

⁷ Since this paper was originally written USGS has issued similar reports for Somerset, Westmoreland, Allegheny, Susquehanna, Fayette, and Lycoming counties. See <http://johnhquigley.blogspot.com/search?q=usgs>

impact Pennsylvania's two largest industries: agriculture and tourism. Greatly enhanced planning is essential to avoid, minimize, and mitigate these impacts in the future for Pennsylvania and other states affected by natural gas extraction.

d. The Cumulative Impacts of Pipelines

As noted, well pad and associated development represent only one piece of the cumulative impacts equation. With that development will come pipelines- gathering lines and transmission lines. Although there were more than a dozen natural gas pipeline projects going into service in the Northeast United States by the end of 2012, industry analysts say that the gap between demand for low-price gas and pipeline capacity is huge. They estimate that it would take 10 times more pipeline expansions than what is already in place to take a significantly reduce the price spikes seen during times of concentrated cold.⁸ Ten times the pipeline may or may not be built, but, if built, would certainly have more than a tenfold impact on the landscape and natural resources.

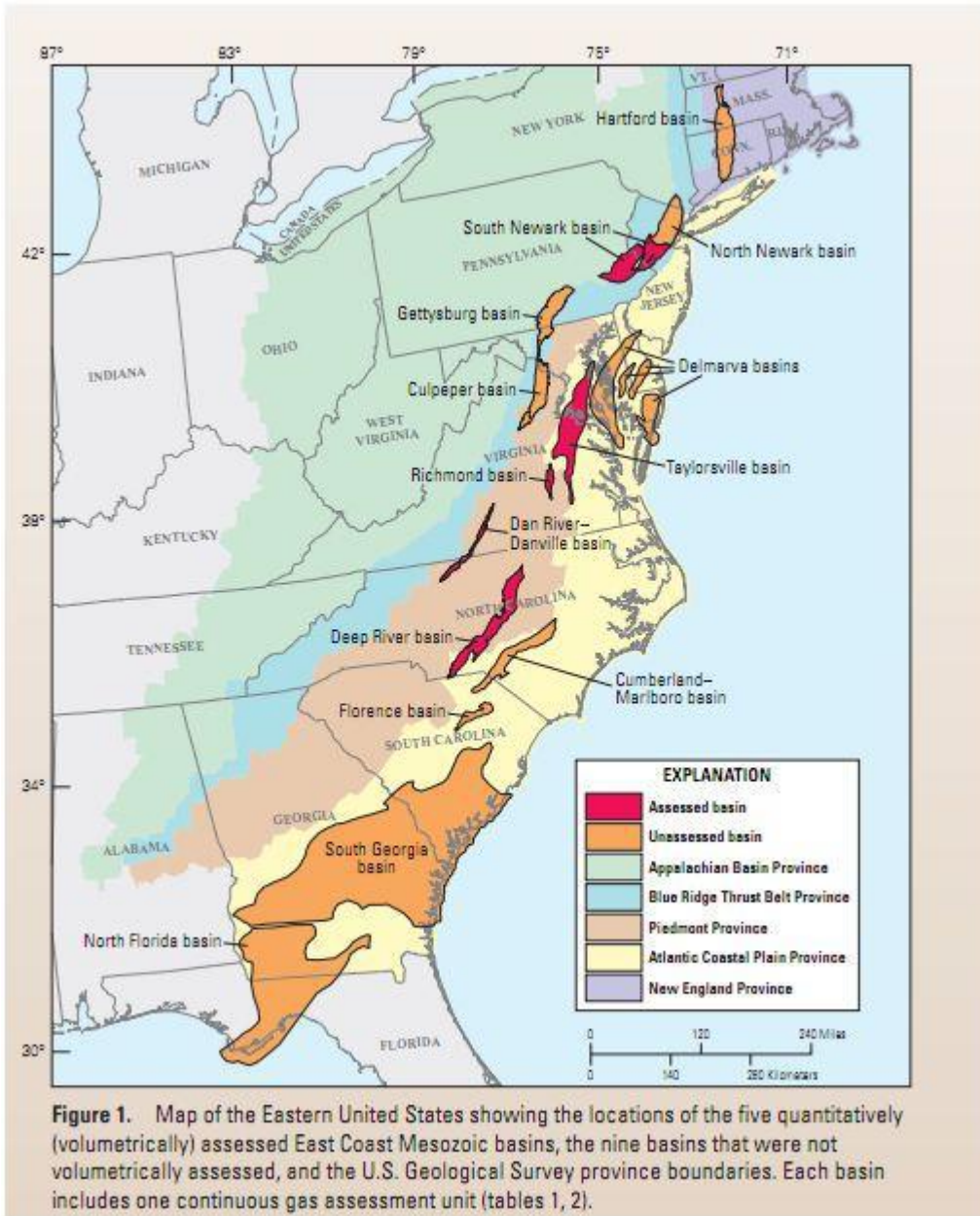
Some of the impacts of drilling activity are temporary, as well pads and some other disturbances are eventually reclaimed. How disturbances are reclaimed, and how quickly, will be significant determinants of the long-term impact of gas development. However, pipelines and associated rights-of-way will permanently – for at least as long as the gas flows - fragment habitat and produce secondary impacts.. Smart planning by the drilling and pipeline industry is the key to avoiding and minimizing the impacts of getting shale gas to market.

e. Implications for Maryland

A 2012 assessment of undiscovered natural gas resources⁹ by USGS shows that there is significant potential for additional shale gas development in Maryland beyond what is currently contemplated.

⁸ <http://www.platts.com/newsfeature/2012/naturalgas/uspipelines/index>

⁹ <http://pubs.usgs.gov/fs/2012/3075/fs2012-3075.pdf>



The potential for development of additional shale basins further underscores Maryland’s need for comprehensive planning.

