

## People's Dossier: FERC's Abuse of Power and Law

### → Deficient EIS Analyses

#### **FERC Consistently Approves Pipeline Projects Based on Applications and NEPA Reviews that are Demonstrably Deficient, False and Misleading**

The National Environmental Policy Act (NEPA) (*18 CFR § 380.3(b)(2)*) requires an applicant to supply the information necessary to determine a project's impact on the environment and natural resources. Complete and accurate information is essential for informed decision making, yet FERC consistently approves projects that lack proper NEPA documentation. FERC approves applications that are filled with data gaps, misrepresentations, and inaccurate, false, or even conflicting information. Additionally, FERC approves projects based on information that has been solidly debunked, contradicted, and undermined by expert, agency, and public comment. The NEPA documents upon which FERC bases its pipeline approvals are of such poor quality that they cannot support legitimate or defensible conclusions.

#### **Missing Information Is a Frequent Deficiency in FERC NEPA Documents**

Often, it is the *lack* of information in NEPA documents which is the most egregious. For example, FERC documentation for the PennEast Pipeline Project (*FERC Docket CP15-558*) lacks: detailed locational maps; accurate lists of wetland, waterbody, and/or aquifer crossings; restoration measures and/or impact mitigation; accurate fisheries classifications; accurate information on vegetative cover impacts; accurate and complete information on endangered or threatened species impacts; an accurate list of biological/ecological impacts; fails to consider socioeconomic conditions and the project's impacts thereon; lacks accurate information on geologic hazards; lacks accurate information on existing air quality; etc.<sup>1</sup> This is the case with other proposed pipelines.

#### **FERC NEPA Documents Routinely Rely Upon Inaccurate Information**

The incorrect information supplied by pipeline companies and adopted by FERC often disregards the most basic of environmental impacts. For example:

- When field-truthing just *one half of a mile* of the proposed PennEast Pipeline route, the Delaware Riverkeeper Network found twelve vernal pool complexes and groundwater seeps, where the pipeline company indicated in its materials to FERC that there were only two in the same area.
- PennEast failed to delineate an intermittent stream in another section of the proposed route, despite the fact that the stream was delineated on government mapping.
- Penneast completely left out from its assessment of project impacts any discussion of eight NJ state threatened, endangered, or special concern mussel species that potentially exist along the project route. In addition, the DEIS asserted "there are no private water supply wells or springs located within 150 feet of the pipeline construction workspace in Pennsylvania", which was proven false by ground-truthing efforts.<sup>2</sup>

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<sup>1</sup> Deficient EIS Analysis Attachment 1, Delaware Riverkeeper Network Comment Regarding the PennEast Pipeline DEIS, September 12, 2016.

<sup>2</sup> Deficient EIS Analysis Attachment 1, Delaware Riverkeeper Network Comment Regarding the PennEast Pipeline DEIS, September 12, 2016 and Deficient EIS Analysis Attachment 11, Delaware

### **FERC Routinely Finds No Significant Impact Even When It Has Identified Deficiencies**

Data gaps are often acknowledged by FERC itself, yet the agency approves applications despite this lack of information. For example, FERC identified over thirty data gaps in PennEast's application, the majority of which were substantial, such as the failure to identify working and abandoned mines near waterbody crossings and migratory bird conservation plans. Experts identified and notified FERC of dozens of additional data gaps. Despite these known gaps, FERC issued the DEIS, concluding that while the Project "would result in some adverse environmental impacts...impacts would be reduced to less-than-significant levels..."

### **Induced Drilling Impacts a Frequent Deficiency in FERC NEPA Documents**

FERC's cumulative impact analyses for pipelines frequently mischaracterize the degree of harm that will result from the project by ignoring reasonably foreseeable future actions. Natural gas production and its subsequent impacts are among the cumulative effects that FERC must consider under NEPA when determining whether an action will have a significant impact. A pipeline's capacity will necessarily lead to additional consumption of natural gas, with consequences for its price, production, and use – these are direct, indirect and clearly foreseeable outcomes, yet FERC fails to consider them. For example, FERC ignored that the PennEast pipeline will likely induce the drilling of 3,000 new wells in Northeast Pennsylvania, Bradford, Susquehanna, Lycoming, and Tioga counties.<sup>3</sup> FERC fails to address these future actions even when the applicants themselves state that more wells will be drilled to feed the proposal pipeline project.<sup>4</sup> Read More in [People's Dossier: Drilling Impacts & Climate Change Ignored](#).

### **Economic Harms & Benefits Routinely Misrepresented in FERC NEPA Documents**

FERC routinely fails to independently verify a pipeline company's assertions of economic benefits, and ignores expert evidence to the contrary. FERC fails to consider the economic harms proposed projects will inflict such as reduced crop production for farmers, adverse impacts to businesses along or near the pipeline right of way, the implications for ecotourism and related businesses and jobs, etc.<sup>5</sup> Read More in [People's Dossier: Economic Harms](#).

Relatedly, FERC uniformly accepts industry assertions that property values are not harmed by pipeline rights of way or by location within the blast radius or evacuation zone of a pipeline, despite significant evidence to the contrary.<sup>6</sup> Reduced property values also reduce the property taxes that can be collected by local governments. For example:

→ An analysis by Key-Log Economics determined that construction of the PennEast

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Riverkeeper Network, Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, September 2016.

<sup>3</sup> Deficient EIS Analysis Attachment 1, Delaware Riverkeeper Network Comment Regarding the PennEast Pipeline DEIS, September 12, 2016.

<sup>4</sup> Deficient EIS Analysis Attachment 14, *Mountain Valley Pipeline DEIS at 3-1*, Docket No. CP 16-10 ("According to Mountain Valley, the MVP would alleviate some of the constraints on...natural gas production").

<sup>5</sup> Deficient EIS Analysis Attachment 2, Key-Log Economics, Economic Costs of the Mountain Valley Pipeline, May 2016 and Deficient EIS Analysis Attachment 3, Key-Log Economics, Economic Costs of the PennEast Pipeline, January 2017.

<sup>6</sup> Deficient EIS Analysis Attachment 15, Key-Log Economics, Memo on effects of pipelines on property values, March 11, 2015.

pipeline would result in a loss of \$158.3 to \$176.0 million in property value in the right of way and evacuation zone.<sup>7</sup>

- For the Mountain Valley Pipeline, projected property value losses result in a loss of \$42.2 to \$53.3 million in property tax revenue annually.<sup>8</sup>
- In fact, in Hancock, New York, “three homeowners have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station” that was proposed as part of the project.<sup>9</sup>

Economic losses resulting from pipelines can be dramatic, and far outweigh the claimed public benefits of the pipeline companies; for example, expert review determined that the PennEast Pipeline could result in as much as \$56.6 billion in total economic harm. By comparison, the company claimed only \$2.3 billion in economic benefit over a 30 year period. Similar findings have been documented for the Mountain Valley Pipeline, the Atlantic Coast Pipeline and the Millennium Eastern System Upgrade Project. In every instance, FERC ignored detailed reports demonstrating economic harm while accepting industry assertions describing only benefits. Attachment 13 includes four summaries of economic harm for pipeline projects including the PennEast Pipeline Project, the Mountain Valley Pipeline Project, the Millennium Eastern System Upgrade Project and the Atlantic Coast Pipeline Project outlining the significance of economic harms that are routinely ignored by FERC.<sup>10</sup>

### **Health Harms Routinely Ignored in FERC NEPA Documents**

FERC NEPA analyses consistently fail to fully assess health impacts of proposed pipelines. For example, those living near compressor stations and other natural gas facilities often suffer from asthma, nosebleeds, dizziness, weakness, and rashes. Some residents are forced to sell or abandon their homes because of these health impacts—however, FERC turns a blind eye to these well-documented issues when assessing a natural gas project.

Proximity to compressor stations inflicts various harms; impacts can be severe, with at least one documented case of a family forced to abandon their \$250,000 home rather than continue to suffer the health, safety, and other harms they were experiencing.<sup>11</sup> People and experts have urged FERC to adequately consider health impacts during NEPA review, including the

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<sup>7</sup> Deficient EIS Analysis Attachment 3, Key-Log Economics, Economic Costs of the PennEast Pipeline, January 2017.

<sup>8</sup> Deficient EIS Analysis Attachment 2, Key-Log Economics, Economic Costs of the Mountain Valley Pipeline, May 2016.

<sup>9</sup> Deficient EIS Analysis Attachment 4, Catskill Citizens for Safe Energy, press release, “Proximity of Compressor Station Devalues Homes by as Much as 50%”, July 7, 2015 and Deficient EIS Analysis Attachment 5, Letter from Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis, September 9, 2016.

<sup>10</sup> Deficient EIS Analysis Attachment 13, Key-Log Economics, Four Summaries of Economic Harm (PennEast Pipeline Project, the Mountain Valley Pipeline Project, the Millennium Eastern System Upgrade Project and the Atlantic Coast Pipeline Project). Attachments 2, 3, and 12 include the full analyses for each project.

<sup>11</sup> Deficient EIS Analysis Attachment 6, Jessica Cohen, *House Abandoned Because of Minisink Compressor Station -- Family Walks Away from \$250,000*, The River Reporter November 24, 2015.

establishment of baseline air quality, and FERC routinely refuses.<sup>12</sup>

### **Harms to Historic Resources Routinely Ignored in FERC NEPA Documents**

Historic and cultural resources are also among the impacts routinely ignored by FERC. For example, the Atlantic Coast Pipeline was found to have no impact on cultural resources, despite the fact that its proposed route slices through the "Most Endangered Historic Place" in Virginia, as found by Preservation Virginia.<sup>13</sup>

The public that has been forced through the FERC process with regards to infrastructure review and approvals has, almost uniformly, the same experience -- deficient EIS/EA documentation, lack of fair access to FERC or to be heard through the NEPA process, the undermining of legal rights and opportunities upon completion of the process.<sup>14</sup>

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#### **Attachments:**

Deficient EIS Analysis Attachment 1, Delaware Riverkeeper Network Comment Regarding the PennEast Pipeline DEIS, September 12, 2016.

Deficient EIS Analysis Attachment 2, Key-Log Economics, Economic Costs of the Mountain Valley Pipeline, May 2016.

Deficient EIS Analysis Attachment 3, Key-Log Economics, Economic Costs of the PennEast Pipeline, January 2017.

Deficient EIS Analysis Attachment 4, Catskill Citizens for Safe Energy, press release, "Proximity of Compressor Station Devalues Homes by as Much as 50%", July 7, 2015.

Deficient EIS Analysis Attachment 5, Letter from Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis, September 9, 2016.

Deficient EIS Analysis Attachment 6, Jessica Cohen, *House Abandoned Because of Minisink Compressor Station -- Family Walks Away from \$250,000*, The River Reporter November 24, 2015.

Deficient EIS Analysis Attachment 7, Neighbors Oppose Wawayanda Gas Plant; Health Concerns Top the List, July 31, 2015.

Deficient EIS Analysis Attachment 8, NH Pipeline Committee Letter to Secretary Bose, January

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<sup>12</sup> Deficient EIS Analysis Attachment 7, Neighbors Oppose Wawayanda Gas Plant; Health Concerns Top the List, July 31, 2015; Deficient EIS Analysis Attachment 8, NH Pipeline Committee Letter to Secretary Bose, January 14, 2016; and Deficient EIS Analysis Attachment 9, Times Union, *Bethlehem Lawmakers Oppose Natural Gas Pipeline*, February 11, 2016.

<sup>13</sup> Deficient EIS Analysis Attachment 10, Union Hill/Woods Corner Rural Historic District Comments on Docket No. CP15-554, June 2, 2016.

<sup>14</sup> See, for example, Deficient EIS Analysis Attachment 16, Letter from Pipeline Awareness Southern Oregon to Maya van Rossum, the Delaware Riverkeeper, February 4, 2016; and consider the testimony available at [www.PeoplesHearing.org](http://www.PeoplesHearing.org).

14, 2016.

Deficient EIS Analysis Attachment 9, Times Union, *Bethlehem Lawmakers Oppose Natural Gas Pipeline*, February 11, 2016.

Deficient EIS Analysis Attachment 10, Union Hill/Woods Corner Rural Historic District Comments on Docket No. CP15-554, June 2, 2016.

Deficient EIS Analysis Attachment 11, Delaware Riverkeeper Network, Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, September 2016.

Deficient EIS Analysis Attachment 12, Key-Log Economics, Economic Costs of the Atlantic Coast Pipeline, February 2016.

Deficient EIS Analysis Attachment 13, Key-Log Economics, Four Summaries of Economic Harm (PennEast Pipeline Project, the Mountain Valley Pipeline Project, the Millennium Eastern System Upgrade Project and the Atlantic Coast Pipeline Project).

Deficient EIS Analysis Attachment 14, Mountain Valley Pipeline DEIS at 3-1, Docket No. CP 16-10.

Deficient EIS Analysis Attachment 15, Key-Log Economics, Memo on effects of pipelines on property values, March 11, 2015.

Deficient EIS Analysis Attachment 16, Letter from Pipeline Awareness Southern Oregon to Maya van Rossum, the Delaware Riverkeeper, February 4, 2016.

***Complete People's Dossier: FERC's Abuses of Power and Law***

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→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 1, Delaware  
Riverkeeper Network Comment Regarding the PennEast  
Pipeline DEIS, September 12, 2016.**



September 12, 2016

Kimberly Bose, Secretary  
Nathaniel J. Davis, Sr., Deputy Secretary  
Federal Energy Regulatory Commission  
888 First Street NE, Room 1A  
Washington, DC 20426

RE: OEP/DG2E/Gas 2  
PennEast Pipeline Company, LLC  
FERC Docket No. CP15558000  
FERC/EIS0271D

Secretary Bose:

On Friday, July 22, 2016, the Federal Energy Regulatory Commission (FERC) issued a Draft Environmental Impact Statement (DEIS) for the PennEast Pipeline project that is 1,174 pages long giving September 5, 2016 as the deadline for comments (only changing the deadline to September 12, 2016 partway through the comment cycle).

A 45-52 day comment period, most of which fell during the end of July and the month of August, which is among the highest vacation times in our region, displays an offensive and unnecessary abuse of power clearly designed to serve the goals of the PennEast Pipeline Company to get a quick answer rather than showing fairness to the people who want and need to comment on the PennEast Pipeline proposal because they are going to be deeply and irreparably harmed.

FERC owes the communities at least (at the very least) a full 120 days (an additional 68 days) to review the information and maps provided by PennEast. In order to provide informed comment not only do people need to review the voluminous DEIS, but we need to assess the information and data behind it, verify the information asserted, identify any potential data gaps that exist, and engage the experts necessary to provide the detailed comprehensive review that a project of this size needs and deserves. To even suggest 45 days (52 with the extra week FERC was forced to provide given that originally the comment period ended on a federal holiday) is a significant insult to those who want to meaningfully participate and have their voices heard, but also demonstrates to our communities that FERC lifts the needs of the pipeline industry over those directly impacted by the proposed Project.

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The DEIS, states that the PennEast Pipeline involves:

- 115.1 miles 36-inch diameter pipeline from Luzerne County, PA to Mercer County, NJ
- 2.1 mile Hellertown lateral, a 12 inch diameter pipe in Northampton County, PA
- 0.1 mile Gilbert lateral, a 12 inch diameter pipe in Hunterdon County, NJ
- 1.5 mile Lambertville lateral, a 36 inch diameter pipe in Hunterdon County, NJ
- 47,700 horsepower compressor station in Kidder Township, Carbon County, PA driven by 3 gas powered Solar Mars 100 units rated at 15,900 hp each
- 8 meter and regulator stations for interconnects
- 11 mainline valve sites
- 4 pig launcher/receiver sites

According to the DEIS, construction of the project will impact 1,613.5 acres of land (1,065.2 acres for pipeline facilities, 110.1 acres for access roads; 372.3 acres for pipe and contractor ware yards, 31.1 acres for above ground facilities). According to the DEIS the project will at least cut through 255 waterbodies (including 159 perennial, 45 intermittent, 40 ephemeral, 11 open water), 633 acres of forest, 91 acres of wetlands, impact “several” vernal pools, and infringe upon and damage habitat for threatened and endangered species of bat, sturgeon, snake, turtle, mussels and more. This comment and others will prove that these impacts are sorely understated, incomplete, and misrepresent the footprint and damage that would be inflicted if the PennEast pipeline were built.

This comment, along with others, demonstrates that the DEIS issued by FERC cannot be said to fulfill its legal obligations pursuant to the National Environmental Policy Act (NEPA), that a new or supplemental Complete DEIS with associated comment period and public hearings is required, and that absent taking such a step FERC will be in violation of the law. Specifically, the DEIS fails establish an accurate baseline from which a determination can be made regarding the significance of the impacts resulting from construction and operational activity of the Project, the DEIS fails to examine the cumulative and induced development that would result from the approval of the Project, the DEIS improperly segments its environmental analysis with regard to other interdependent projects, the DEIS does not sufficiently account for climate change impacts, the DEIS’s alternatives analysis is unlawfully narrow, and the DEIS fails to sufficiently establish need for the Project. Additional deficiencies are noted throughout this comment letter, and the attached expert reports.

Given the lack of need, the self-serving interests of the PennEast companies (AGL Resources; NJR Pipeline Company; PSEG Power; SJI Midstream; Spectra Energy Partners; UGI Energy Services) to advance this project, the high level of environmental, community and economic harm that will be inflicted, the use of eminent domain purely for private gain, the threat and harms to the health, safety and natural resources of the communities impacted as well as to future generations, this project cannot be said to meet the standards for FERC to issue a Certificate of Public Convenience and Necessity.

**The DEIS is unable to support its conclusion that construction of PennEast as proposed by the company and FERC will not have significant adverse environmental impacts**

FERC asserts in its DEIS:

“We determined that construction and operation of the PennEast Project would result in some adverse environmental impacts. Most of these impacts would be temporary or short-term during construction and operation, but long-term and potentially

permanent environmental impacts on vegetation, wetlands, and individual fish and wildlife species would also occur as part of the Project. However, if the Project is constructed and operated in accordance with applicable laws and regulations, the mitigating measures discussed in this EIS, and our recommendations, most of the adverse impacts would be reduced to less than significant levels.”

While FERC argues that it used information from outside sources to reach this conclusion, it is clear on the record that FERC adopted, whole cloth, PennEast Company’s information, filings, characterizations, language, assertions, information and conclusions. FERC did not conduct the kind of independent, rigorous review anticipated or mandated by NEPA.

NEPA is our “basic national charter for protection of the environment.” 40 C.F.R. § 1500.1(a). As such, it makes environmental protection a part of the mandate of every federal agency. *See* 42 U.S.C. § 4332(1). NEPA requires that federal agencies take environmental considerations into account in their decision-making “to the fullest extent possible.” 42 U.S.C. § 4332. Federal agencies must consider environmental harms and the means of preventing them in a “detailed statement” before approving any “major federal action significantly affecting the quality of the human environment.” *Id.* § 4332(2)(C). When preparing an Environmental Impact Statement (EIS), an agency must take a detailed, “hard look” at the environmental impact of and alternatives to the proposed action. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989). This required analysis serves to ensure that “the agency will not act on incomplete information, only to regret its decision after it is too late to correct.” *Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 371 (1979).

NEPA also “guarantees that the relevant information [concerning environmental impacts] will be made available to the larger audience,” including the public, “that may also play a role in the decision-making process and the implementation of the decision.” *Robertson*, 490 U.S. at 349. As NEPA’s implementing regulations explicitly provide, “public scrutiny [is] essential to implementing NEPA.” 40 C.F.R. § 1500.1(b). The opportunity for public participation guaranteed by NEPA ensures that agencies will not take final action until after their analysis of the environmental impacts of their proposed actions has been subject to public scrutiny. *See N. Plains Res. Council v. Surface Transp. Bd.*, 668 F.3d 1067, 1085 (9th Cir. 2011) (noting that where “data is not available during the EIS process and is not available to the public for comment,” the process “cannot serve its larger informational role, and the public is deprived of their opportunity to play a role in the decision-making process”) (quoting *Robertson*, 490 U.S. at 349).

An EIS must fully assess and disclose the complete range of environmental consequences of the proposed action, including “ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, [and] cultural” impacts, “whether direct, indirect, or cumulative.” 40 C.F.R. §§ 1502.16(a), (b); 1508.8. Direct effects are “caused by the action and occur at the same time and place.” 40 C.F.R. § 1508.8(a). Indirect effects are those impacts that are caused by the action, but occur “later in time or farther removed in distance, but are still reasonably foreseeable,” and may include “growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.” 40 C.F.R. § 1508.8. Cumulative impacts are “impact[s] on the environment which result[] from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.” 40 C.F.R. § 1508.7 (emphasis added). As the regulations make clear, “[c]umulative impacts can result from individually

minor but collectively significant actions taking place over a period of time.” *Id.* In addition, NEPA requires FERC to take a hard look at the ways to avoid or mitigate the Projects’ impacts.

NEPA is an “environmental full disclosure law.” *Monroe Cnty. Conservation Council, Inc. v. Volpe*, 472 F.2d 693, 697 (2d Cir. 1972). It requires that an agency obtain and consider detailed information concerning environmental impacts, and it “ensures that an agency will not act on incomplete information, at least in part, by ensuring that the public will be able to analyze and comment on an action’s environmental implications.” *Ohio Valley Envtl. Coal. v. U.S. Army Corps of Eng’rs*, 674 F. Supp. 2d 783, 792 (S.D. W. Va. 2009) (internal quotation marks and citations omitted). The information provided to the public “must be of high quality” because “[a]ccurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA.” 40 C.F.R. § 1500.1(b). The potential adverse effects of the PennEast Project cannot be adequately analyzed without complete data on all affected resources. However, as described below the DEIS falls short in a significant number of areas.

As evidenced by this comment and the attached expert reports, the DEIS does not contain the complete or accurate information required to reach this asserted conclusion, or any meaningful conclusion for that matter. The DEIS is filled with key data gaps, misrepresentations, misinformation, missing information, inaccurate information, false information, and conflicting information and is likewise based on submissions from PennEast that are filled with data gaps, misrepresentations, misinformation, missing information, inaccurate information, false information, and conflicting information. The quality of the DEIS is so poor that it cannot support any conclusion whatsoever, other than there is a need for a supplemental DEIS that is subject to the rigors of the public process prior to advancement to the final EIS stage.

In addition, it is clear that this DEIS cannot be relied upon by any government agency, not FERC, not the US Fish & Wildlife Service, not the U.S. Army Corps of Engineers, not the U.S. Environmental Protection Agency, not the NJ Department of Environmental Protection, not the PA Department of Environmental Protection, not the Delaware River Basin Commission for evaluation or decision-making purposes. And for any agency to do so would subject them to successful legal challenge.

In addition to the immense deficiencies and inaccuracies in the FERC DEIS, it is unbelievable that FERC determines the PennEast Pipeline will not have a significant impact on the environment and communities, with or without the mitigation FERC postures given the reality of the harms to be inflicted which include, by way of a short list:

- The PennEast pipeline will likely induce the drilling of 3,000 new wells in Pennsylvania (from a combination of wells that have been drilled but are not yet producing and wells not yet drilled) in Northeast Pennsylvania, in Bradford, Susquehanna, Lycoming, and Tioga counties. The DEIS ignores analysis of the resulting impacts. (See discussion below)
- The DEIS fails to properly respond to the Counsel on Environmental Quality’s new guidance regarding consideration of the greenhouse gas emissions of the proposed PennEast pipeline project and its climate changing ramifications. (See discussion below)
- In Carbon County, 560 people live within 2 miles of the proposed compressor station. From existing experience we can anticipate “504 people experiencing odor events, 398 people

experiencing respiratory impacts, 325 people experiencing sinus problems, and 218 people experiencing sleep disturbances and/or severe headaches.”<sup>1</sup>

- “PennEast, LLC estimates the pipeline would transport 401,500,000 dekatherms annually, contributing to an equivalent of 20.1 metric tons of CO<sub>2</sub> emitted per year (U.S. EPA, 2016a). Using the most conservative estimate of the cost per metric ton of carbon (U.S. EPA, 2016b), the additional emission of CO<sub>2</sub> would cost \$252.4 million annually.”<sup>2</sup>
- Using “conservative assumptions, the Kidder compressor station would reduce the value of 43 properties by a total of \$1.9 million dollars.”<sup>3</sup>
- While the DEIS considers all presumed benefits advanced by PennEast, it ignores the economic damage inflicted to public health, property values, jobs, businesses and from the loss of ecosystem services.<sup>4</sup>
- While 75% of the stream crossings will be undertaken using open cut methods, only 26% of the 189 road crossings will be open cut with horizontal directional drilling used to avoid impacts on 74% of the roadways crossed – demonstrating that both FERC and PennEast place a higher priority on avoiding disturbance of roadways than protecting streams, including streams of the highest quality in Pennsylvania and New Jersey.<sup>5</sup>
- The single largest land use to be disturbed in Pennsylvania is forest -- 59% of the pipeline length in Pennsylvania.<sup>6</sup>
- The PennEast pipeline would cause an initial loss of \$7.3 million in ecosystem services during a one year construction period. For each year the pipeline is in operation, the pipeline would induce an additional loss of \$2.4 million in ecosystem services due to conversion of land in the ROW. Land converted for use as permanent pipeline related infrastructure would mean an

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<sup>1</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>2</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>3</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>4</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>5</sup> Adams, Michelle and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

<sup>6</sup> Adams, Michelle, and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

additional loss of \$218,200 each year. Such losses are not accounted for in the DEIS or FERC's balancing of the economic costs of the project.<sup>7</sup>

- Key-Log Economics estimates that construction of the PennEast pipeline would result in a loss of \$158.3 to \$176.0 million in property value in the right of way and evacuation zone.<sup>8</sup>
- 44 dry stream crossings will impact Conservation Areas and Public Lands, and 14 dry stream crossings will impact areas held in private conservation easement.<sup>9</sup>
- Shallow bedrock is a common feature along 33 miles and 302 sections of the route that likely would require blasting (Table G-3) - 69% of Hunterdon Co., 35% of Northampton Co., 28% of Carbon Co., 25% of Luzerne County, and 23% of Mercer County have shallow bedrock.
- Spot checks and field-truthing indicate inadequate and incomplete mapping of sensitive wetlands along the proposed ROW. Along one 0.5 mile of the proposed route in sensitive State Gamelands, at least 12 vernal pool complexes or groundwater seeps were identified while PennEast tables only indicate 2 vernal pool habitats along the same proposed route and no groundwater seeps.<sup>10</sup>
- At least 43 waterbody crossings have steep slopes that would be cut by the pipeline. These 43 crossings are proposed to have additional temporary work spaces (ATWS) within 50 ft. of sensitive water features, adding to the potential erosion threats to these steep banks and the nearby sensitive streams where sediment pollution can cause long term harm.<sup>11</sup>
- "Pennsylvania was already grossly over-supplied and that the proposed additional 1 Bcf/d supply would result in an over-supply for New Jersey of approximately 53%," and there is no evidence that PennEast will result in lowered costs for consumers.<sup>12</sup>
- A total of 8 NJ state threatened, endangered, or special concern mussel species are completely left out of the EIS. These species are as follows: triangle floater (threatened), brook floater (endangered), yellow lampmussel (threatened), eastern lampmussel (threatened), green floater (endangered), tidewater mucket (threatened), eastern pondmussel (threatened), and creeper (species of special concern). All eight of these species may potentially occur in various

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<sup>7</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>8</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>9</sup> Adams, Michelle, and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

<sup>10</sup> Delaware Riverkeeper Network. *Field-Truthing and Monitoring of the Proposed PennEast Pipeline*, FERC Draft EIS, Docket No. CP15-558, September 2016.

<sup>11</sup> Delaware Riverkeeper Network. *Field-Truthing and Monitoring of the Proposed PennEast Pipeline*, FERC Draft EIS, Docket No. CP15-558, September 2016.

<sup>12</sup> Berman, Arthur. *Professional Opinion on the PennEast Pipeline*, Labrynth Consulting Services, Inc. February 2015 and September 11, 2016.

waterbodies crossed by the project, based on the GIS range maps created by the Conserve Wildlife Foundation of New Jersey

- “Pennsylvania was already grossly over-supplied and that the proposed additional 1 Bcf/d supply would result in an over-supply for New Jersey of approximately 53%,” and there is no evidence that PennEast will result in lowered costs for consumers.<sup>13</sup>
- “72% of the proposed pipeline alignment in New Jersey and 23% in Pennsylvania has not yet been field investigated for wetlands and other water resources.”<sup>14</sup>
- Investigation is incomplete for vernal pools; in Pennsylvania, survey work is 21% **incomplete**; in New Jersey, it is 74% **incomplete**.
- FERC's statement that "there are no private water supply wells or springs located within 150 feet of the pipeline construction workspace in Pennsylvania" (DEIS, page ES-5) is false. Delaware Riverkeeper Network experts have “identified properties and specific landowners in Pennsylvania where there are (confirmed), or where there are likely to be, springs or drinking water wells located within 150 feet of the proposed pipeline construction workspace.”

The information that has been garnered from the DEIS materials, the filed resource reports, filings with other regulatory agencies, that were then vetted, analyzed and in some cases field verified by third party experts and DRN demonstrates that this project will inflict substantial adverse environmental and community impacts regardless of implementation of the supposed mitigation recommended by FERC. In addition to the comments specifically discussed here, the expert reports filed herewith include a number of other factual and legal deficiencies that are adopted by DRN and incorporated by reference.

**DEIS assertion of need is contradicted by the preponderance of the evidence and is largely a statement of industry desires rather than public need**

The DEIS asserts the proposed pipeline is necessary to serve New Jersey and eastern Pennsylvania communities and some unidentified “surrounding states”. It is asserted that the project is needed to “provide low cost natural gas produced from the Marcellus Shale region”. The DEIS asserts that there is a need to displace Gulf Coast gas with cheaper and reliable access to Marcellus shale gas. It is asserted that there is a need for the project in order to “provide enhanced competition among natural gas suppliers and pipeline transportation providers.” The DEIS asserts there is a need in order to allow “supply flexibility”, “diversity”, “reliability”, better pricing, and to allow direct access to long lived dry gas reserves.

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<sup>13</sup> Berman, Arthur. *Professional Opinion on the PennEast Pipeline*, Labrynth Consulting Services, Inc. February 2015 and September 11, 2016; Berman, Arthur. *PennEast Updated Opinion*, September 11, 2016.

<sup>14</sup> *The Effects of the Proposed PennEast Pipeline on Exceptional Value Wetlands in Pennsylvania*, Prepared for the Delaware Riverkeeper Network, Schmid and Company, July 2016; Letter dated September 9, 2016 written by Schmid & Company, Consulting Ecologists to Maya K. van Rossum, the Delaware Riverkeeper.

However, none of these are “needs”. These are industry desires, goals, hopes, dreams, wishes and wants. However you look at it, these claims do not assert a “need” for the gas. They assert a desire by the pipeline company to be able to provide a different source of gas so it can make money. These are very clearly private corporate goals and gains. These are not “needs” of the public; they are desires of private industry.

In fact, there is no need for the gas PennEast would carry to New Jersey and Pennsylvania; both states are fully supplied. And to the degree that PennEast wants to assert it is delivering the gas to other unknown, unidentified states -- in order to substantiate this claim and subject it to the public process that is required by NEPA, more detail is required that actually identifies the states and the users.

As noted in the attached expert report from Arthur Berman<sup>15</sup>:

“Natural gas consumption for New Jersey has been relatively flat for the past four years at average rate of 1.8 billion cubic feet of gas per day (Bcf/d), somewhat below the higher levels of the late 1990s. Although consumption increased slightly in 2013 compared to the three previous years, New Jersey cannot be called a growth market....”

“The proposed PennEast Pipeline would deliver an additional 1 Bcf/d of natural gas to New Jersey potentially creating a 53% supply surplus above the current level of consumption.” and “...Pennsylvania has no unfulfilled demand...”

“Because of the lack of demand for Marcellus gas in Pennsylvania and adjacent New Jersey, it is possible that PennEast and its committed suppliers have an unstated intent to send gas to other markets not specified in their proposal....”