2. SUPPORT FOR TIGHTER REGULATIONS AND BETTER PLANNING

There is broad support for the concept of comprehensive planning among industry leaders, national and international NGOs, government agencies, and other institutions, investors, and among the general public.

a. Secretary of Energy Advisory Board Shale Gas Subcommittee

In August, 2011, the Shale Gas Subcommittee (SGS) of the Secretary of Energy Advisory Board released its first report¹⁰ that addressed immediate steps that can be taken to reduce the environmental impact and improve the safety of shale gas production. The importance of managing short- term and cumulative impacts of gas production and transport on communities, land use, wildlife, and ecologies was highlighted. The SGS called for the preservation of unique/sensitive areas by declaring them off-limits to drilling and supporting infrastructure, and for science-based analysis of important landscapes, habitats and corridors to improve planning, prevention, mitigation, and reclamation of surface impacts.

The report states:¹¹

Intensive shale gas development can potentially have serious impacts on public health, the environment and quality of life – even when individual operators conduct their activities in ways that meet and exceed regulatory requirements. The combination of impacts from multiple drilling and production operations, support infrastructure (pipelines, road networks, etc.) and related activities can overwhelm ecosystems and communities.

The Subcommittee believes that federal, regional, state and local jurisdictions need to place greater effort on examining these cumulative impacts in a more holistic manner; discrete permitting activity that focuses narrowly on individual activities does not reach to these issues. Rather than suggesting a simple prescription that every jurisdiction should follow to assure adequate consideration of these impacts, the Subcommittee believes that each relevant jurisdiction should develop and implement processes for community engagement and for preventing, mitigating and remediating surface impacts and community impacts from production activities.

The SGS recommends several mechanisms that should be considered to manage short-term and cumulative impacts, including:

- optimizing use of multi-well pads;
- evaluating water use at the scale of affected watersheds;
- declaring unique and/or sensitive areas off-limits to drilling and supporting infrastructure;

¹⁰ http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf

¹¹ pp. 25-26

- undertaking science-based characterization of important landscapes, habitats and corridors to inform planning, prevention, mitigation and reclamation of surface impacts;
- establishing effective field monitoring and enforcement; and
- mitigating noise, air, and visual pollution.

b. The International Energy Agency's Golden Rules for a Golden Age of Gas report

In May 2012, The International Energy Agency issued *Golden Rules for a Golden Age of Gas*.¹² In it, IEA projects that the world's demand for natural gas could rise more than 50% by 2035 – reaching as much as 25% of the global energy mix, surpassing coal as the world's second largest energy source after oil.

IEA says that for shale gas and other natural gas resources to attain those levels, they must be developed in an environmentally acceptable way. It urges government regulators, the industry, and stakeholders to adopt a set of “golden rules” that take into account a range of social and environmental considerations.

IEA's Golden Rules contain no surprises. They stress the responsibility of government to impose and enforce strict regulations, and the industry to employ the “highest possible standards” of performance. IEA calls on operators to go beyond minimally satisfying legal requirements in demonstrating their commitment to local development and environmental protection.

The Golden Rules call for measuring and monitoring of environmental impacts; careful choice of drilling sites; and rigorous assessment, tracking, and monitoring of water requirements. IEA specifically calls for improved project planning and attention to cumulative impacts.¹³

IEA says that applying the Golden Rules could increase the cost of a typical shale-gas well by around 7%, but, for a larger development project with multiple wells, investment in measures to reduce environmental impacts may in many cases be offset by lower operating costs.¹⁴

Indeed, IEA estimates that more sensitive environmental planning - minimizing or eliminating environmental risk, improving efficiency, optimizing drilling and infrastructure costs, and taking advantage of economies of scale - could yield *overall cost savings of 5 percent* for the gas industry.¹⁵ Saving this money will have the added virtue of saving forests and fields. To be clear, not all of the 5% savings is attributable to landscape planning, but it is the foundation upon which the savings are built.

¹²http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/WEO2012_GoldenRulesReport.pdf

¹³ p. 44

¹⁴<http://www.iea.org/newsroomandevents/pressreleases/2012/may/name.27266.en.html>

¹⁵ IEA, p.60

c. Expert opinion

Resources for the Future's¹⁶ Center for Energy Economics and Policy¹⁷ (CEEP) has released the results of a survey of 256 shale gas experts (the author included) from government agencies, industry, academia, and nongovernmental organizations “to identify the priority environmental risks related to shale gas development—those for which the experts believe government regulation and/or voluntary industry practices are currently inadequate to protect the public or the environment.”

*Pathways to Dialogue: What the Experts Say about the Environmental Risks of Shale Gas Development*¹⁸ found a high degree of consensus among experts about the specific risks to mitigate on 12 risk pathways:

- 7 involve potential risks to surface water,
- 2 involve potential risks to air quality,
- 2 involve potential risks to groundwater, and
- 1 is related to habitat disruption.

The graphic below¹⁹ illustrates that groundwater impacts and habitat fragmentation are among the consensus concerns, lending support to Maryland's contemplated actions.