“There is no evidence...that more gas supply [would] result[] in lower costs to consumers” “All leading companies in the Marcellus and Utica plays reported net losses for the second quarter of 2015”.

A second report issued by Arthur Berman further clarifies that<sup>16</sup>:

“There is no evidence...that more gas supply [would] result[] in lower costs to consumers”

“All leading companies in the Marcellus and Utica plays reported net losses for the second quarter of 2015”

“U.S. gas production is declining and shale gas output is down almost 2.5 Bcf per day”

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<sup>15</sup> Berman, Arthur, *Professional Opinion of Proposed PennEast Pipeline Project*, Petroleum Geologist, Labyrinth Consulting Services, Inc., February 26, 2015

<sup>16</sup> Berman, Arthur, *PennEast Opinion Updated*, Petroleum Geologist, Labyrinth Consulting Services, Inc., September 11, 2016

An additional expert report generated by Skipping Stone (already on the record but also attached) similarly finds a lack of need for the capacity of PennEast. According to this report, PennEast obtains many of its clients by commitments to switch from one pipeline to the other, which means unfilled excess capacity, not more needed gas delivered. According to Skipping Stone, similar to Labyrinth Consulting:<sup>17</sup>

“Local gas distribution companies in the Eastern Pennsylvania and New Jersey market have more than enough firm capacity to meet the needs of customers during peak winter periods. Our analysis shows there is currently *49.9% more capacity than needed to meet even the harsh winter experienced in 2013*”

This demonstration of a lack of need is complimented by the predictions and concerns of experts that the industry is proposing an “overbuild” of pipelines from the Marcellus and Utica shales:<sup>18</sup>

“Speaking to attendees at the 21st Annual LDC Gas Forums Northeast conference in Boston Tuesday, Braziel said an evaluation of price and production scenarios through 2021 suggests the industry is planning too many pipelines to relieve the region’s current capacity constraints.”

“What we’re really seeing is the tail end of a bubble, and what’s actually happened is that bubble attracted billions of dollars’ worth of infrastructure investment that now has to be worked off,” Braziel said.

Lack of “need” for gas in Pennsylvania is also asserted by a Labrynth Consulting reaction to a recently released report advocating for more pipelines for similar goals, to fulfill an asserted need for gas and to reduce prices in the region. In this responsive analysis the assertion of a need for the gas was proven false with facts:

“First, Pennsylvania exported 3.23 Bcfd to other regions of the country in 2015 an amount almost equal to its 2014 consumption of 3.3 Bcfd. There is plenty of existing pipeline capacity to meet Pennsylvania’s demand and enough left over to send out of the state.”<sup>19</sup>

The assertion that PennEast is intended to provide “enhanced competition” and cheaper pricing for industry users is not a need – it is a corporate desire, but it is not a need. It is an abuse of process and power for FERC to allow PennEast to claim that cheaper prices and setting the PennEast companies up to better compete with other industries fulfills the requirement of “need”. Approving construction of a pipeline project, granting it exemption from state and local laws, giving it the power of eminent domain, so it can take private property, so it can take publicly preserved parks, forests and natural lands, in order to inflict un-mitigatable and irreparable harms, all so the pipeline company can achieve its independent goal of greater profits and other industries can save a buck on the backs of the rest of us, subjecting communities to the threat and reality of pipeline accidents, incidents and

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<sup>17</sup> *Analysis of Public Benefit Regarding PennEast*, Skipping Stone, March 9, 2016

<sup>18</sup> *Marcellus/Utica on Pace for Pipeline Overbuild*, Says Braziel, Natural Gas Intelligence, June 8, 2016

<sup>19</sup> Labrynth Consulting responding to “A Pipeline For Growth Report”

explosions (which happen with concerning regularity) does not characterize a legitimate need that warrants the property takings and associated harms.

The assertion that PennEast is necessary to provide greater reliability is also not a “need”. There is no evidence that New Jersey, Pennsylvania, and the undisclosed other states do not have reliable access to energy sources, gas or otherwise. The reports above document that in fact both states are already fully and reliably served. It is incumbent upon PennEast to demonstrate there is a reliability problem, and that the proposed project will necessarily ameliorate this problem. They have not done so.

Regarding the claim that PennEast is “needed” to provide direct access to long lived reserves, this claim is neither explored nor demonstrated by the DEIS document. In fact, there is a wealth of analysis which documents that shale gas will soon be on a swift decline and as such is not in fact a long term reliable source of energy; to the contrary it is a short term fix that will quickly run dry and require replacement with other energy sources. As the Post Carbon Institute’s *Drilling Deeper* report fully documents, the shale gas and tight oil industries have a short life, one that is only a few decades long.<sup>20</sup> Multiple experts reach similar conclusions when reflecting on EIA figures, current production rates, and other objective data, e.g. findings of Labrynth consulting when reacting to a recently released report titled, “A Pipeline For Growth” found:

Official EIA proven developed producing shale gas reserves for the Marcellus Shale are 84.5 trillion cubic feet (Tcf) and, for the Utica Shale, 6.4 Tcf (Table 1). That suggests approximately 18 years of supply at current production rates. There are approximately 27 years of supply including proven undeveloped reserves (PUD).<sup>21</sup>

Construction of a 40 year pipeline for an energy source that will peak by 2020 and be on decline thereafter is irrational and cannot be said to fulfill the definition of a “need”.

The claim that this pipeline is “needed” in order to provide lower cost gas to New Jersey and Pennsylvania customers is not a “need” (as discussed above and in the attached expert reports) but in addition, it cannot be an expected outcome of this project. The construction of the PennEast pipeline may, to the contrary, contribute to an increase in gas prices for many in PennEast’s identified service area.

Natural gas prices are lowest in the regions in which gas is produced. For many years, the lowest natural gas prices in the East were found at Henry Hub, located near the Gulf of Mexico where much of the natural gas in the United States was produced. With the increase in shale gas production, however, the lowest natural gas prices in the country are now found at trading points in and around the Marcellus and Utica shale plays in Pennsylvania, West Virginia, and Ohio. Availability of pipeline infrastructure to send natural gas to other regions has a direct impact on the price of natural gas in those regions—greater gas take-away capacity allows more natural gas to be produced, and an increase in supply will lead to a decline in price in those regions that receive additional gas. The improved access to higher priced markets via additional pipeline infrastructure will raise the price of natural gas in the producing region, which also will increase production – in this case the producing region is Pennsylvania, therefore it is not a given that prices would in fact reduce. In addition, while

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<sup>20</sup> <http://www.postcarbon.org/publications/drillingdeeper/>

<sup>21</sup> Labrynth Consulting responding to “A Pipeline For Growth Report”

generally speaking increasing the supply in a nonproducing region (such as NJ) from a lower cost producing region (Pennsylvania) may be expected to lower prices in the downstream market, one recent study that was specific to the PennEast Pipeline showed how gas rates for some customers in NJ may increase due to other pipelines increasing their transportation rates.<sup>22</sup>

The claim that increased pipeline capacity will necessarily result in reduced gas prices is challenged by other experts considering the issue when responding to claims that pipeline capacity is needed to reduce prices for Eastern Pennsylvania end users:

“The correlation between volume of gas production and the price of gas for power generation is poor because there are other factors besides production volume that affect the price of gas. Still it seems unlikely that more gas production in Pennsylvania would result in a cost reduction since production already exceeds consumption by almost 100%.”<sup>23</sup>

Further, as information regarding actual asserted customers for PennEast is revealed, it is increasingly clear that the claim of need is largely self-manufactured. For example, Spectra Energy Partners is a “member company” in PennEast Pipeline Company, LLC and 10% owner of the PennEast Pipeline proposal. Spectra Energy is currently planning for and proposing a new project called the Texas Eastern Marcellus to Market project (M2M). Spectra has made clear that the proposed PennEast pipeline will be the primary source of gas that the M2M project will transport. Specifically, according to the Spectra Energy website, the new M2M pipeline would receive the majority of its gas, 62.5%, (up to 125,000 dekatherms per day (Dth/d)) from the PennEast pipeline (this equates to over 11% of PennEast’s anticipated capacity). In other words, Spectra, as part of PennEast, is asserting the PennEast pipeline needs to be built in order to service the Texas Eastern M2M customer which is, in fact, Spectra. The end users of the M2M project are not identified in the DEIS or anywhere else in the record, and have not, in fact, demonstrated a need for that project. Again we are dealing with self-serving speculation of need rather than a demonstration of a genuine public need for the project. Of the 12 shippers PennEast identifies as demonstrating a need for the pipeline and thereby helping to game the system in this way, at least five are PennEast owners: PSEG, Spectra (Texas Eastern Transmission), South Jersey Gas, UGI, and Elizabethtown Gas (Pivotal Utility Holdings).

Making the artificial argument of “need” for the PennEast project is used to craft an artificial justification for imposing extreme and unnecessary harm on the environment and communities. The asserted “need” for PennEast is really an argument for a project that will allow the PennEast companies to achieve their private goals of generating a profit – it does not support a genuine “need” for the PennEast pipeline. Given the significant level of impacts that will be inflicted by the PennEast pipeline on the water resources of Pennsylvania and New Jersey, and that the project will necessarily result in unavoidable and unmitigatable harm to the environment and communities, this lack of need for the PennEast pipeline project is a fatal flaw. It is improper for the DEIS to presume “need” rather than require the project applicant to affirmatively demonstrate it.

FERC has made it clear that it does not “look behind the contracts to determine whether the customer commitments represent genuine growth in market demand” or need. *See also NE Hub*

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<sup>22</sup> Lander, Gregg. “Analysis of Public Benefit Regarding PennEast Pipeline”, New Jersey Conservation Foundation. March 9, 2016. Available at: <http://njconservation.org/docs/PennEastNotNeeded.pdf>

<sup>23</sup> Labrynth Consulting responding to “A Pipeline For Growth Report”

*Partners, L.P.*, 90 FERC ¶ 61,142 (2000). Such an arbitrary review process, when taken to its logical conclusion, leads to absurd results. Indeed, to the extent the contracts are artificially manufactured and do not represent “genuine growth in market demand” FERC essentially admits that such fraudulent representations to FERC are sufficient for a decision approving the certificate. Here, substantial questions have been raised regarding the underlying contracts, and to the extent FERC fails to make a determination on “genuine market growth” and subsequent approval provided by FERC is arbitrary and capricious.

Furthermore, eminent domain originated as a way for governments to build necessary public infrastructure projects such as national highways and public buildings. It also enables governments to create parks and other public recreation areas. While eminent domain is considered an inherent power, it is subject to constitutional limitations. Among those limitations is that the land acquisition must be for “public use”.<sup>24</sup> The power of eminent domain is abused when it is used to benefit powerful interest groups at the expense of the less powerful; Supreme Court justices have recognized that the beneficiaries of this abuse “are likely to be those...with disproportionate influence and power in the political process, including large corporations and development firms.”<sup>25</sup> At its best, eminent domain allows for the acquisition of private property to create national parks for all to enjoy, and at worst, it exploits less politically and economically powerful groups. In the latter instance, the government acts as a henchman for private corporations, and this is not the intent of eminent domain. However, this is precisely what is happening at the behest of pipeline companies including PennEast. As noted, there is no genuine need for this project; the true goals are not to serve the public but to help the six companies that comprise the PennEast Pipeline LLC to meet their corporate goals and to generate profits. This amounts to a government subsidization of a private company’s profits, at the expense of the public.

FERC has stated that “[e]ven though the compensation received in [an eminent domain proceeding] . . . is deemed legally adequate, the dollar amount received as a result of eminent domain may not provide a satisfactory result to the landowner and this is a valid factor to consider in balancing the adverse effects of a project against the public benefits.” *See Order Clarifying Statement of Policy*, 90 FERC ¶ 61,128, at 61,398. FERC has made clear that “[u]nder the Certificate Policy Statement, FERC will not authorize the construction of a project, with the concomitant right to obtain the necessary rights-of-way through either negotiation or the eminent domain process, unless it first finds that the overall public (not private) benefits of the project will outweigh the potential adverse consequences.” *See Order Clarifying Statement of Policy*, 88 FERC ¶ 61,748, at 50. Here, a significant portion of the landowners have refused PennEast access to their property, which will require PennEast to acquire vast tracts of property via eminent domain. As such, this significant adverse impact supports a finding that the adverse effects of the Project outweigh its questionable benefits to the public.

### **The DEIS fails to consider cumulative impacts across the Project and across multiple other projects, including the source and end use of the natural gas**

NEPA prohibits FERC from ignoring the ‘indirect’ impacts of its export-facility approval on the production and use of natural gas within the United States. The DEIS cumulative impacts assessment fails to fulfill the requirements of NEPA.

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<sup>24</sup> U.S. Const. Amend. V

<sup>25</sup> *Kelo v. City of New London*, 545 U.S. 469 (2005), O’Connor Dissent

Cumulative impacts caused by “reasonably foreseeable” future actions are recognizable under NEPA and must be considered through the NEPA process. Additionally, FERC must consider the cumulative effects of actions similar to the proposed action, whether existing or reasonably foreseeable. Cumulative impacts include impact[s] on the environment which result from the incremental impact of the action “when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.”<sup>26</sup> Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.<sup>27</sup> Cumulative effects include “direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who has taken the actions.”<sup>28</sup> A cumulative effects analysis focuses on resource sustainability, and has expanded geographic and time boundaries.

FERC has framed its cumulative impact analysis too narrowly as well as mischaracterizing the degree of harm that will result from approval and construction of the proposed PennEast pipeline project. The cumulative impact assessment neglects reasonably foreseeable future actions that will directly and indirectly result from approval of this proposed project and are clearly causally related.

Upstream natural gas production, and its subsequent impacts, are among the ‘effects’ that NEPA requires FERC to consider, in determining whether its action will have a significant impact. NEPA’s implementing regulations define, as “[i]ndirect effects,” those “which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” 40 C.F.R. § 1508.8(b). The Project’s takeaway capacity will necessarily lead to additional demand for natural gas, with consequences for its price, production, and use, is eminently foreseeable. This Court has recently held that such “generally applicable economic principles,” as the relationship between the price of a good and its production and consumption, are “sufficiently ‘self-evident’ ” to “require ‘no evidence outside the administrative record.’” *Airlines for Am. v. Transp. Sec. Admin.*, 780 F.3d 409, 410-11 (D.C. Cir. 2015) (finding standing based on “basic proposition that ‘increasing the price of an activity ... will decrease the quantity of that activity demanded in the market’ ” (omission in original and citation omitted)). The results of “generally applicable” economics are all the more foreseeable here - because the administrative record does contain “evidence” specifically foreseeing them.

NEPA’s implementing regulations provide illustrative examples of indirect effects that are closely analogous to those at issue here: “growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate.” 40 C.F.R. § 1508.8(b). Like impacts on gas production and use, ‘growth inducing effects’ and ‘induced changes in the pattern of land use’ reflect responses - generally, market-based - to changes in the supply and demand for various resources. Further reflecting the need to consider such impacts, the regulations include

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<sup>26</sup> 40 C.F.R. § 1508.7 (2010).

<sup>27</sup> 40 C.F.R. § 1508.7 (2010).

<sup>28</sup> From: [http://energy.gov/sites/prod/files/nepapub/nepa\\_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf](http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-ConsidCumulEffects.pdf)

“economic” as well as environmental impacts among those that an agency must consider. 40 C.F.R. § 1508.8.

For that reason, courts have consistently required that agencies extend the ambit of their analysis to include effects akin to those that FERC ignored here. The Eighth Circuit has addressed circumstances that closely parallel those here, holding that when an agency approves a rail-line extension that would result in “an increase in availability and a decrease in price” of coal, NEPA demands that the agency examine the environmental “effects that may occur as a result of the reasonably foreseeable increase in coal consumption.” *Mid-States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549-50 (8th Cir. 2003) (requiring that agency address air pollution resulting from increased coal use). In *Mid-States*, the agency's decision enabled an increase in the supply of coal to the domestic market; here, as described below, FERC has enabled an increase in demand for natural gas. In *Mid-States*, that decision had foreseeable effects on the price of coal, its production, and its use.

FERC's decision has foreseeable impacts on natural gas's price, production, and use. In *Mid-States*, the Eighth Circuit held that the agency could not responsibly or lawfully ignore those effects under NEPA. *Id.* Likewise, neither could FERC do so here. Other Circuits have reached similar results. When authorizing a runway that would expand capacity and “spur demand,” the Ninth Circuit has held that the Department of Transportation must examine the increased usage that will result from that demand. *Barnes v. U.S. Dep't of Transp.*, 655 F.3d 1124, 1138-9 (9th Cir. 2011). The First Circuit has refused to let an agency construct a causeway and port, without examining the “industrial development” that would be enabled by that construction. *Sierra Club v. Marsh*, 769 F.2d 868, 877-79 (1st Cir. 1985). See also *Friends of the Earth v. U.S. Army Corps of Eng'rs*, 109 F. Supp. 2d 30, 39-40 (D.D.C. 2000) (invalidating agency decision approving casino, without considering economic development that would result). Those cases establish that when an Agency approves infrastructure that will increase demand for a resource, it cannot ignore the effects of that increased demand.

NEPA does not require agencies to consider only those effects whose specifics are known and certain. As the Eighth Circuit held, “when the *nature* of the effect is reasonably foreseeable but its *extent* is not ... [an] agency may not simply ignore the effect.” *Mid-States Coal. for Progress*, 345 F.3d at 549-50 (when agency permits rail extension that will increase “availability of coal,” it may not ignore “the construction of additional [coal-fired] power plants” that may result merely because agency does not “know where those plants will be built, and how much coal these new unnamed power plants would use”).

Indeed, where an action's effects are not precisely known, the Council on Environmental Quality's regulations suggest that the action is more - not less - likely to warrant an environmental impact statement. See 40 C.F.R. § 1508.27(b)(5) (intensity depends upon “[t]he degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks”); *Found. on Econ. Trends*, 756 F.2d at 154-55 (It is not “sufficient for the agency merely to state that the environmental effects are currently unknown,” because uncertainty is “one of the specific criteria for deciding whether an [environmental impact statement] is necessary”).

NEPA's implementing regulations provide detailed instructions as to how such uncertainty is to be addressed in an environmental impact statement. 40 C.F.R. § 1502.22(b) (specifying how agency should proceed when “the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known.”).

That the precise location of natural gas production is unknown, therefore, does not render such production unforeseeable, or allow FERC to dismiss its effects as insignificant. “It is well recognized that a lack of certainty concerning prospective environmental impacts cannot relieve an agency of responsibility for considering reasonably foreseeable contingencies.” *Potomac Alliance v. U.S. Nuclear Reg. Comm'n*, 682 F.2d 1030, 1036-37 (D.C. Cir. 1982). Rather, “[a]t the threshold stage of the NEPA inquiry ... an agency must determine, to the extent feasible, whether the sum of all reasonably foreseeable effects, discounted by the probability of their occurrence, represent a ‘significant’ effect on the environment.” *Id.* If so, the “agency must issue an [environmental impact statement] analyzing the probabilistic facets of the prospective environmental impact.” *Id.* Here, record evidence shows that not only will additional drilling be necessary to support the Project over the lifespan of its contracts, but furthermore, it is shown where the new wells are likely to be located, and how many wells will be needed to support the Project.

**Cumulative Impacts Assessment must consider reasonably foreseeable shale gas production.**

Pursuant to NEPA, the DEIS must include existing and reasonably foreseeable shale development/production that will be advanced, induced and supported if the PennEast pipeline were to be approved by FERC and built. Among the reasonably foreseeable actions whose environmental and community impacts must be considered include the construction, operation and maintenance of the shale gas wells that will be the source of the gas carried by PennEast, which will be carrying that gas in interstate commerce – both the new wells that will be constructed and the production that will be induced at pre-existing wells by the proposed PennEast pipeline. The analysis of impact for these gas wells which will be producing gas for the purposes of delivering it through the PennEast pipeline system in interstate commerce must include the associated gathering pipelines, access roads, gathering lines, compressor stations, and other supporting infrastructure which is necessary for the construction and development of these wells.

Given that shale gas production activities for delivery of gas into interstate commerce through the PennEast Pipeline are “sufficiently likely to occur that a person of ordinary prudence would take it into account in reaching a decision” *City of Shoreacres v. Waterworth*, 420 F.3d 440, 453 (5th Cir. 2005) (quoting *Sierra Club v. Marsh*, 976 F.2d 763, 767 (1st Cir. 1992)), and given that FERC’s approval of this project is a legally relevant cause resulting in the induced new, expanded, extended, and ongoing production of shale gas through construction of new gas wells and well pads, and inducing new production at pre-existing wells, FERC is obligated to consider their impacts in its NEPA analysis of the project.

FERC arbitrarily limits the scope of its review by failing to require the disclosure of the readily available, and reasonable and attainable, analyses, projections and assumptions that would inform the agency of the scope and extent of the foreseeable induced natural gas production upon which it can base its cumulative impact analysis across the broad range of environmental and community harms

(e.g. air, water, wetlands, habitat, forest, floodplain, water quality, drinking water supplies, health, safety, climate change). FERC's self-inflicted ignorance of the extent of induced shale gas production does not alleviate the agency of its obligation to undertake these assessments of significant impacts that will, reasonably and foreseeably, and predictably result.

Analysts, experts, and modelers use the location of interstate transmission gas lines as a predictor of where gas production will take place. The reality of the industry is that gas is produced for transmission through interstate commerce, and that there is a direct relationship between the siting and construction of well pads and the location of existing or proposed interstate pipelines.

Cumulative Impact Assessment must consider the reasonably foreseeable outcome of natural gas exports.

The direct, cumulative, and foreseeable impacts resulting from the exportation of the PennEast transported gas must also be considered. The DEIS fails to identify where exactly any of the end-users of the natural gas are located.

Facts are clear; PennEast will interconnect with a pipeline system that could transport its shale gas to the recently approved Cove Point LNG export facility. Specifically, PennEast will have an interconnect with Transco's mainline in Mercer County, NJ, a pipeline that intersects with the Pleasant Valley interconnect in Fairfax County Virginia, which in turn could deliver the gas to Dominion's Cove Point Pipeline. Given that natural gas can sell at a significantly higher price overseas as compared to domestically, it is both reasonable and foreseeable that PennEast transported gas will be transported to Cove Point for export. Furthermore, it is likely that natural gas that is displaced by the PennEast line will likely be exported as well. There is no information in the DEIS examining this issue.

Cumulative impacts of multiple linear projects must be considered.

Additionally, the DEIS needed to examine the cumulative impact of the multiple utility and other linear projects that are being proposed or constructed in the Delaware River watershed, in each subwatershed, and in each unique ecological community and human community.

For example, there are significant concerns related to the cumulative impacts of the continuous water crossings and wetlands disturbances that pipeline construction activity has on the health and vitality of the Delaware River basin and its tributaries. This is particularly a concern with the PennEast Pipeline, as many of the same subwatersheds subject to development as a result of PennEast were recently, or could be in the future, impacted by construction activity from other pipelines. Among the pipeline projects that are, will, or have impacted the same subwatersheds as PennEast, are Transco's Leidy line system upgrade projects which include the Northeast Supply Link project, the Southeast Leidy Expansion project, and the Atlantic Sunrise project. These projects all upgrade portions of Transco's Leidy line system, which parallels PennEast's proposed project.

Indeed, it is unclear why an entire new right of way would need to be cleared for this project when there is a parallel right of way within several miles of the proposed right of way. Also, in addition to Transco's previous and proposed pipeline projects, there are several other pipeline projects that have been concentrated in the same subwatersheds as the PennEast line, such as: Texas Eastern's TEAM 2014 Project, Buckeye Pipeline, and Columbia's East Side Expansion Project. Large

high tension ROW's and the Buckeye pipeline are other older ROWs that cut across and have already made lasting and sustained impacts to many of the subwatersheds that PennEast would cut.

“[W]ith each of these projects comes some combination of stream impact, core forests destruction, wetland and riparian corridor disturbance, and clearing of steeply sloped lands. As such, each project has caused or will cause its own unique set of impacts and add another layer of acute and long-term assaults to the environment. Additionally, each new project magnifies the project specific impacts of each prior project. When dealing with environmental impact assessment, each project is evaluated independently; the cumulative impacts of multiple linear development projects are not assessed and the additive long-term impacts of past and future linear projects fail to be recognized.”<sup>29</sup>

Another example of the kind of cumulative assessment that is obviously required within this category of harms relates to the Buckeye Oil Gas Transmission ROW in the Blue Mountains. Sensitive glacial soils, extreme compaction, continued and repeated ATV traffic and pipeline maintenance, lack of diverse growth, bare soils, and thermal heat and fragmentation impacts to the ROW and within the mature forest paralleling the Buckeye ROW were observed by DRN.<sup>30</sup>

Consideration of the multiple cuts proposed by PennEast in subwatersheds also needs study and consideration. For example, the Harihokake watershed, a C-1 waterbody in NJ would be inflicted with 7 different pipeline cuts for PennEast (Table G-6: MP 85.4, 85.6, 85.8, 85.9, 86, 86.3, 86.7) , which poses a threat to this watershed individually and cumulatively. The Alexauken Creek, another NJ C-1 stream would be cut 7 times by PennEast (Table G-6: MP 99.6, 100, 100, 100.1, 100.4, 100.9, 101). FERC has not assessed the cumulative impact of all of these multiple cuts on a subwatershed scale.

These are among the impacts that must be assessed as part of a cumulative impact statement – acknowledging the accumulation of harm that will result to these ecological resources and recreational and cultural assets given that PennEast would be cutting through these same natural resources and inflicting similar harms.

These projects do not occur in a vacuum. Each project individually depletes the natural and scenic resources of the region, and the combined impact becomes increasingly severe, unavoidable, unmitigatable, and irreversible. As such, the DEIS needs to examine these projects holistically in order to satisfy the requirements of NEPA.

Cumulative impacts of the pipeline construction, operation, and maintenance on impacted ecological systems must be considered by the DEIS

The DEIS does not consider the cumulative impacts to key ecological systems, over the lifetime of the pipeline, from construction through operation and including maintenance activities.

For example, forest ecological systems would experience enduring but also fresh impacts throughout the life and presence of the pipeline. The initial impact will include the removal of the forest and understory vegetation, coupled with the changes in light, moisture, wind, etc. impacting

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<sup>29</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016

<sup>30</sup> Delaware Riverkeeper Network. *Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, Docket No. CP15-558*, September 2016.

300 feet into the forest on either side of the ROW footprint. There will be enduring compacted soils, and dramatically altered vegetative composition along the ROW and along that forest edge that will increase volume and alter the timing of stormwater runoff, reduce groundwater recharge, change/take habitats for species of all kinds. There will then be the influx of invasive plant and animal species that will have cascading impacts on the forest ecosystem, which will spread along the ROW and back into the core of the adjacent forest.

There are the impacts of the fragmentation of the forest by PennEast but also by other cuts in the same region by other pipelines and/or linear projects. Over the life of the pipeline will be the maintenance of the ROW which will include the prevention of tree growth and maintenance of low growing vegetation only – this will be accomplished by periodic mowing and the use of herbicides. The mowing will disturb the vegetation and habitats that were allowed to encroach on the ROW. The herbicides will include impacts for non-target species, and could have implications for soil microbes and nearby wetland, vernal pool and stream ecosystems. Maintenance activities will involve periodic trimming, pruning, cutting back and removal of trees and woody vegetation growing along the perimeter of the ROW. “The inspection and maintenance of the ROW means the repetitive access and traverse of the ROW by inspection vehicles and maintenance equipment. This increases overall soil compaction and because there are no stabilized access-ways, it also creates repeated opportunity for soil erosion.” PennEast will only be required to “ensure that the soils are stable and is under no regulatory obligation to restore soil to pre-construction conditions.” “[T]hese changes in the properties of the soils along the pipeline and within the pipeline ROW will contribute to the predicted increases in the volume and rate of runoff. Along the entire length of the 115.1-mile long pipeline, these changes in the post-construction hydrology of the affected lands (especially the steeper sloped areas) will invariably alter runoff properties. The end result will be impacts to the streams, wetlands and riparian areas traversed by the pipeline and pipeline ROW and increased opportunity for erosion along the steeper segments of the pipeline and pipeline ROW. Because PennEast is not required to implement any of the conventionally utilized best management measures to collect, treat and control ROW runoff, there is no way to mitigate for these changes other than to revegetate. However, once again the cover type will be different pre to post-construction (e.g. trees to grass) and PennEast is only obligated to achieve 80% post-revegetation coverage with the vegetation type it is using.”<sup>31</sup>

FERC states that completed E&S Control Plans by agencies will adequately avoid harms but this is a false conclusion as can be seen on other pipeline projects where severe sediment pollution harmed local waterbodies, many of which had special protection designations<sup>32</sup>. Most agencies require quick establishment of groundcover to stabilize soils which takes the place of establishing more desired and diverse native habitats, biodiversity and soil health is lost. Once soil chemistry, soil porosity, and soil layering (horizons) that took eons to form are destroyed by the construction process, erosion control measures usually require lime and fertilizer to be applied so that seed mixes grow rapidly. The addition of lime and fertilizer are like poison to what were once forest soils of low pH and low nutrients. This essentially ruins the chance that the soil will ever revert to a native plant community again. Alien invasive weeds of all kinds thrive on the nutrient-enriched, topsy-turvy soil layers in the aftermath of construction. Native herbaceous plants and shrubs almost never outcompete weeds in these altered, nutrient-enriched, high pH soils. Just like on abandoned farmland,

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<sup>31</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016

<sup>32</sup> Delaware Riverkeeper Network *Field Monitoring Report, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams. Addendum to Comment for the PennEast Pipeline* Page **18 of 80**

these construction sites act as "post-agricultural soils," and just like our abundant forests on post-agricultural soils, the herbaceous and shrub layers will be dominated by alien weeds virtually forever, especially with over-abundant deer in the equation.<sup>33</sup>

As documented in the comment from Meliora Design,<sup>34</sup> the DEIS fails to consider cumulative impacts in an ecological system and fails to consider the multiple elements of specific site conditions that impact one another synergistically to determine what will be the impact that results from development of that site, with and/or without mitigation – e.g. pre and post vegetation composition, soils, slope etc. This missing component of the DEIS is massive and seriously undermines any of the conclusions reached regarding ecological impacts:

- “The DEIS and supporting materials provided by PennEast fail to consider the unique, site specific conditions at each individual proposed stream and wetland crossing, and the corresponding potential adverse water quality impacts associated with stream crossings, including open cut crossings. The DEIS fails to comprehensively evaluate each stream crossing with regards to conditions such as water quality, erosive soils, existing land use and forested areas, existing slopes, riparian buffers, and the potential need for in-stream blasting. Lacking consideration of the site specific conditions at each crossing, the DEIS fails to require adequate location and construction recommendations to protect water quality, as well as construction techniques specific to conditions at each crossing. The proposed stream and wetland crossing locations, methods of construction, and long-term land use conditions appear to be based on the needs and preferences of PennEast and not informed by site specific conditions.”

- “Importantly, the supporting documentation provided by PennEast fails to provide stream and wetland crossing information in a manner that allows FERC and other reviewing agencies to evaluate the site specific conditions at each stream crossing, including information discussed further in this memo. Important site specific information is located in different Resource Report volumes and other documents, and not easily correlated or evaluated. Much of the information discussed in this memo was compiled from multiple volumes, documents, and updates and is not readily reviewed by FERC or other reviewing agencies in a comprehensive manner. The project selection of stream and wetland crossing locations and construction methods cannot be clearly evaluated in the form in which it is presented in the DEIS and supporting documents.”

The cumulative assessment, considering near term and long term impacts, cumulative impacts resulting from the damage done near term and long term to a resource, including the lasting implications even with mitigation measures undertaken and full compliance with the law (let alone acknowledgement of the violations that are documented to take place as a matter of course during pipeline construction, operation and maintenance) needs to be, and is not, conducted by the DEIS. The forest example above is but one kind of resource that experiences these multi-pronged impacts in need of cumulative assessment by the DEIS – vernal pools, wetlands, streams, aquatic life, avian life,

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<sup>33</sup> Dr. Emile DeVito, New Jersey Conservation Foundation, Email Correspondence Re: Tennessee Gas Pipeline practices. July 14, 2015.