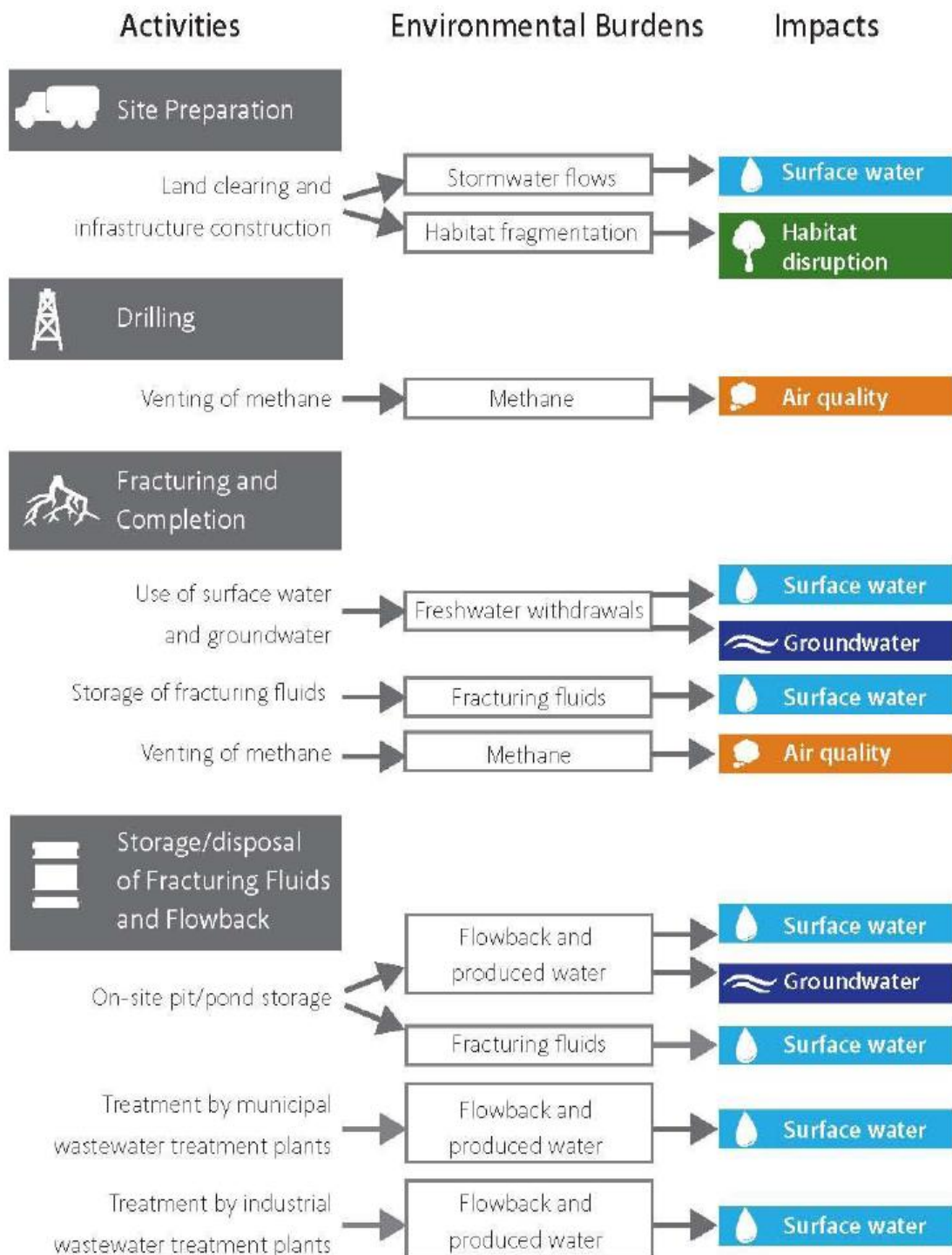
¹⁶ <http://www.rff.org/Pages/default.aspx>

¹⁷ http://www.rff.org/centers/energy_economics_and_policy/Pages/default.aspx

¹⁸ http://www.rff.org/Documents/RFF-Rpt-PathwaystoDialogue_FullReport.pdf

¹⁹ RFF, p. 17

ROUTINE RISK PATHWAYS



d. The public

There is a strong, bipartisan public consensus about the need to enact and enforce regulations that protect the environment, with a focus on clean air and water:

- A Bloomberg National Poll²⁰ found that 66% of Americans want more government oversight of fracking;
- A poll by ORC International for the Civil Society Institute and Environmental Working Group²¹ found that 94% of Americans want to balance new energy production with protecting clean water and air – including 92% of Republicans. Further, 79% of Americans are concerned about fracking as it relates to water quality.

e. PA Marcellus Shale Advisory Commission

Pennsylvania Governor Tom Corbett's Marcellus Shale Advisory Commission²² (MSAC) recognized the central importance to Pennsylvania of avoiding, minimizing, or mitigating the impacts of natural gas development on areas of high conservation value. The MSAC noted that:

[The Department of Conservation and Natural Resources] has developed a set of best management practices for use on state forestland that are also applicable for private lands.

Minimizing the number of well pads through coordinated planning and consultation, as well as utilization of existing rights of way, can mitigate the cumulative impact on the Commonwealth's landscape. This is especially important as additional shale and unconventional natural gas plays are explored and developed.²³

Indeed, if companies can follow these high standards on the public lands, they should follow them everywhere.

Further MSAC recommendations include:

- Minimize the size and disturbance of well sites and related facilities;
- Minimize, avoid, or buffer against conflicts with resources such as critical waterways, public parks, endangered or threatened plants, species and habitats, historic and cultural areas; and
- Avoid or minimize forest loss and fragmentation.

²⁰ <http://www.bloomberg.com/news/2012-12-14/tougher-fracking-regulations-backed-by-66-poll-shows.html>

²¹ <http://www.civilsocietyinstitute.org/media/pdfs/011013%20CSI%20EWG%20ACEA%20survey%20report%20FINAL2.pdf>

²² http://teampa.com/wp-content/uploads/2011/07/MSAC_FinalReport_Web.pdf

²³ MSAC p. 76

f. Report to the PA General Assembly on Pipeline Placement of Natural Gas Gathering Lines

In December, 2012, the Pennsylvania Governor's Office issued a *Report to the General Assembly on Pipeline Placement of Natural Gas Gathering Lines*,²⁴ as required by Act 13.²⁵ The report reviews existing laws governing gathering line placement and makes 16 recommendations for improving environmental and public safety – including six that aim to reduce or minimize the impact of gathering line development and embrace comprehensive planning.

The recommendations include:

1. Remove legal impediments to the sharing of state and local road rights-of-way with gathering lines.
2. County planning offices must work with drillers and gathering line companies to maximize opportunities for shared rights-of-way.
3. Enhancement of the PA Natural Diversity Inventory²⁶ review tool to assist gathering line developers in avoiding conflict with threatened and endangered species.
4. The Department of Environmental Protection should adopt environmental review standards for drilling proposals that avoid surface disturbances, impacts on sensitive lands, forest fragmentation, viewsheds and direct intersection with waterways;
5. County and municipal governments should be encouraged to consult with gathering line operators to better understand the implications of a proposed project on local comprehensive plans.
6. Pipeline operators should be encouraged to consult with appropriate experts to replant rights-of-way with vegetation that fosters habitat development for wildlife.

g. European Commission

In September, 2012, The European Commission²⁷ published three studies²⁸ to help inform the debate on shale gas development in the EU and to help ensure an appropriate legal framework is put in place to govern shale gas extraction. The studies look at potential effects of shale gas development on energy markets, on climate, and the potential risks to human health and the environment.