<sup>34</sup> Adams, Michelle and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

amphibian life, soil life, and wildlife all need an assessment of the cumulative impacts that will be visited upon them by PennEast if it were to be constructed.

Expansion of PennEast is a foreseeable impact that must be considered by the DEIS

Furthermore, by creating an entirely new ROW for this Project FERC is creating a new industrial corridor that will foreseeably be used in future PennEast pipeline upgrades. A quick review of other major pipeline corridors in the region support this assertion as natural gas pipeline operators including Columbia, Tennessee Gas Pipeline, Texas Eastern, and Transcontinental have all, within the last three years, added looping segments to their pipelines. As such, the DEIS analysis must account for the foreseeable expansion of the ROW to accommodate future upgrades. Indeed, there are no existing large scale, natural gas transmission lines that are not looped and/or being proposed for expansion in some capacity in the Delaware River watershed. As such, future looping and additional compressor stations is all but assured.

Looping is a common practice to expand the capacity of an existing pipeline by laying additional pipelines along the same right-of-way. Looped pipelines can be used to increase the distance between compressor stations or to provide additional storage capacity within the pipeline itself.

Compression is another way to increase throughput capacity on an existing pipeline. Upgrading existing compressor stations with additional or higher powered compressors or adding new compressor stations can significantly increase pipeline capacity. PennEast, as a new greenfield pipeline, would have significant opportunities for low-cost expansion through the addition of compression. Table 5 shows capacity expansions that have occurred shortly after new pipelines have commenced operations but prior to the consideration of looping, which can be a more costly alternative or supplement to additional compression. Table 2 shows several recent and proposed projects that have used compression, and notes if these projects also incorporate compression as an element of the capacity expansion.

**Table 1: New Pipeline Compressor-Based Expansions**

	Capacity (Dth/day)	In Service Date
<b>Millennium Pipeline</b>		
Initial Capacity	450,000	2008
Minisink Compressor	225,000	2013
Hancock Compressor	107,500	2014
	<hr/>	
	782,500	
Percent Change	74%	
<b>Maritimes &amp; Northeast</b>		
Initial Capacity	361,575	2000
Compressor Upgrade	78,425	2001
Phase IV Expansion	393,000	2009
	<hr/>	
	833,000	
Percent Change	130%	
<b>Vector Pipeline</b>		

Initial Capacity	925,200	2000
2007 Expansion	245,400	2007
Athens Expansion	105,000	2009
	1,275,600	
Percent Change	38%	

**Table 2: Recent and Proposed Pipeline Looping Projects<sup>35</sup>**

	Initial Pipeline Completion	In-Service Date	Looping	Compression
Transco Leidy Southeast Tennessee	Late 1950	Jan-16	30 miles	Yes <sup>36</sup>
Susquehanna West Tennessee Orion	2011	2017	8 miles	Yes
Millenium Eastern Upgrade	2011	2018	13 miles	No
Northeast Upgrade Project	2008	2018	7 miles	Yes
Triad Project	2011	Nov-13	40 miles	Yes
East Side Expansion	2011	2017	7 miles	No
	Late 1940	Nov-15	19 miles	Yes

Under NEPA guidance, the environmental review area must include all the subwatersheds through which the pipeline crosses. A critical consideration in determining the cumulative environmental effects must be the interaction of runoff, lost recharge, deforestation, damaged habitat, compacted soils, air pollution, water pollution, methane emissions, and all other harms impacted by the proposed PennEast pipeline along with the other past, present, and reasonably foreseeable future actions, whether federal, non-federal, or private that are connected to and/or would be the result of construction of the proposed PennEast pipeline.<sup>37</sup>

The DEIS asserts positive cumulative benefits, asserting jobs, air benefits and tax receipts but fails to assess the negative ramifications from construction of PennEast on all of these fronts. This is a crucial deficiency in the NEPA analysis. The adverse air quality impacts of PennEast are largely avoided by failing to do an appropriate cumulative impacts analysis that includes the induced and supported drilling, fracking, and other associated activities that would result from approval of a PennEast pipeline. The jobs and economic harms are overlooked in their entirety – there is no discussion of the reduced crop production for farmers, the adverse impacts to businesses along or near the pipeline right of way, the implications for ecotourism and related businesses and jobs, etc.

<sup>35</sup> Properties of these projects are available in the respective FERC dockets: Transco Leidy Southeast (CP13-551), Tennessee Susquehanna West (CP15-148), Tennessee Orion (CP16-4), and Millenium Eastern Upgrade (PF 16-3).

<sup>36</sup> Susquehanna West, Orion, Northeast upgrade, and Triad are all expansions to the TN 300 line, which is itself an expansion of a 1950s era TGP line.

<sup>37</sup> 40 C.F.R. §§ 1508.7-8, 1508.27 (2010).

As is shown by the economic analysis undertaken by Key-Log Economics and discussed elsewhere in this comment, the job and economic harms as a result of this project skyrocket and the supposed benefits are so flawed as to be indefensible.

### **Induced shale gas production and impacts must be considered by the DEIS**

The PennEast pipeline will result in new production of shale gas. Construction of the PennEast pipeline will cause industry to undertake and pursue new shale gas production – both by drilling new wells for production of shale gas and by pursuing production from wells that have been drilled but for which production was not pursued due to lacking pipeline capacity. Determining the shale gas production that will be induced and supported by the PennEast pipeline for delivery into interstate commerce is achievable using readily available data, methodologies, modeling, knowledge, resources and tools. Assessing the direct and indirect impacts from shale gas production and drilling that will result from construction of the PennEast pipeline is required by NEPA.

#### Pipelines can result in new shale gas production and drilling in several ways

Regardless of whether there is an actual need for the gas that would be transported in interstate commerce to the areas identified by PennEast in its application, once the project is constructed there will be shale gas production that will feed the pipeline which could then redirect it to other markets such as to LNG export facilities that can take the gas overseas for sale to foreign nations and users.

While FERC continues to try and ignore the connection between natural gas infrastructure investments and increased production, for producers, industry experts, and other government agencies, the effect is clear. With limitations on the ability to deliver gas to high-value markets, the economics do not favor increased drilling. In the last year or so, due to low gas prices and constrained delivery systems, many drillers have cut back on drilling; total production in the Marcellus actually declined for the first time since the shale boom began in 2008.<sup>38,39</sup>

Currently, there are at least 12 projects proposed or under construction that would either expand existing pipeline capacity or add new pipelines for the purpose of delivering shale gas from the Marcellus region into markets in the Northeast, South, and beyond.<sup>40</sup> The map below shows some of the recent proposals to expand take-away capacity from the Marcellus (notably, this map does not include the PennEast or the Atlantic Sunrise pipeline projects).

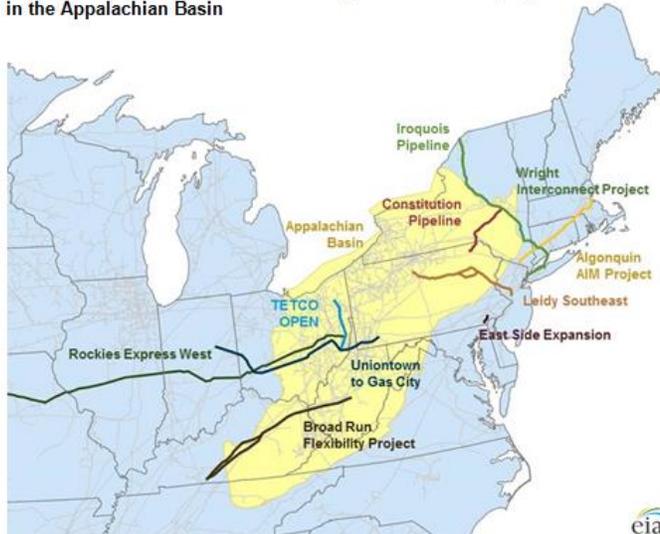
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<sup>38</sup> Bloomberg. *"America's Biggest Shale Gas Field Is Choking on Its Own Supply."* October 14, 2015. Available at: <http://www.bloomberg.com/news/articles/2015-10-14/america-s-biggest-shale-gas-field-is-choking-on-its-own-supply>

<sup>39</sup> EIA Drilling Productivity Report. August 2016. Available at: <https://www.eia.gov/petroleum/drilling/pdf/dpr-full.pdf>

<sup>40</sup> Northeast Gas Association. *"Planned Enhancements, Northeast Natural Gas Pipeline Systems"*. August 2016. Available at: [http://www.northeastgas.org/pdf/system\\_enhance0816.pdf](http://www.northeastgas.org/pdf/system_enhance0816.pdf)

**Selected existing and planned natural gas infrastructure projects  
in the Appalachian Basin**



Reproduced from EIA, January 2016. Available at:  
<http://www.eia.gov/todayinenergy/detail.cfm?id=24732>

These new pipelines, including PennEast, will unlock additional production potential in the Marcellus region, both directly by providing additional takeaway capacity from the region and indirectly by resulting in higher regional prices. Natural gas prices in the Marcellus region have been trading at a significant discount to national benchmark prices for several years, as discussed elsewhere in this comment. Growth in gas production slowed in Pennsylvania in 2015, and local prices dropped significantly.

As a result of the recent slowdown in production, there are numerous well sites that are permitted but have not yet been drilled. For example, a subsidiary of the Natural Fuel Gas Company, Seneca Resources, stated in a presentation to its investors earlier this year that it had “[l]imited development drilling [in its Eastern Development Area in northeastern Pennsylvania] until firm transportation on [the proposed] Atlantic Sunrise (190 MDth/d) is available in late 2017” and that it had “50-60 remaining Marcellus [drilling] locations” and “100-120 [Geneseo shale] locations” that could not be developed until that pipeline project was underway.<sup>41</sup>

Other producers in the region have similarly stated that they require additional pipeline capacity to develop new production capacity. Argus Media, a leading provider of data on prices and fundamentals for the natural gas industry, reported that “Antero Resources is waiting on the 3.25 Bcf/d Energy Transfer Rover pipeline to come online in the second half of 2017 before it increases drilling activity,” while “Northern Fuel Gas [in July 2016] said it was waiting on its own 475mn cf/d Northern Access to come online in the second half of 2017 before it raises its production levels.”<sup>42</sup> Argus also reported that “Range Resources plans to drill a seven-well pad in the Appalachian shale region this year, and could quickly drill up to 42 more laterals. The producer is expecting the 628mn cf/d (18mn m<sup>3</sup>/d) Spectra Gulf Markets project to facilitate some of its increased output when it

<sup>41</sup> National Fuel. Investor Presentation: Q2 Fiscal 2016 Update April 2016. Slide 10. Available at: [http://s2.q4cdn.com/766046337/files/doc\\_presentations/2016/April/20160428\\_NFG-IR-Presentation.pdf](http://s2.q4cdn.com/766046337/files/doc_presentations/2016/April/20160428_NFG-IR-Presentation.pdf)

<sup>42</sup> Argus Media. August 29, 2016. “US gas producers boost output ahead of expansions.” Available at: <http://www.argusmedia.com/news/article/?id=1302610>

begins flowing in the fourth quarter [of 2016].”<sup>43</sup> In their 2015 Annual Report, Cabot Oil & Gas noted that drilling activity in the Marcellus region had been reduced to a single rig, in response to “the market environment.” Cabot further noted that the company plans to “exit 2016 with between 45 and 50 drilled uncompleted wells, which will allow for operational flexibility into 2017.”<sup>44</sup> New pipeline capacity such as the PennEast pipeline would enable Cabot and other operators to complete additional wells and begin to further accelerate their production in the state – Cabot is among the shippers identified in the DEIS as being an anticipated customer of PennEast.

A recent report<sup>45</sup> issued by the Greater Philadelphia Energy Action Team advocates for more pipelines in order to induce and support more and new shale gas production:

“In creating an Energy Hub, the goal, first and foremost, is to expand the market for the Marcellus/Utica natural gas and NGLs to increase the economic benefits that will come to the Commonwealth and the Greater Philadelphia region from more vigorous production... To achieve this goal, however, we need to expand the existing interstate and intrastate natural gas pipeline infrastructure.”

“Encouraging the industry to invest in new pipelines and in new distribution system infrastructure ... provides additional capacity for increased volumes of gas.”

Industry is advocating for pipeline capacity exiting Northeast Pennsylvania to grow by over 60 percent in the next several years in order to allow for drilling activity to resume. PennEast is a major component of this expansion, as identified in **Table 3**.

**Table 3: Pipeline Capacity Exiting Northeast Pennsylvania<sup>46</sup>**

	Capacity (Bcf/day)
<b>Existing</b>	
Transco	3.4
Tennessee	1.8
Millennium	0.8
Existing Capacity	6.0
<b>In Development</b>	
TGP Susquehanna	
West	0.15
TGP Orion Expansion	0.14
Constitution Pipeline	0.65
Transco Atlantic	
Sunrise	1.70

<sup>43</sup> Ibid.

<sup>44</sup> Cabot Oil & Gas 2015 Annual Report. Page 3. Available at: <http://www.cabotog.com/wp-content/uploads/2016/04/COG-2015-AR.pdf>

<sup>45</sup> Greater Philadelphia Energy Action Team, *A Pipeline for Growth*, March 30, 2016.

<sup>46</sup> Pipeline capacities are taken from the relevant FERC dockets: TGP Susquehanna (CP15-148), TGP Orion (CP16-4), Constitution (CP13-449), Transco Atlantic Sunrise (CP155-138), PennEast (CP15-558), and Millennium (PF16-3)

PennEast Pipeline	1.11
Millennium Upgrade	0.20
In Development	3.95
<b>Total</b>	<b>10.0</b>

Historical drilling activity is an accurate and strong indicator for new wells

The state of Pennsylvania currently has 9,480 “active” unconventional natural gas wells.<sup>47</sup> Active gas wells have been issued a permit, but may or may not have been drilled or be currently producing natural gas. Those wells are found largely in the counties located in the Northeast and Southwest regions of the state, which contain 83 percent of active wells. Table 2 shows the breakdown of these active natural gas wells by region.

**Table 4. Active natural gas wells in Pennsylvania**

Region	Active Wells
Northwest	856
Southwest	3,537
Capital	0
Central	673
Northeast	4,414
Southeast	0
<b>Total</b>	<b>9,480</b>

*Source: Pennsylvania Department of Environmental Protection. PA Oil and Gas Mapping. Accessed August 26, 2016. Available online at:*

<http://www.depgis.state.pa.us/PaOilAndGasMapping/OilGasWellsStrayGasMap.html>

In the Northeast, near the start of the PennEast pipeline, four counties contain large volumes of active gas wells: Bradford County (12 percent of active wells in the state), Lycoming County (9 percent), Susquehanna County (14 percent), and Tioga County (8 percent). Figure 1 shows the distribution of active wells across the state.

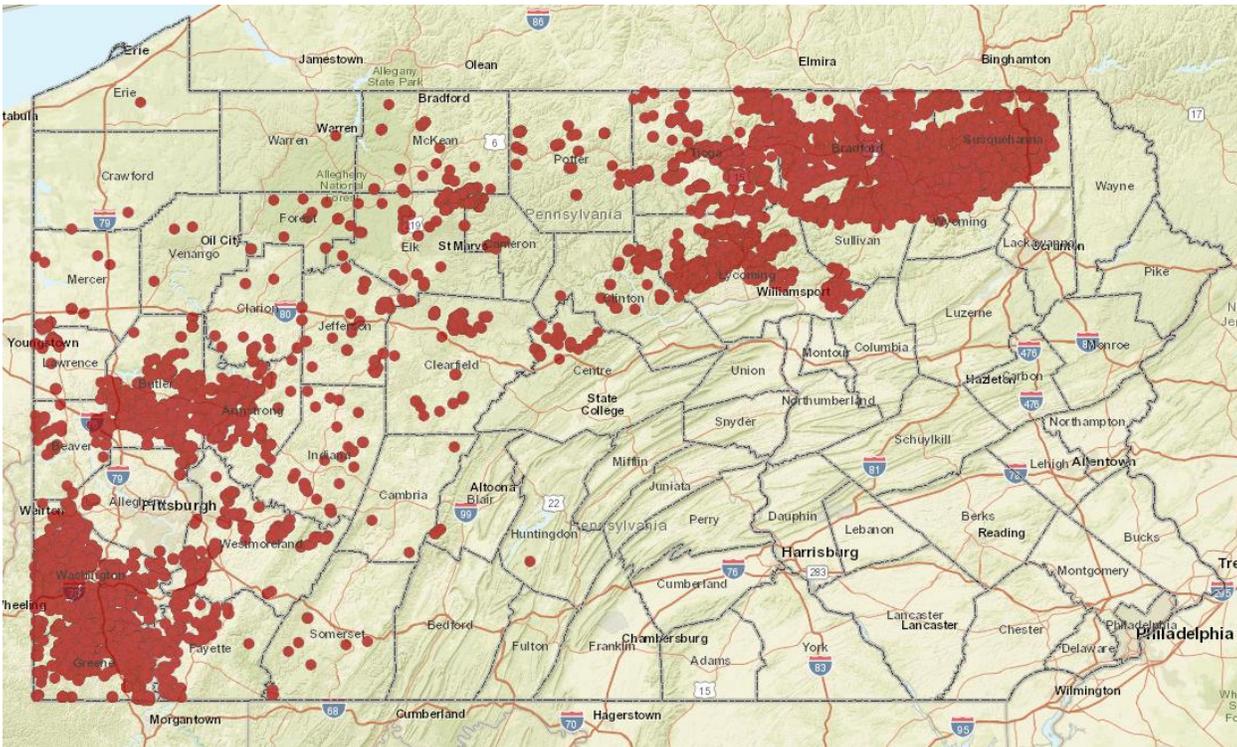
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<sup>47</sup> Pennsylvania Department of Environmental Protection. PA Oil and Gas Mapping. Accessed August 26, 2016. Available online at:

<http://www.depgis.state.pa.us/PaOilAndGasMapping/OilGasWellsStrayGasMap.html>

## Figure 1. Map of Active Natural Gas Wells in Pennsylvania

Source: Pennsylvania Department of Environmental Protection. PA Oil and Gas Mapping. Accessed August 26, 2016. Available online at:



<http://www.depgis.state.pa.us/PaOilAndGasMapping/OilGasWellsStrayGasMap.html>

For a full listing of the number of active wells in Pennsylvania by county, see Appendix 1.

The state of Pennsylvania tracks natural gas wells that are Proposed but Never Materialized (PBNM), in which a permit was issued but expired prior to the commencement of drilling, as well as Operator Reported Not Drilled (ORND), in which a permit was issued but the operator reported that the well was never drilled. These sites are logical and likely candidates for new drilling in Pennsylvania. A total of 2,733 wells fall into the PBNM category, and 4,258 wells are classified as ORND. The breakdown by region is shown in Table 2. Well more than half of these sites are located in Northeastern Pennsylvania.

**Table 5. Number of Wells in Pennsylvania That Have Been Permitted but Not Drilled**

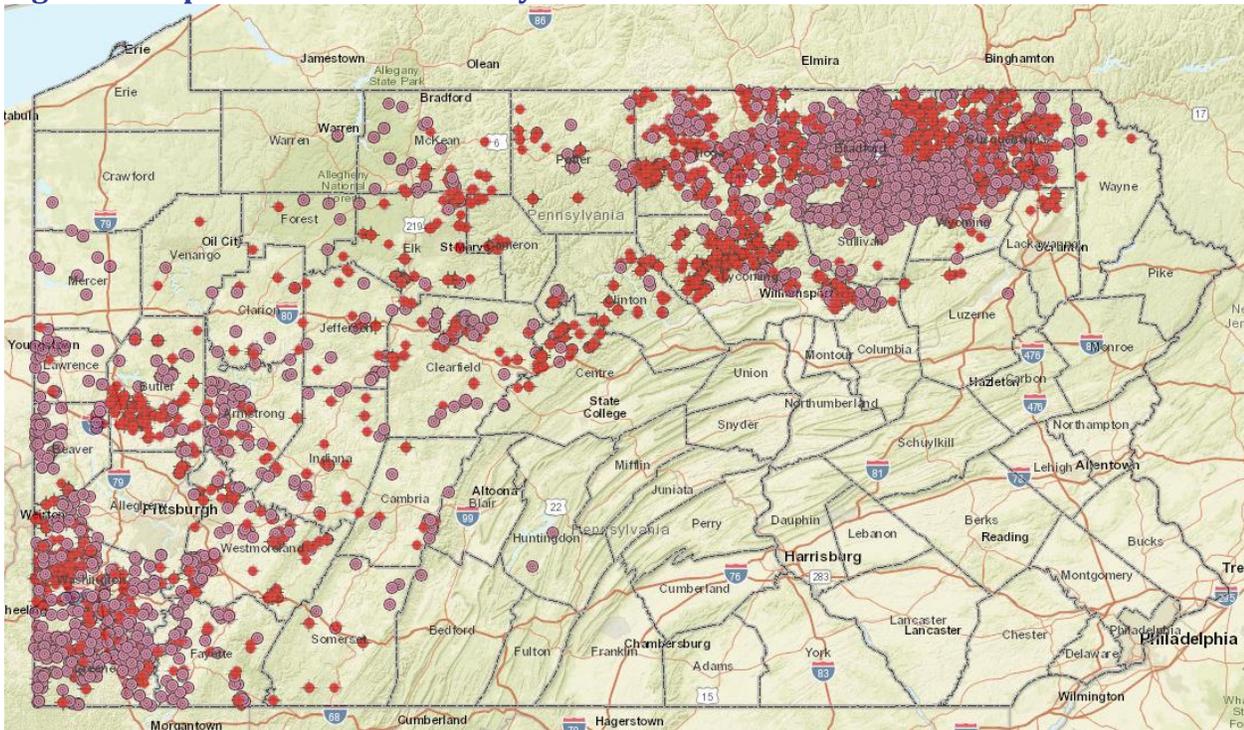
Region	Proposed but Never Materialized	Operator Reported Not Drilled
Northwest	200	275
Southwest	789	746
Capital	0	0
Central	295	517
Northeast	1,449	2,720
Southeast	0	0
<b>Total</b>	<b>2,733</b>	<b>4,258</b>

As shown in Table 4, of the counties in Northeast Pennsylvania, Bradford County and Susquehanna County have the highest number of wells that are PBNM and ORND. In general, the counties with the highest number of active wells also have the highest number of PBNM and ORND wells. Figure 2 shows the distribution across the state of Pennsylvania of natural gas wells that were permitted but never drilled, with the purple circles representing PBNM wells, and the red circles representing ORND wells. Appendix 1 contains a full listing by county of PBNM and ORND wells.

**Table 6. Active, PBNM, and ORND wells in Northeast Pennsylvania**

County	Active	Proposed but Never Materialized	Operator Reported Not Drilled
<b>Northeast Pennsylvania</b>	<b>4,414</b>	<b>1,449</b>	<b>2,720</b>
Bradford	1,133	650	1,114
Carbon	0	0	0
Lackawanna	0	0	27
Luzerne	0	1	12
Lycoming	894	104	404
Monroe	0	0	0
Pike	0	0	0
Sullivan	119	131	82
Susquehanna	1,306	262	494
Tioga	743	199	449
Wayne	0	5	4
Wyoming	219	97	134

**Figure 2. Map of Gas Wells in Pennsylvania that were Permitted but Not Drilled**



Distribution across the state of Pennsylvania of natural gas wells that were permitted but never drilled, with the purple circles representing PBNM wells, and the red circles representing ORND wells.

*Source: Pennsylvania Department of Environmental Protection. PA Oil and Gas Mapping. Accessed August 26, 2016. Available online at:*

*<http://www.depgis.state.pa.us/PaOilAndGasMapping/OilGasWellsStrayGasMap.html>*

Given the large number of wells that have been permitted but not drilled, one can reasonably expect that new natural gas wells drilled as a result of the construction of the PennEast pipeline would most likely be among the sites identified in Figure 2. Those counties with the highest number of wells that received permits but were never drilled are Bradford, Susquehanna, Greene, Washington, Tioga, Sullivan, Wyoming, Lycoming, and Clearfield.

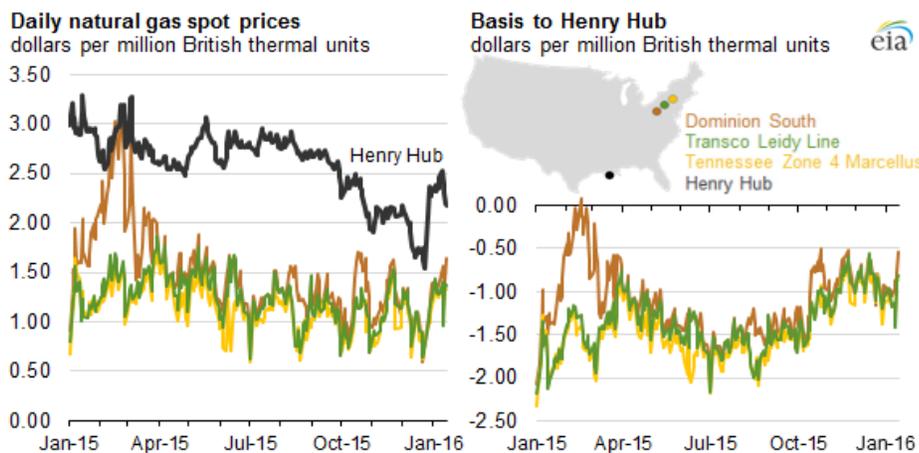
### Relative Pricing Impacts of Pipelines

Natural gas prices are lowest in the regions in which gas is produced. For many years, the lowest natural gas prices in the East were found at Henry Hub, located near the Gulf of Mexico where much of the natural gas in the United States was produced. With the increase in shale gas production, however, the lowest natural gas prices in the country are now found at trading points in and around the Marcellus and Utica shale plays in Pennsylvania, West Virginia, and Ohio. Availability of pipeline infrastructure to send natural gas to other regions has a direct impact on the price of natural gas in those regions—greater gas take-away capacity allows more natural gas to be produced. The improved access to higher priced markets via additional pipeline infrastructure will raise the price of natural gas in the producing region, which also will increase production.

Information on natural gas spot prices published in January 2016 by the EIA shows these market forces in action. While trading points in and around the Marcellus and Utica shale regions have been below the Henry Hub price in recent years, the EIA points out that, as of January 2016, the

difference between these price points has narrowed due to the recent pipeline projects that have come online. That narrowing is shown in Figure 3.

**Figure 3. Spread in Natural Gas Prices at Henry Hub and Marcellus Trading Points**



*Source: US Energy Information Administration, based on Natural Gas Intelligence. Available online at: <http://www.eia.gov/todayinenergy/detail.cfm?id=24712>*

Despite the eroding of the Marcellus basis differential in late 2015, towards close to \$1 per million BTU, that differential has persisted throughout 2016 and further increased. On August 29, 2016, natural gas in Northeast Pennsylvania was trading at \$1.30 per million BTU, while Henry Hub gas was at \$2.87—a \$1.57 differential.<sup>48</sup>

The narrowing of prices between the Henry Hub and Marcellus/Utica trading points in late 2015 may be due in part to the fact that producers in the Marcellus curtailed production of natural gas by approximately 1.2 Bcf/d as of November 2015 in response to weak prices resulting from the rapid growth of production in the face of pipeline constraints. Of the gas production that was curtailed, about 750 MMcf/d was in Bradford and Susquehanna counties in Pennsylvania.<sup>49</sup>

Economics dictates that natural gas production is likely to increase as additional pipeline capacity is added to the region. Producers in the Marcellus such as Seneca Resources and Cabot Oil & Gas have indicated that additional pipeline infrastructure is a cornerstone of plans to increase production in Northeast Pennsylvania.<sup>50</sup> In January 2016, Bentek Energy and the EIA noted a large backlog of natural gas wells that have been drilled but will not begin production until infrastructure (in the form of pipelines) becomes available to transport additional supply or until the price of natural gas increases. Bentek and EIA suggested that this backlog will allow production of natural gas in the

<sup>48</sup> NGI Shale Daily, August 29<sup>th</sup>, 2016.

<sup>49</sup> NGI's Shale Daily. Information on the Marcellus Shale. Available online at: <http://www.naturalgasintel.com/marcellusinfo>. Accessed on August 28, 2016.

<sup>50</sup> Comments of Allegheny Defense Project before the Federal Energy Regulatory Commission on the Draft Environmental Impact Statement for Transcontinental Pipe Line Company proposed Atlantic Sunrise Project. Docket No. CP14-138-000. June 2016. Page 22.

Marcellus to increase quickly when new infrastructure projects are completed.<sup>51</sup> And so, in addition to advancing new drilling, additional pipeline infrastructure will advance gas production in wells that may have been drilled but from which the industry did not yet extract gas due to a lack of available pipeline infrastructure.

### The PennEast Project would induce significant and predictable new drilling activity

The PennEast pipeline represents a significant fraction of the total new pipeline capacity coming to Northeast Pennsylvania—over 25 percent according to Table 1. A significant amount of existing production that has been curtailed will now come online for asserted customers as a result of the new pipeline. Permitted wells that were not previously completed would start producing gas for transport to New Jersey and Pennsylvania markets through the PennEast pipeline.

The total number of wells induced by any given pipeline depends on the lifetime production, or estimated ultimate recovery (EUR), from a given well. Wells in Northeast Pennsylvania provide up to 20 Bcf of total lifetime production, according to a recent Range Resources presentation.<sup>52</sup> There is significant variability across wells, and well decline rates—the decline in daily production over time after a well starts producing gas—have proven to be much more significant than initially estimated. As a result of this uncertainty, we use a lower average well EUR based on EIA data. We weight this county-specific EIA data based on the number of wells in each county in Northeast Pennsylvania (as provided in Table 6). This results in an average EUR for the region near the start of the PennEast pipeline of between 3.84 Bcf and 5.5 Bcf.

The PennEast pipeline, with 1.1 Bcf per day of gas transmission capacity, could result in the transfer of up to 16,000 Bcf over its expected economic lifetime. Based on an average well EUR of 5 Bcf, the PennEast could effectively support the drilling of **3,000 new wells in Pennsylvania**. This would likely come from a combination of wells that have been drilled but are not yet producing due to market conditions and wells not yet drilled. These wells are most likely to be located in Northeast Pennsylvania, in Bradford, Susquehanna, Lycoming, and Tioga counties.

### **The economic benefits asserted in the DEIS are indefensible and unsupported, and the economic harms are entirely overlooked**

FERC's section 7 duty to consider the public interest is broader than promoting a plentiful supply of cheap gas. *See Fla. Gas Transmission Co. v. FERC*, 604 F.3d 636, 649 (D.C. Cir.2010). Rather, FERC must ensure "the [public] benefits of the proposal outweigh the adverse effects on other economic interests." *AES Ocean Express, LLC*, 103 F.E.R.C. ¶ 61,030 at ¶ 19. Here, it is clear that the record shows that the net costs resulting from the construction of this pipeline outweigh the alleged public benefits of the Project.

Specifically, the DEIS consideration of economic benefits and harms is so misleading, inaccurate and deficient as to be a meaningless element of the DEIS, and certainly cannot be said to

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<sup>51</sup> US Energy Information Administration. 2016. *Spread between Henry Hub, Marcellus natural gas prices narrows as pipeline capacity grows*, Available online at:

<http://www.eia.gov/todayinenergy/detail.cfm?id=24712>

<sup>52</sup> Range Resources. EnerCom Oil & Gas Conference 21. August 15, 2016.

<http://ir.rangeresources.com/phoenix.zhtml?c=101196&p=irol-presentations>

fulfill the mandates of NEPA or FERC's Policy Statement to fully and fairly consider the economic issues involved with this proposed project.

As demonstrated in the attached report by Key-Log Economics, this comment and the comments of others on the docket, the claims of economic benefit advanced by PennEast and adopted by FERC in the DEIS are based on an analysis that is so flawed it is indefensible.

As determined by a careful analysis by Key-Log Economics.<sup>53</sup> In short, the DEIS;

- Overestimates short term impacts due to inherent issues with the models used and the choice of the size of the study region.
- Overestimates long term job "creation" and other impacts due to use of a model empirically proven to have no value as a predictor of economic activity occurring more than a year into the future."