On the subject of regulation, the reports concluded that “Robust regulatory regimes would be required to mitigate risks and to improve general public confidence.” The report cites the 2011 report of the U.S. Secretary of Energy’s Shale Gas Subcommittee and endorsed SGS’ recommendation on characterizing important landscapes, habitats and corridors to inform planning, prevention, mitigation and reclamation of surface impacts;

²⁴ <http://docs.google.com/file/d/0B4Y3VQLxjkxQQ0FUaktrN3JESDA/edit?pli=1>

²⁵ <http://stateimpact.npr.org/pennsylvania/2012/02/06/here-it-is-the-impact-fee-bill/>

²⁶ <http://www.naturalheritage.state.pa.us/>

²⁷ http://ec.europa.eu/index_en.htm

²⁸ http://ec.europa.eu/energy/studies/energy_en.htm

effective monitoring and enforcement to inform on-going assessment of cumulative impacts; and declaring high value or environmentally sensitive areas off-limits to drilling.

The report's General Recommendations²⁹ include very specific references to comprehensive planning.

h. Investors

Fifty five major investment organizations and institutional investors with nearly \$1 trillion in assets under management³⁰ have united to support “best practices” for the fracking of shale gas. These investors are seeking action from the industry due to the persistent, increasing level of uncertainty about fracking and growing shareholder unrest at a reported 16 companies in the last two years.

In December 2011, the Investor Environmental Health Network and Interfaith Center on Corporate Responsibility published *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations*.³¹ The guide presents 12 core goals for shale gas companies and supporting practices and indicators, including minimizing surface disturbance from natural gas exploration and production through better planning.

More recently, investors have called on³² nine leading oil and gas companies to disclose information about the way they are managing and measuring the risks associated with hydraulic fracturing and shale gas transmission, specifically voicing support for comprehensive planning.

i. Industry leaders

In March, 2012 at an international energy conference held in Houston, the author heard Royal Dutch Shell CEO Peter Voser endorse the Shale Gas Subcommittee work and call for stronger regulation to protect the environment³³:

We need to do a better job of listening and responding. To this end, Shell last year announced five operating principles for our onshore tight oil and gas operations. These provide a framework for protecting water, air, wildlife and the communities in which we operate.

We have invited comment on these principles, and we are committed to support regulations consistent with them. Our hope is they can be applied over time to all tight oil and gas operations around the world.

²⁹ p. 139 ff.

³⁰ <http://iehn.org/news.press.pressreleasetrillion5-16-12.php>

³¹ <http://www.iehn.org/documents/frackguidance.pdf>

³² <http://iehn.org/news.press.frackingpressrelease02-05-13.php>

³³ <http://www.shell.com/global/aboutshell/media/speeches-and-webcasts/2012/voser-ceraweek-houston-07032012.html>

To that end, the US Energy Secretary’s Shale Gas Production Subcommittee ... examined potential measures to ensure public safety and protect the environment in shale gas production. As it notes in a recent report, “a prudent balance between development and environmental protection is best struck by establishing a strong foundation of regulation and enforcement” ...

As an industry, we should insist on strong regulation and enforcement to ensure everyone in the industry does the job right.

Two of Shell’s Five Operating Principles³⁴ deal with water and footprint issues. In pertinent part:

Footprint: Shell Works to reduce its operational footprint

For example³⁵:

- We design facilities and use technology to limit disturbance, including road location, well pad location, and noise and light mitigation, as reasonably practicable.
- We work to understand and reduce the impact from our operations on wildlife and livestock. This includes limiting activities during specific time periods.
- We evaluate the installation of gathering systems and pipelines to reduce trucking of produced fluids where reasonably practicable and economically feasible during the development stage.
- We use best practices (such as using native plants and monitoring) for site restoration.

Shell wasn't the only company whose leadership was at least saying the right things at that conference in Houston. Southwestern Energy’s Executive Vice President, General Counsel, and Secretary Mark K. Boling,³⁶ was particularly strong, saying,³⁷ “The statement that ‘we’ve been doing fracking for 60 years’ is irrelevant. We had better be willing to stand behind our product. We need to think unconventionally above ground.” He went on to define that as practicing at a higher environmental standard, as recommended by the Secretary of Energy’s Shale Gas Subcommittee. He said that the industry should perform land-use planning and assess local impacts. Further, he said that the industry should assess the cumulative impacts of gas development, and that watershed-level planning should become an industry norm.

3. THE HOW – EMERGING PRACTICE OF LANDSCAPE LEVEL PLANNING

There are at least six examples of detailed standards/practices – by Federal/state governments and industry – that embrace comprehensive planning.

³⁴ <http://s06.static-shell.com/content/dam/shell/static/usa/downloads/onshore/onshore-principlesfactsheet2.pdf>

³⁵ <http://s04.static-shell.com/content/dam/shell-new/local/corporate/corporate/downloads/pdf/shell-operating-principles-tight-sandstone-shale.pdf>

³⁶ <http://www.swn.com/aboutswn/Pages/MarkKBoling.aspx>

³⁷ Author notes.

a. U.S. Department of Interior Bureau of Land Management

U.S. DOI/BLM use of comprehensive drilling plan³⁸ includes an overall drilling program and surface use program. BLM says that this increases processing efficiency and allows the BLM and oil and gas operators an opportunity to better plan development in a given area. Further, BLM says that these strategies encourage field development that minimizes resource impacts.

b. Anadarko Petroleum

In May of 2012, US Secretary of the Interior Ken Salazar, in what he called³⁹ a “historic event,” agreed to allow a large-scale natural gas project to go forward in an environmentally sensitive area of northeastern Utah. The record of decision (ROD)⁴⁰ for Anadarko Petroleum’s Greater Natural Buttes infill drilling project will allow the company to drill up to 3,675 new wells over a 10-year period in an existing gas field in Uintah County. Salazar said that the years-long collaborative approach that led up to the signing of the ROD “creates a template for development of natural gas resources around the United States.”