In addition to providing exaggerated and false claims of benefit, the DEIS ignores the economic harms inflicted by construction and operation of PennEast. Among its many deficiencies, the DEIS analysis does not consider the adverse impacts to recreation and ecotourism so vitally important to the impacted region; the analysis fails to consider the implications for future investment in open space preservation and the adverse impacts thereof as communities realize that preserved lands are not protected from pipeline construction; the economic damage to agricultural crop production is overlooked as are harms to other businesses;<sup>54</sup> the impact on market values and marketability of properties through which the project will cut are misrepresented; the costs to the community to respond to emergencies, to the increased stormwater runoff, pollution inputs, and other adverse impacts that could result from this project and be foisted upon the shoulders of local towns and residents are given short shrift if they are mentioned at all; and the DEIS does not consider the health impacts to the residents who will be impacted by construction and operation of this project.

By way of more specific examples, the DEIS analysis ignores the many and varied economic harms that would result from the construction, operation and maintenance of the PennEast pipeline. Attached is a detailed analysis of the many deficiencies provided by Key-Log Economics. Among the deficiencies highlighted in that report, and in other resources provided as part of this comment, the DEIS fails to consider:

- *Public health costs*

"Based upon experience with other pipelines it can be anticipated that, for example, just in Carbon County where 560 people live within 2 miles of the proposed compressor station (US Census

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<sup>53</sup> In addition to the Key-Log Economics analysis attached she attached report by Jannette Barth challenging the Econsult Analysis. This report was provided on the FERC docket as public comment prior to completion of the DEIS, but FERC clearly chose to ignore this report along with all the other comments you ignored.

<sup>54</sup> We have learned from farmers, and it has been documented on the record, that crop production has gone down by as much as 30% when a pipeline cuts through farm crop lands. DEIS figures do not consider harms to other local businesses, such as the 7th generation nursery business reported in the press that said their ability to continue to operate would be harmed if PennEast passes through their property as is under consideration.

Bureau, 2015), there will be on the order of “504 people experiencing odor events, 398 people experiencing respiratory impacts, 325 people experiencing sinus problems, and 218 people experiencing sleep disturbances and/or severe headaches.”<sup>55</sup>

- *Reduced property values*

Of the comments reviewed so far by the Delaware Riverkeeper Network in partnership with Key-Log Economics (which includes the majority filed to date) “35% mention concerns about the effect on property value. Of this group, 99.6% believe the effect on property value will be negative.”<sup>56</sup>

- “68% of Realtors believe the presence of a pipeline would decrease residential property value.”<sup>57</sup>
- “Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%).”<sup>58</sup>
- “70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.”<sup>59</sup>
- “In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36 inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (Kielisch, 2015, p. 7). Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%. This loss in value provides the midlevel impact in our estimates. A much greater loss (and higher estimates) would occur if one were to consider the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.”<sup>60</sup>

- “Based on five “impact studies” in which appraisals of smaller properties with and without

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<sup>55</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>56</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

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<sup>58</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>59</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>60</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is 11.6%”(Kielisch, 2015, p. 11). The average rises to a range of 12% to 14% if larger parcels are considered, possibly due to the loss of subdivision capability.”<sup>61</sup>

- Research has also “found that properties within the “emergency plan response zone” of sour gas wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.”<sup>62</sup>
- Proximity to compressor stations have inflicted health harms, quality of life impacts and property damage, as well as lost property value, and have had impacts so severe that in at least one documented case it forced a family to abandon their \$250,000 investment in the home rather than suffer the health, safety and other harms they were experiencing.<sup>63</sup>
- “In Hancock, another New York town with a much smaller (15,000 hp) compressor station, three homeowners have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station (“Proximity of Compressor Station Devalues Homes by as Much as 50%” 2015).”<sup>64</sup>
- The experts at Key-Log Economics estimate that “properties within one half mile of the Kidder Township compressor station would lose 25% of their value if the station is built.” ... “[T]he Kidder compressor station would reduce the value of 43 properties by a total of \$1.9 million dollars.”<sup>65</sup>
- *Damage caused by air pollution to agriculture and infrastructure*

“One study found that shale gas air pollution damages in Pennsylvania already amount to between \$7.2 and \$30 million, with compressor stations responsible for 60-75% of this total (Walker & Koplinka-Loehr, 2014). Using the low estimate of 60%, that is between \$4.32 and \$18 million in damages associated with compressor stations.”<sup>66</sup>

- *The Social Cost of Carbon*

“PennEast, LLC estimates the pipeline would transport 401,500,000 dekatherms annually, contributing to an equivalent of 20.1 metric tons of CO2 emitted per year (U.S. EPA, 2016a). Using the

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<sup>61</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>62</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

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most conservative estimate of the cost per metric ton of carbon (U.S. EPA, 2016b), the additional emission of CO<sub>2</sub> would cost \$252.4 million annually.”<sup>67</sup>

- *Loss of Ecosystem Services*

The ecosystem services, “benefits that flow from nature to people”, that will be lost, for example, “tangible physical quantities, such as food, timber, and clean drinking water, life support functions like assimilating waste that ends up in air and water or on the land, as well as aesthetics, recreational opportunities, and other benefits of a more cultural, social, or spiritual nature.”<sup>68</sup>

In addition there is no recognition in the DEIS for the decrease in property values associated with increased ecological impacts to the environment from PennEast. For example, one of the benefits of living next to a stream or other natural body of water is the increased property value those riparian rights bring as well as the recreational and quality of life benefits that can be enjoyed. But the cut of a pipeline diminishes all of these rights and benefits of living near a waterway. Property values are demonstrably harmed by the presence of a pipeline.<sup>69</sup> Aesthetic qualities, ecological health of a stream and instream populations such as fish are diminished due to a pipeline’s stream cuts and permanent loss of riparian vegetation essential for healthy riparian and instream habitat. Ecological and aesthetic harm translates into diminished recreational enjoyment and opportunities as well as a diminished ability to enjoy the environment and one’s property.

In addition, the economic analysis included in the DEIS fails to consider the potentially superior economic benefits and values of a clean energy alternative for fulfilling energy needs in Pennsylvania, New Jersey and the unnamed surrounding states PennEast asserts it is seeking to serve. For example, an investment in clean energy strategies are known to result in far superior job creation for every million dollars invested as compared to the oil and gas industry, including pipeline projects.

Research has demonstrated that investment in clean energy generates a greater number of long term jobs that bring greater capacity for worker earning and advancement. For every million dollars invested in clean energy, including wind, solar, eco-friendly water, and efficiency, generates 6 to 8 times the number of direct jobs, and 3 times the number of direct, indirect and induced jobs collectively as compared to oil, gas or coal.<sup>70</sup>

FERC wrongly concentrates its determinations regarding pipeline certificate approvals largely on the contracts and the alleged reliability accessibility proposed by the applicant without considering the economic costs articulated above –given that improper review, FERC’s failure to fully consider economic harms renders a decision flowing therefrom as arbitrary and capricious.

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<sup>67</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>68</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

<sup>69</sup> See e.g. Review of INGAA Foundation Report, “*Pipeline Impact to Property Value and Property Insurability*”, Key-Log Economics, March 11, 2015

<sup>70</sup> See *The Economic Benefits of Investing in Clean Energy*, by the Center for American Progress & PERI Univ of Mass Amhersts

Using methods established in Phillips and McGee (2016) and applied to pipelines in Phillips, Wang and Bottorff (2016), the PennEast pipeline would cause an initial loss of \$7.3 million in ecosystem services during a one year construction period. For each year the pipeline is in operation, the pipeline would induce an additional loss of \$2.4 in ecosystem services due to conversion of land in the ROW. Land converted for use as permanent pipeline related infrastructure would mean an additional loss of \$218,200 each year. Such losses are not accounted for in the DEIS or FERC's balancing of the economic costs of the project. Additionally, using methods established by Kielisch (2015) and Boxall, Chan, McMillan (2005), and applied to pipelines in Phillips, Wang and Bottorff (2016), we estimate that construction of the PennEast pipeline would result in a loss of \$158.3 to \$176.0 million in property value in the right of way and evacuation zone.<sup>71</sup>

### **The DEIS fails in its legal obligation to consider greenhouse gas emissions and climate change implications of the PennEast Pipeline**

On August 1, 2016, The Council on Environmental Quality (CEQ) issued final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The final guidance directs federal agencies on how to consider a proposed action's impacts on climate change—both in terms of the potential effects of *a proposed action on climate change* (by assessing the GHG emissions that would result *directly and indirectly* from the action) and in terms of the effects of *climate change on a proposed action* and its environmental impacts.

The guidance, building off of recent scientific assessments and conclusions, including the 2009 EPA finding that climate change impacts are “reasonably anticipated to endanger the public health and public welfare of present and future generations”, states that “Climate change is a fundamental environmental issue, and its effects fall squarely within NEPA’s purview.” The document acts as a guide for federal agencies to apply NEPA principles and practices to the analysis of GHG emissions and climate change.

DEIS discussion of greenhouse gas emissions cannot be said to fulfill the requirements of the CEQ Guidance issued on August 1, 2016.

According to CEQ guidance:

“when addressing climate change agencies should consider: (1) The potential effects of a proposed action on climate change as indicated by assessing GHG emissions (e.g., to include, where applicable, carbon sequestration); and, (2) The effects of climate change on a proposed action and its environmental impacts.”

Pursuant to the guidance CEQ recommends:

- “...that agencies quantify a proposed agency action’s projected direct and indirect GHG emissions, ...;”
- “....agencies use projected GHG emissions ... as a proxy for assessing potential climate change effects when preparing a NEPA analysis for a proposed agency action;”

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<sup>71</sup> See letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

- “ that where agencies do not quantify a proposed agency action’s projected GHG emissions because tools, methodologies, or data inputs are not reasonably available to support calculations for a quantitative analysis, agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not reasonably available;”
- agencies “[d]iscuss methods to appropriately analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions and climate effects;”
- “...agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis;”

The assessment undertaken in the DEIS to fulfill consideration of the climate change impacts of this proposed project is overwhelmingly deficient. The DEIS fails to fully, fairly and accurately consider the greenhouse gas emissions of the proposed PennEast pipeline project itself, as well as the shale gas extraction emissions that will directly and indirectly be induced by approval of this project, the potential for climate change to worsen environmental impacts associated with the project and the impacts of climate change on the project itself.

#### DEIS uses improper time frame and GWP for Methane.

It is notable that at the outset the DEIS asserts for Methane, CH<sub>4</sub>, a Global Warming Potential (GWP) of 25. According to the USEPA, “Methane (CH<sub>4</sub>) is estimated to have a GWP of 28–36 over 100 years.”<sup>72</sup> As a result of FERC using the outdated figure of 25, it will have seriously understated the greenhouse gas emissions calculations for the proposed PennEast pipeline regardless of the other deficiencies noted in this comment with the DEIS analysis – the current EPA accepted range of 28-36 should be the figure used for all calculations associated with Methane emissions for this project. A failure to do so understates the associated global warming potential by between 12% and 44%.

Given that the earth may reach a temperature tipping point in anywhere from 18 to 38 years,<sup>73</sup> it is the 20 year time frame that is the most meaningful and needs to be the basis of present day decision-making. If a 20-year time frame is used, the global warming potential of methane identified by the USEPA is between 84 and 87. For purposes of assessing the climate changing impacts of approving the PennEast pipeline the DEIS should engage in a robust analysis that includes the 20 year GWP for methane of 84 to 87. If FERC insists on using the scientifically inaccurate 100 year time frame for this assessment then it should use the EPA range of 28 to 36. But in no instance is use of a 25 GWP for methane appropriate for this assessment. And at a minimum the DEIS should do an analysis that includes both the 100 year and the 20 year time frame with the more accurate numbers discussed above for the GHG and climate change assessment of the proposed pipeline.

#### GHG and Climate change analysis needs to consider full pipeline project development and the resulting shale gas production

The climate changing effects of approving PennEast are significant and a climate change assessment needs to include consideration of methane emissions along the entire 115 plus miles of

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<sup>72</sup> <https://www.epa.gov/ghgemissions/understanding-global-warming-potentials>

<sup>73</sup> R. Howarth, D Shindell, R. Santoro, A. Ingraffea, N. Phillips, A Townsend-Small, *Methane Emissions from Natural Gas Systems*, Background Paper Prepared for the National Climate Assessment, Reference number 2011-0003, Feb. 25, 2012.

proposed pipeline, including consideration of greenhouse gas and methane emissions from the proposed compressor station, 8 meter and regulator stations for interconnects, 11 mainline valve sites and 4 pig launcher/receiver sites. The climate change assessment also needs to include the gas production that will take place in order to supply the gas that will be carried by the PennEast pipeline in to interstate commerce and that is a foreseeable and direct element of the PennEast pipeline project. End uses of the gas must likewise be considered. Carrying out a legally appropriate, necessary and data driven assessment demonstrates that approval, construction and operation of the PennEast pipeline will have significant climate changing ramifications.

The DEIS acknowledges that there will be methane emissions from the PennEast pipeline. The DEIS states “Potential emissions of GHGs associated with operation of the Project, including methane emissions from fugitive leaks and equipment venting, are estimated to exceed the 25,000 metric ton threshold for the Kidder Compressor Station. In addition, GHG operating emissions from the New Jersey portion of the Project are also estimated to exceed 25,000 metric tons per year.” DEIS p. 4-209

- Table 4.10.1-8 says that during operations the PA greenhouse gas CO2 equivalent emissions will be 11,450 tons per year; in NJ they will be 70,823 tons per year
- Table 4.10.1-6 says that for the compressor state the greenhouse gas CO2 equivalent emissions will be 191,785 tons per year
- Table 4.10.1-9 says that the greenhouse gas CO2 equivalent emissions for the operational phase of the project in total will be 274,057 tons per year
- Table 4.12.4-1 estimates construction phase greenhouse gas CO2 equivalent emissions at 34,878 tons per year

But these figures understate what should be the anticipated emissions as compared to what is being documented by current science for other pipeline infrastructure.

For example, the DEIS fails to assess the emissions resulting from the induced shale gas production that will result from construction and operation of the pipeline necessary to fulfill its claimed “need” for the project. While recognizing that “upstream development and production of natural gas might be a “reasonably foreseeable” effect of a proposed action” FERC asserts that “ the actual scope and extent of potential GHG emissions from upstream natural gas production is not reasonably foreseeable” and as a result no consideration pursuant to the DEIS is necessary. This kind of double speak – shale gas production is reasonably foreseeable at the same time it is not reasonably foreseeable – does not provide firm, or legally defensible ground for FERC’s failure to consider the GHG emissions or climate changing ramifications of shale gas production that will be the result of approval and construction of the PennEast pipeline. In fact the production of shale gas is reasonably foreseeable, and so too is the scope and extent of that production upon which a GHG emissions analysis can be performed. (See above analysis.)

“Natural gas systems are the single largest source of anthropogenic methane emissions in the United States” contributing approximately 40% of the anthropogenic emissions of methane.<sup>74</sup> Emission of methane to the atmosphere during the production and distribution of shale gas contributes to this fossil fuel’s climate changing impacts. Methane is released to the atmosphere on multiple occasions during the shale gas extraction process. It has been estimated that “during the life cycle of an average shale-gas well, 3.6 to 7.9% of the total production of the well is emitted to the

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<sup>74</sup> *Id.*

atmosphere as methane.”<sup>75</sup> Among the most recent scientific findings is that as much as 9% of the methane produced while drilling for gas is lost to the atmosphere.<sup>76</sup> While a previous estimation that 4% was lost from the well fields had already raised alarm bells for many;<sup>77</sup> the new figure of 9% is increasing evidence of the massive methane contribution shale gas development provides to the atmosphere.

Additionally, large amounts of methane leak into the atmosphere during the “transport, storage and distribution” phases of the natural gas delivery process including during transmission through interstate pipelines like PennEast.<sup>78</sup> Even conservative estimates of leakage during gas transmission, storage and distribution have given a range of up to 3.6%.<sup>79</sup> Emissions from the transmission of natural gas occur along the length of pipeline project.