The ROD states:

The Agency Preferred Alternative meets the BLM’s purpose and need, as described in Section 1.3 of the Final EIS,⁴¹ because it will provide for oil and natural gas exploration and development while mitigating impacts on key resources including floodplains, riparian areas, and wetlands; threatened and endangered species; recreation; cultural resources; air quality; and water resources.

The Southern Utah Wilderness Alliance, Natural Resources Defense Council, and the Utah Chapter of the Sierra Club applauded this event as a “win-win” for all sides.⁴²

c. Colorado Department of Natural Resources

Colorado’s Department of Natural Resources had adopted the use of Comprehensive Drilling Plans (CDPs), “which will result in enhanced protection for Colorado’s environment, wildlife, and communities while increasing the level of certainty for operators and reducing their cost of doing business in Colorado.”⁴³

³⁸ http://www.blm.gov/pgdata/etc/medialib/blm/mt/blm_programs/energy/oil_and_gas/policy.Par.15090.File.dat/03wom152.pdf

³⁹ <http://www.platts.com/RSSFeedDetailedNews/RSSFeed/NaturalGas/6276889>

⁴⁰ http://www.blm.gov/pgdata/etc/medialib/blm/ut/vernal/fo/planning/greater_natural_buttes/record_of_decision.Par.86388.File.dat.Cover_ROD.pdf

⁴¹ http://www.blm.gov/ut/st/en/fo/vernal/planning/nepa_.html

⁴² <http://www.suwa.org/2012/05/07/conservation-groups-applaud-signing-of-greater-natural-buttes-record-of-decision/>

⁴³ <http://www.ourcolorado.org/what-we-do/energy/oil-gas/cogcc-fact-sheet-cdps-121808.pdf>

Comprehensive Drilling Plans, as defined by DNR, are tools that:

provide incentives for companies to take a broader approach to oil and gas planning and permitting. The CDP will identify future oil and gas activities in a defined geographic area, facilitate discussions between operators, surface owners, and state and local officials, identify potential impacts resulting from the planned activities, and develop agreed-upon ways to minimize them.

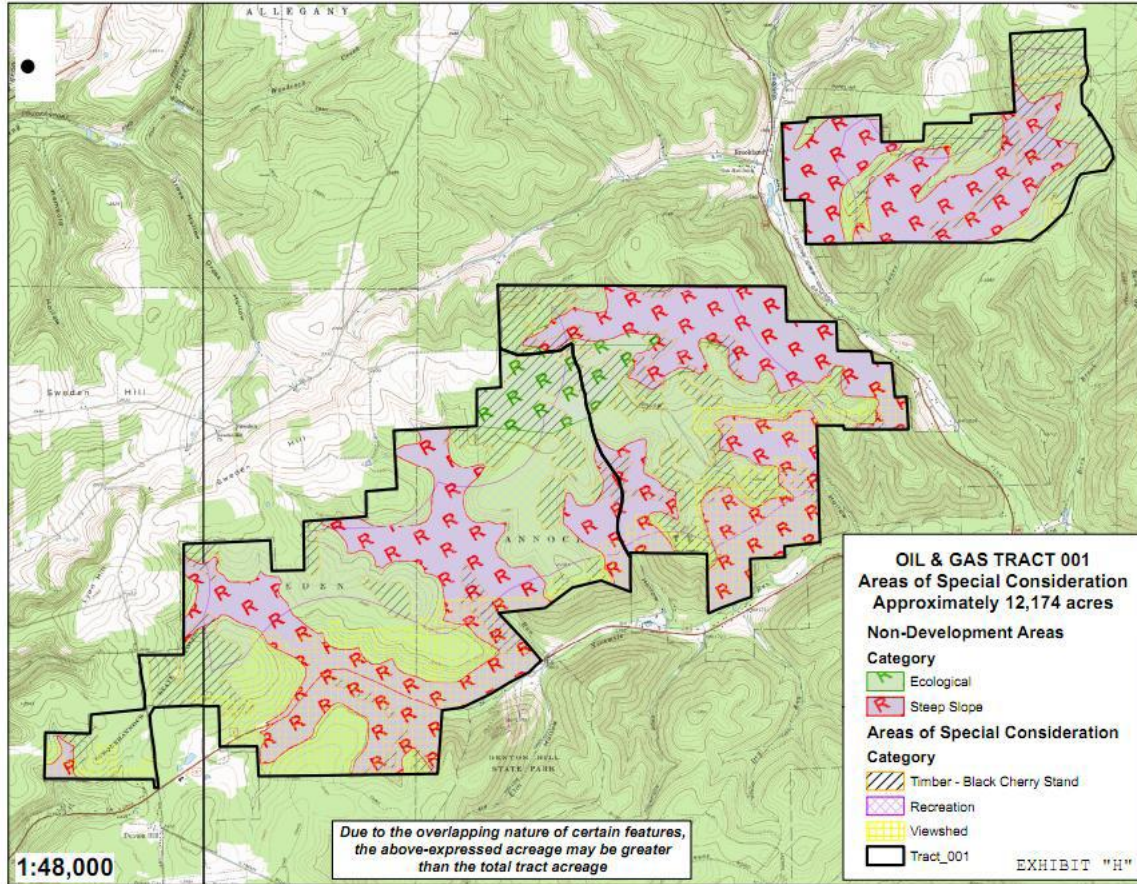
Because a CDP is a flexible planning and permitting tool, operators can tailor it to their needs and circumstances. While an operator may develop a CDP however it chooses, the information that is included and the procedures that are followed will have a significant bearing on what kind of procedural benefits result from a CDP.

In addition, CDNR says that the use of CDPs will allow for the elimination of site-specific permitting requirements in certain circumstances, expedited permitting, and predictability for companies.

d. Pennsylvania Department of Conservation and Natural Resources

Pennsylvania's State Forest Resource Management Plan⁴⁴ guides PA DCNR's management of the state's 2.2 million acre state forest. 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 – including oil/gas leasing activity. The result of an ER in a leasing scenario is a detailed specification – prior to leasing – of any leased tract and identification of areas of non-development or special consideration due to ecological, topographical, timber, recreation, and viewshed values, as shown in the example below.

⁴⁴ <http://www.dcnr.state.pa.us/forestry/sfrmp/update.aspx>



This map displays areas that must receive special consideration before developing an oil and gas tract in Pennsylvania's state forest.

This is often in addition to standard Departmental policy that no drilling or production activity, included but not limited to well drilling and construction, pipeline construction, compressor station placement and construction, or road construction, is permitted on the surface of any State Forest Wild Area, or State Forest Natural Area. The results of an ER are incorporated into lease documents, which require gas companies to coordinate and pre-plan all exploration and development activities with the Department. Thus, there is extensive engagement with the lessees and landscape level planning is very much an iterative process.

e. American Petroleum Institute's Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing

APIs Practices for Mitigating Surface Impacts Associated with Hydraulic Fracturing⁴⁵ contains strong support for comprehensive planning in order to minimize surface impacts. API has developed strong recommendations on site selection, environmental assessment, site evaluation and planning; well development; protection of visual resources,

⁴⁵ http://www.api.org/~media/Files/Policy/Exploration/HF3_e7.pdf

placement of gathering lines and infrastructure; and location of production and water handling facilities.

f. Det Norske Veritas Recommended Practice on Shale Gas Extraction

Det Norske Veritas (DNV),⁴⁶ a global provider of risk management services, has created an initial Recommended Practice for the life cycle of shale gas extraction, based on risk management principles. The document, developed following consultation with European and US regulators, oil and gas companies, NGOs, and other industry bodies, is intended to form the basis for a global standard for safe and sustainable shale gas extraction.

The Recommended Practice focuses on: management systems; safety, health, and the environment; well integrity; management of water and energy; infrastructure and logistics; public engagement; stakeholder communication; and permits. A summary⁴⁷ published in September, 2012 identifies DNVs most essential recommendations. The full 59-page Recommended Practice⁴⁸ is painstakingly thorough, detailed, and comprehensive prescription for all aspects of shale gas development – including pre-development environmental assessments.

4. IMPLEMENTATION

Maryland’s capacity to require landscape level planning will rest on the data it has and maintains on the state’s natural resources, the additional data that it will require developers to gather, and the ways in which that data is interpreted and used. Robust natural resource inventory data, GIS capacity, and appropriate skill sets among agency employees tasked with responsibilities under such a requirement is essential. Thus, an initial recommendation in implementing these planning requirements is to define internal resource needs and then to conduct an organizational analysis – a gap analysis – that looks at how well appropriate departments are positioned to undertake, manage and enforce the requirement.

Next, experience in Pennsylvania and elsewhere indicates that a successful comprehensive planning requirement implies an iterative process and intensive communication and collaboration with industry and stakeholders – to arrive at win-win solutions that protect natural resources and allow responsible energy development. A careful review of those organizational capacities and crafting of appropriate internal and external guidance documents and procedures is recommended.

Another consideration is transparency. Iterative processes must be transparent to industry, stakeholders, and the public to win industry confidence and stakeholder and public understanding and support. Clear – and early – explanations of planning requirements to industry and stakeholders – including local and county governments – will help to ensure

⁴⁶ <http://www.dnv.com/>

⁴⁷ http://www.dnv.com/binaries/Shale_gas_summary_250912_tcm4-527576.pdf

⁴⁸ <http://exchange.dnv.com/publishing/Codes/download.asp?url=2013-01/rp-u301.pdf>

common expectations. Detailed record-keeping and publicly available data on the process and outcomes are essential. In addition, it is equally essential to ensure an ongoing commitment to measuring, monitoring, and reporting results of the planning requirement.

A commitment to continuous improvement has been recognized in several of the reports cited in this document. Maryland should commit to and design a continuous improvement process as an early step in the development and promulgation of planning and other regulatory requirements.

CONCLUSION

There is a critical need and extensive support for comprehensive landscape-level planning in the development of shale gas resources, and robust recommendations for and an emerging practice of it. Maryland has the opportunity to take a national leadership position in demonstrating how smart planning can achieve environmental and business “win-wins” that will go a long way to ensuring responsible production of shale gas – and citizen acceptance of it.

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This guidance document identifies and describes best practices currently used in the oil and natural gas industry to minimize potential surface environmental impacts associated with hydraulic fracturing operations. It complements two other API documents: API Guidance Document HF1, *Hydraulic Fracturing Operations—Well Construction and Integrity Guidelines*, First Edition, October 2009, which focuses on groundwater protection related to drilling and hydraulic fracturing operations while specifically highlighting recommended practices for well construction and the integrity of hydraulically fractured wells, and API Guidance Document HF2, *Water Management Associated with Hydraulic Fracturing*, First Edition, June 2010. A fourth related guidance document, API 51R, *Environmental Protection for Onshore Oil and Gas Production Operations and Leases*, First Edition, July 2009, addresses the design and construction of access roads and well locations prior to drilling, as well as site abandonment, reclamation and restoration operations, including produced water handling.

American Petroleum Institute. *Environmental Protection for Onshore Oil and Gas Production Operations and Leases, Upstream Segment*. API Recommended Practice 51R First Edition (July 2009).

This standard provides environmentally sound practices for domestic onshore oil and gas production operations. It is intended to be applicable to contractors as well as operators. Facilities within the scope of this document include all production facilities, including produced water handling facilities. Offshore and arctic areas are beyond the scope of this document. Operational coverage begins with the design and construction of access roads and well locations, and includes reclamation, abandonment, and restoration operations. Gas compression for transmission purposes or production operations, such as gas lift, pressure maintenance, or enhanced oil recovery (EOR) is included; however, gas processing for liquids recovery is not addressed. Annex A provides guidance for a company to consider as a “good neighbor.”

Anadarko Petroleum Corporation. *Utah Fact Sheet* (2012).

Company fact sheet on Utah operations

Commonwealth of Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry. *August 2008 Oil and Gas Lease Sale State Forest Environmental Review* (June 20, 2008).

The report describes the August 2008 Oil and Gas Lease Sale that occurred on August 18, 2008. The project review criteria includes 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.

Commonwealth of Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry. *Oil and Gas Lease for State Forest Lands State Forest Tract No. 001*. M-O & G (11-09) Contract No. M-110001-15. (2008).

PA DCNR's standard State forest lease, that is replete with environmental protections.

Det Norske Veritas AS. *Recommended Practice: Risk Management of Shale Gas Developments and Operations*, DNV-RP-U301 (January 2013).

The overall objective of this Recommended Practice (RP) is to establish guidelines and recommendations for the processes required to protect the safety of people and the environment during all phases of shale gas field development and operations. In addition, the document is intended to increase the overall awareness of risks from shale gas activities and demonstrate how to best manage these risks. This Recommended Practice is intended to serve as a reference document for independent assessment or verification. It aims at covering risk management issues which are particular for shale gas fields. It does not cover issues related to what are considered normal gas field facilities, even if such facilities are normally also used at shale gas fields.

Det Norske Veritas AS. *Shale Gas Recommended Practice Summary* (September 2012).

DNV's Recommended Practice applies risk management principles to ensure that threats related to shale gas activities are effectively managed in an accurate, balanced, transparent and traceable way. The Recommended Practice focuses on the following aspects: management systems; safety, health, and the environment; well integrity; management of waste, resources, water and energy; infrastructure and logistics; public engagement; stakeholder communication; and permits.

Drohan, P. J., M. Brittingham, J. Bishop, K. Yoder. *Early Trends in Landcover Change and Forest Fragmentation Due to Shale-Gas Development in Pennsylvania: A Potential Outcome for the Northcentral Appalachians*. *Environmental Management* (2012) 49: 1061-1075.

Using Pennsylvania as a proxy for regional development across the Allegheny Plateau, the study examines land cover change due to shale-gas exploration, with emphasis on forest fragmentation. Pennsylvania's shale-gas development is greatest on private land, and is dominated by pads with 1–2 wells; less than 10 % of pads have five wells or more. Approximately 45–62 % of pads occur on agricultural land and 38–54 % in forest land (many in core forest on private land). Development of permits granted as of June 3, 2011, would convert at least 644–1072 ha of agricultural land and 536–894 ha of forest land. Agricultural land conversion suggests that drilling is somewhat competing with food production. Accounting for existing pads and development of all permits would result in at least 649 km of new

road, which, along with pipelines, would fragment forest cover. The Susquehanna River basin (feeding the Chesapeake Bay), is most developed, with 885 pads (26 % in core forest); permit data suggests the basin will experience continued heavy development. The intensity of core forest disturbance, where many headwater streams occur, suggests that such streams should become a focus of aquatic monitoring. Given the intense development on private lands, the authors believe a regional strategy is needed to help guide infrastructure development, so that habitat loss, farmland conversion, and the risk to waterways are better managed.

DG Environment. *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*. Report for European Commission, Ref: ED57281- Issue Number 17c (10/08/2012).

The study on environmental impacts shows that extracting shale gas generally imposes a larger environmental footprint than conventional gas development. Risks of surface and ground water contamination, water resource depletion, air and noise emissions, land take, disturbance to biodiversity and impacts related to traffic are deemed to be high in the case of cumulative projects.

Governor's Marcellus Shale Advisory Commission. *Governor's Marcellus Shale Advisory Commission Report*. Commonwealth of Pennsylvania (July 22, 1011).

Pennsylvania Governor Tom Corbett created the Marcellus Shale Advisory Commission and charged it to identify, prioritize and craft recommendations on the safe, efficient and environmentally responsible extraction and use of unconventional natural gas reserves in Pennsylvania. The Commission undertook a broad review of issues related to Marcellus Shale natural gas development, including examining and recommending efforts to mitigate environmental impacts; fostering efforts to promote market development; developing a trained workforce; enhancing emergency response; identifying and mitigating uncompensated local and community impacts; providing for appropriate public health monitoring and analysis; and the responsible and efficient deployment of infrastructure.

Henderson, Patrick. *Report to the General Assembly on Pipeline Placement of Natural Gas Gathering Lines As Required by Act 13 of 2012*. Commonwealth of Pennsylvania, Office of Governor Tom Corbett (December 11, 2012).

The report from Pennsylvania Governor Tom Corbett's Energy Executive contains recommendations on the placement of gathering lines for natural gas in Pennsylvania, as required by Act 13 of 2012.

International Energy Agency *World Energy Outlook Special Report on Unconventional Gas: Golden Rules for a Golden Age of Gas* (2012).

IEA has developed a set of "Golden Rules", suggesting principles that can allow policymakers, regulators, operators and others to address the environmental and social impacts of natural gas development. IEA called them Golden Rules because

their application can bring a level of environmental performance and public acceptance that can maintain or earn the industry a “social license to operate” within a given jurisdiction, paving the way for the widespread development of unconventional gas resources on a large scale, boosting overall gas supply and making the golden age of gas a reality.

Johnson Nels. *Pennsylvania Energy Impacts Assessment Report 1: Marcellus Shale Natural Gas and Wind*. The Nature Conservancy – Pennsylvania Chapter (November 15, 2010)

The study develops credible energy development projections and assesses how they might affect high priority conservation areas across Pennsylvania. Marcellus natural gas, wind, wood biomass, and associated electric and gas transmission lines were chosen as the focus since these energy types have the most potential to cause land-use change in the state over the next two decades. The conservation impacts focus is on forest, freshwater and rare species habitats. The assessment does not address other potential environmental impacts, including water withdrawal, water quality, air quality and migratory pathways for birds and bats. The assessment also does not address a range of other social, economic, and climate characteristics of these energy types.

Johnson, Nels, Tamara Gagnolet, Rachel Ralls, and Jessica Stevens. *Natural Gas Pipelines: Excerpt from Report 2 of the Pennsylvania Energy Impacts Assessment*. The Nature Conservancy – Pennsylvania Chapter (December 16, 2011)

This assessment looks closely at pipeline development associated with Marcellus gas development in Bradford County, Pennsylvania, to better understand the potential scale and scope of statewide habitat impacts. Pennsylvania’s existing network of large diameter natural gas pipelines (including transport and gathering pipelines) will at least double, and possibly even quadruple, over the next two decades. This expansion will be largely due to a five-to twelve- fold increase in gathering pipeline mileage associated with Marcellus development. The expanding pipeline network could eliminate habitat conditions needed by “interior” forest species on between 360,000 and 900,000 acres as new forest edges are created by pipeline right-of-ways. This is substantially greater than the combined forest interior impacts from all other energy types examined in the *Pennsylvania Energy Impacts Assessment*.

Johnson, Nels, Scott Bearer, Emily Nicholas, Tamara Gagnolet, Michele DePhilip, Tara Moberg. *Evaluating the Scientific Support of Conservation Best Management Practices for Shale Gas Extraction in the Appalachian Basin*. *Environmental Practice* 14:308–319 (2012).

Extensive shale gas development is expected throughout the Appalachian Basin, and implementing effective avoidance and mitigation techniques to reduce ecosystem impacts is essential. Adoption of *best management practices* (BMPs) is an important approach for standardizing these techniques. For BMPs to be credible and effective, they need to be strongly supported by science. The authors focused on 28 BMPs

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Keefer, Matt. *Landscape Planning - Public Lands Perspective*. Resource Planning and Inventory, PA DCNR Bureau of Forestry (April 10, 2012).

A PowerPoint presentation delivered at the 2012 Goddard Forum at Penn State University summarizing PA DCNR's approach to landscape-level planning of natural gas development on state forest lands.

Krupnick, Alan, Hal Gordon, and Sheila Olmstead. Pathways to Dialogue: *What the Experts Say about the Environmental Risks of Shale Gas Development*. Resources for the Future (February 2013).

This report is the first survey-based, statistical analysis of experts in government, industry, universities, and nongovernmental organizations to identify the priority environmental risks related to shale gas development—those for which the experts believe government regulation and/or voluntary industry practices are currently inadequate to protect the public or the environment.

Liroff, Richard. *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations*. Investor Environmental Health Network (IEHN) and the Interfaith Center on Corporate Responsibility (ICCR), (December, 2011).

This document was inspired by energy companies' requests, in dialogues with investors, for enhanced guidance on disclosure of risk management practices. This is Version 1.0, in anticipation of future updates to accommodate technological innovations and regulatory changes.

Royal Dutch Shell. *Shell Onshore Tight Sand/Shale Oil & Gas Operating Principles* (December 28, 2011).

Shell has a set of five aspirational global onshore tight sand/shale oil and gas operating principles that the company believes provides a framework for protecting water, air, wildlife and the communities in which the company operates. Shell aims to have all Shell-operated projects where hydraulic fracturing is used for the development of tight sand/shale oil and gas to adhere to the five principles. As new technologies, challenges and regulatory requirements emerge, Shell plans to periodically review and update these principles.

Secretary of Energy Advisory Board Shale Gas Production Subcommittee. *Ninety-Day Report* (August 11, 2011).

The Shale Gas Subcommittee of the Secretary of Energy Advisory Board is charged with identifying measures that can be taken to reduce the environmental impact and improve the safety of shale gas production. The 90-day report presents recommendations that if implemented will reduce the environmental impacts from shale gas production.

Slonecker, E.T., Milheim, L.E., Roig-Silva, C.M., Malizia, A.R., Marr, D.A., and Fisher, G.B., 2012, *Landscape consequences of natural gas extraction in Bradford and Washington Counties, Pennsylvania, 2004–2010: U.S. Geological Survey Open-File Report 2012–1154* (September, 2012).

This document quantifies the landscape changes and consequences of natural gas extraction for Bradford County and Washington County, Pennsylvania, between 2004 and 2010. Patterns of landscape disturbance related to natural gas extraction activities were collected and digitized using National Agriculture Imagery Program (NAIP) imagery for 2004, 2005/2006, 2008, and 2010. The disturbance patterns were then used to measure changes in land cover and land use using the National Land Cover Database (NLCD) of 2001. A series of landscape metrics is used to quantify these changes and are included in this publication.

United States Department of the Interior, Bureau of Land Management. *Instruction Memorandum No. 2003-152: Application for Permit to Drill (APD) - Process Improvement*. (April 14, 2003).

This Instruction Memorandum provides guidance to Field Offices on the use of comprehensive drilling plan and National Environmental Policy Act (NEPA) analysis strategies to more efficiently and effectively process APDs.

United States Department of the Interior, Bureau of Land Management. *Greater Natural Buttes Record of Decision*. UT-080-07-807 (May 2012).

Kerr-McGee Oil & Gas Onshore LP (KMG), a wholly owned subsidiary of Anadarko Petroleum Corporation, proposed to the USDO I Bureau of Land Management (BLM) Vernal Field Office to conduct infill drilling to develop oil and natural gas resources within the 162,911-acre Greater Natural Buttes Project Area (GNBPA) located in Uintah County, Utah. This Record of Decision (ROD) documents the Secretary's decision to approve the Resource Protection Alternative (identified as the Agency Preferred Alternative in the Greater Natural Buttes Final Environmental Impact Statement [EIS]); The Agency Preferred Alternative meets the BLM's purpose and need, as described in Section 1.3 of the Final EIS, because it will provide for oil and natural gas exploration and development while mitigating impacts on key resources including floodplains, riparian areas, and wetlands; threatened and endangered species; recreation; cultural resources; air quality; and water resources.

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Voser, Peter. *Speech by Chief Executive Officer, Royal Dutch Shell, Peter Voser at the 31st Annual CERAWEEK Executive Conference, Houston, Texas, USA* (March 7, 2012).

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