Researchers “have found that methane leaks would need to be held to 2% or less in order for natural gas to have less of a climate changing impact than coal due to the life cycle of methane.”<sup>80</sup> At leakage above 3.2%<sup>81</sup> natural gas ceases to have any climate advantage over other fossil fuels. As discussed above, science is finding that the existing leakage rate during the production and/or transmission of shale produced gas is significantly higher than either of these numbers.

When upstream and downstream emissions are considered along with the increase in shale gas wells over the next 2 decades, the methane emissions from the natural gas industry will increase, by as much as 40 to 60%.<sup>82</sup> Upstream emissions occur during well completion and production at a well site while midstream emissions occur during gas processing. Downstream emissions are those that happen in the storage systems as well as the transmission and distribution pipelines.<sup>83</sup>

Scientists believe that if the earth warms to 1.8°C above what it was between 1890 and 1910 that it will put in play a set of chain reactions that will result in increasing releases of methane to the atmosphere – largely released from the arctic as a result of melting permafrost – which will in turn cause increased warming and its associated impacts.<sup>84</sup> It is posited by scientists that without immediate reductions in methane emissions and black carbon the earth will warm to 1.5°C by 2030 and 2.0°C by 2045/2050 and that this will be the case regardless whether carbon dioxide emissions are reduced or not.

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<sup>75</sup> Howarth, *supra note* 55.

<sup>76</sup> *Methane Leaks Erode Green Credentials of Natural Gas*, Nature International Weekly Journal of Science, Jan. 2, 2013. See also Howarth, *supra note* 56

<sup>77</sup> *Id.*

<sup>78</sup> Howarth, *supra note* 56; See also U.S. EPA 1997. *Methane Emissions from the Natural Gas Industry*. USEPA National Risk Management Research Laboratory, June 1997, EPA-600-SR-96-080.

<sup>79</sup> Howarth, R. W. (2014). A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas. Energy Science & Engineering.; See also Howarth, *supra note* 55.

<sup>80</sup> *Switching from Coal to Natural Gas Would Do Little for Global Climate, Study Indicates*, UCAR/NCAR Atmos News, Sept 8, 2011.

<sup>81</sup> According to the Environmental Defense Fund

<sup>82</sup> Howarth, *supra note* 56.

<sup>83</sup> Howarth, *supra note* 56.

<sup>84</sup> Howarth, *supra*.

Another cascading and irreversible impact of climate change involves irreversible changes in ocean currents. The Atlantic serves as the engine for the planet's conveyor belt of ocean currents - Atlantic Meridional Overturning Circulation (AMOC). The massive amount of cooler water that sinks in the North Atlantic stirs up that entire ocean and drives global circulation. When the Atlantic turns sluggish or stops, it has worldwide impacts and likely irreversible effects: The entire Northern Hemisphere cools, Indian and Asian monsoon areas dry up, North Atlantic storms get amplified, and less ocean mixing results in less plankton and other life in the sea.<sup>85</sup> Paleo climatologists have spotted times in the deep past when the current slowed quickly and dramatically, cooling Europe by 5 to 10 degrees C (10 to 20 degrees F) and causing far-reaching impacts on climate.

Acknowledged in the DEIS is that FERC:

“received comments from EPA recommending that we also estimate GHG emissions from the development and production of natural gas being transported through the proposed pipeline, as well as estimate the GHG emissions associated with the end use of the gas.”<sup>86</sup>

FERC rejects its obligation to consider GHG emissions stating:

FERC has in the past ruled that while upstream development and production of natural gas might be a “reasonably foreseeable” effect of a proposed action, the actual scope and extent of potential GHG emissions from upstream natural gas production is not reasonably foreseeable (FERC 2015).<sup>87</sup>

In fact, FERC arbitrarily limits its review by failing to require the current, available, reasonable and attainable analyses, projections and methodologies that will in fact inform the agency of the scope and extent of the foreseeable induced natural gas production and, from there, allow assessment of the anticipated resulting greenhouse gas emissions. FERC's self-inflicted ignorance on the subject does not alleviate the agency of its obligation to undertake an assessment of greenhouse gas emissions from induced shale gas production associated with this project and its climate changing implications. Once the scope and extent of induced drilling is determined, FERC has demonstrated it has a competence in determining resulting levels of greenhouse gas emissions. This analysis should be undertaken and subjected to the NEPA review and comment process.

#### DEIS ignores other clear guidance

Even if FERC did not have an obligation to quantitatively consider the projected greenhouse gas emissions it is still obligated to “explain the basis for determining that quantification is not reasonably available” and then to undertake a “qualitative analysis in the NEPA document” neither of

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<sup>85</sup> Hansen, J., M. Sato, P. Hearty, R. Ruedy, M. Kelley, V. Masson-Delmotte, G. Russell, G. Tselioudis, J. Cao, E. Rignot, I. Velicogna, E. Kandiano, K. von Schuckmann, P. Kharecha, A.N. LeGrande, M. Bauer, and K.-W. Lo, 2016: Ice melt, sea level rise and superstorms: Evidence for paleoclimate data, climate modeling, and modern observations that 2°C global warming could be dangerous. Atmos. Chem. Phys., <http://csas.ei.columbia.edu/2016/03/22/ice-melt-sea-level-rise-and-superstorms-the-threat-of-irreparable-harm/>

<sup>86</sup> FERC DEIS pg 4-285

<sup>87</sup> FERC DEIS pg. 4-285

which FERC has done for the induced shale gas production from this project.<sup>88</sup>

Furthermore, because FERC arbitrarily limited its consideration of alternatives to different route proposals it has also denied itself and the public the ability to consider a comparison of greenhouse gas emissions between the proposed pipeline and other mechanisms for fulfilling genuine end use energy needs such as investments in energy efficiency, solar, wind energy, geothermal, environmentally sustainable water, etc.

In addition, according to CEQ guidance:

“When discussing GHG emissions, as for all environmental impacts, it can be helpful to provide the decision maker and the public with a recognizable frame of reference for comparing alternatives and mitigation measures. Agencies should discuss relevant approved federal, regional, state, tribal, or local plans, policies, or laws for GHG emission reductions or climate adaptation to make clear whether a proposed project’s GHG emissions are consistent with such plans or laws. For example, the Bureau of Land Management has discussed how agency actions in California, especially joint projects with the State, may or may not facilitate California reaching its emission reduction goals under the State’s Assembly Bill 32 (Global Warming Solutions Act). This approach helps frame the policy context for the agency decision based on its NEPA review.”<sup>89</sup>

The DEIS failed to properly give this kind of frame of reference or context for the greenhouse gas emissions discussion.

DEIS fails to consider combined adverse environmental impacts of climate change and the PennEast pipeline and the potential implications for the PennEast pipeline itself.

The DEIS states:

“These projected climate change effects in the Project area are not anticipated to exacerbate any other environmental impacts from the Project during its expected lifetime”

FERC, in the DEIS, summarily dismisses any consideration of the combined adverse environmental impacts of climate change and the PennEast pipeline and the potential implications for the PennEast pipeline itself resulting from climate change.

In fact, the PennEast pipeline, if built, would have compounding adverse effects with regard to climate change, requiring a more thorough assessment and analysis in the DEIS. In addition, the impacts of climate change on the northeast region is likely to have implications for the PennEast pipeline itself that require NEPA consideration and assessment

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<sup>88</sup> Counsel on Environmental Quality, Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, August 1, 2016

<sup>89</sup> Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews, Aug 1, 2016

With regards to this element of the NEPA analysis, CEQ guidance states:

“The analysis of climate change impacts should focus on those aspects of the human environment that are impacted by both the proposed action and climate change. Climate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts and lessen its resilience to other environmental impacts apart from climate change. This increase in vulnerability can exacerbate the effects of the proposed action.”

The DEIS identifies the following list of potential implications for the Northeast region of the United States resulting from climate change that are expected in the project’s lifetime:

- “the frequency, intensity and duration of heat waves is expected to increase. The average number of days exceeding 90 °F currently ranges between 0-5 and 10-20 days per year in the Project area, and could increase in range to between 5-10 and 30-40 days per year during the 2041-2070 time period.
- changes in precipitation patterns are expected. During the expected Project lifetime, the NCA projects small increases in average winter precipitation, an increased frequency of heavy downpours, and an increased risk of summer drought due to earlier spring snowmelt.
- increased cold damage to crops is projected, due to a higher frequency of premature spring warm spells followed by hard freezes.
- increased crop damage and reduced crop yields are projected due to intense precipitation events, delays in crop plantings and harvest, and heat stress.
- increased stress on native vegetation is projected due to the spread of invasive insects and growth of invasive weeds such as kudzu.
- the species distributions of trees and plants are projected to move to higher elevations.
- bird ranges are projected to move northward, and migratory birds are projected to arrive earlier in the spring.
- increases are projected in carrier habitat and human exposure to vector-borne diseases such as Lyme disease, West Nile virus, and Zika virus.”

But after providing this list, the DEIS summarily dismisses them without any discussion or consideration, simply stating:

“These projected climate change effects in the Project area are not anticipated to exacerbate any other environmental impacts from the Project during its expected lifetime.”

In fact, there is a lot to be considered in terms of compounding and synergistic affects between the pipeline and climate change for ecological systems, drinking water supplies, and communities. The summary dismissal fails to fulfill NEPA’s obligations to consider the impacts of climate change for the pipeline, but also the combined effects of the pipeline and climate change for the environment and communities. Simply listing some anticipated climate change impacts for the region is obviously deficient.

Frequency, intensity, duration of heat waves in the region

As identified in this comment and others on the docket, the PennEast pipeline will alter groundwater flows and increase stormwater runoff thereby reducing groundwater recharge. This altered and loss of groundwater to streams and wetlands will alter stream base flow, wetland source water, water quality, and temperatures. Increasing the “average number of days exceeding 90 °F currently ranges between 0-5 and 10-20 days per year in the Project area, and could increase in range to between 5-10 and 30-40 days per year” will exacerbate these harms inflicted by PennEast and vice versa. The combination of increasing weather temperatures, declining baseflow and wetland source water, will increase instream temperatures and decrease the moderating affect healthy groundwater flows would provide, in addition the increased temperatures will result in increased evaporation that will compound the impacts of lost recharge and base flow.

Pipeline construction results in the loss of riparian (streamside) vegetation.<sup>90</sup> For each of the pipeline construction techniques there is a resulting loss of vegetation and foliage associated with clearing the stream banks – the PennEast pipeline is no exception. At least 255 streams will be crossed with the vast majority being crossed via open trench methods which result in permanently denuded streambanks. Riparian vegetation is an important part of a healthy ecosystem and protects the land adjoining a waterway which in turn directly affects water quality, water quantity, and stream ecosystem health. A reduction in streamside healthy and mature streamside vegetation reduces stream shading, increases stream temperature and reduces its suitability for incubation, rearing, foraging and escape habitat.<sup>91</sup> These impacts are not accounted for in the DEIS.

The loss of riparian vegetation along streams will, among other impacts, remove shading and result in increased stream temperatures. Many of the streams being cut by PennEast are smaller, headwater streams with high water quality. The loss in vegetation coupled with the more extreme temperatures brought on by climate change, will magnify increased stream temperature and thereby reduce its quality and suitability for aquatic life. For some species the resulting change in temperature could have dramatic impacts.

The Union of Concerned scientists has also recognized the combined effect of warming temperatures, changing precipitation, altered streams flows, higher water temperatures and diminished shading along stream banks for fish species, identifying two but recognizing others may be implicated as well: “As global warming drives up air temperatures and changes precipitation patterns, altered seasonal stream flows, higher water temperatures, and diminished shade along stream banks may follow. The native brook trout and smallmouth bass are particularly sensitive to such changes.”<sup>92</sup> The Penn East lists at least 131 Wild Trout Waters in Pennsylvania to be cut across by the pipeline (Table G-5). Hawk Run, Little Bear Creek, Black Creek, Bull Run, Cooks Creek, Frya Run, Monocacy Creek, Hokendauqua Creek, Aquashicola Creek, Indian Creek, Pohopoco Creek, Hunter Creek, Buckwha Creek, White Oak Run, Wild Creek, Mud Run, Stony Creek, Laurel Run, Lehigh River, Little Shades Creek, Shades Creek, Mill Creek, Deep Creek, Abrahams Creek, Trout Brook, and Toby Creek are some of the streams in Pennsylvania to be crossed, some crossed multiple times, but that have naturally reproducing populations of trout. It is important that with recent updates to the Fish and Boat Commission Class A lists that PennEast update this list and ensure all designations are accurate.

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<sup>90</sup> Norman, *supra*.

<sup>91</sup> CAPP (2005), *supra*.

<sup>92</sup> Union of Concerned Scientists, *Climate Change in Pennsylvania – Impacts and Solutions for the Keystone State*, Oct 2008

The synergistic implications of climate change and the PennEast pipeline on stream flows, quality, temperatures, health, and aquatic life were not assessed by the DEIS.

Changes in precipitation – increase in downpours and drought due to earlier spring snowmelt

As documented by experts in the attached reports, including Meliora Design<sup>93</sup> who stated:

“Due to land use changes and soil alteration, there will be permanent long term water quality impacts related to stormwater runoff, including increases in the rate, volume, and frequency of stormwater runoff.”

“The proposed pipeline conditions will significantly reduce the land surface’s ability to retain rainfall and facilitate infiltration, and will increase runoff frequency, volumes, and flow rates, including increased surface erosion and sediment transport to Special Protection or C1 water bodies.”

Furthermore, the loss of riparian vegetation associated with the PennEast pipeline will make impacted streams more susceptible to erosion events, resulting in the loss of riparian lands (including floodplain) and exacerbating the sedimentation impacts of construction. As noted by experts, the deforestation caused by the PennEast pipeline will result in increased stormwater runoff; this will result in increasing flows in the stream with stream banks more susceptible to its erosive forces due to the loss of vegetative protection. Increased erosion means loss of habitat; channel migration that can have serious implications for riparian lands and vegetation over long stretches and long periods of time as the stream continues to erode, downcut and deposit sediment in order to try and reestablish a stable channel; and increased instream sedimentation which is considered a pollutant both legally and scientifically. Having more extreme weather events, including “increased frequency of heavy downpours,” means that the instream flows from both rainfall and runoff will be much more extreme and have stronger erosion potential. These more erosive and extreme flow events will combine with the impacts inflicted by the construction and ongoing land management, including removal of riparian vegetation and forest, associated with the pipeline ROW to intensify the impacts of both.

The ROW associated with PennEast will be the location of compacted soils and, in the case of natural landscapes like forests, the maintenance of plants that have lesser capacity to infiltrate rainfall. The combination of compacted soils with low growing plants (to the degree they are able to grow in the compacted soils or under PennEast’s ROW management protocols) will result in increased runoff to nearby streams, thereby increasing flows that are flooding downstream communities. The combination of increased duration, frequency and intensity of storms by climate change, coupled with the increased landscapes that are the source of stormwater runoff contributing to flood flows, flood peaks, and more erosive stream flows, could be significant in some areas.

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<sup>93</sup> Adams, Michelle, and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

The compacted soils and lost or altered vegetation from the pipeline will not only increase stormwater runoff, but it will decrease groundwater recharge. In addition the presence of the pipeline will already be altering the flow path of some groundwater systems, diverting water from streams and wetlands that would otherwise provide life supporting base flow for them. Increased drought caused by climate change will work with the altered and impacted groundwater flows resulting from the PennEast pipeline to more seriously impact streams during periods of drought. Climate change generally and the PennEast Pipeline specifically, will adversely impact base flow of streams along the pipeline route which will harm water quality, habitat, recreation and potentially drinking water supplies, but together these impacts will be magnified. In addition to adversely impacting stream and/or wetland base flows, drinking water supplies/aquifers could be adversely impacted, losing the historic water recharge they receive.

The threat of increased drought from climate change is significant depending on how quickly the U.S. reduces climate changing emissions – and given that we are commenting on yet another proposal for a fossil fuel based gas pipeline, it is not unlikely that emissions will significantly reduce in sufficient time to prevent these consequences from coming to fruition. According to the Union of Concerned Scientists:

“On a higher-emissions pathway, a short seasonal drought can be expected every year in most of New England by the end of this century, while the frequency of longer droughts could triple to once every 6 to 10 years in parts of New York, Pennsylvania, and Maine— the region’s key agricultural states.”<sup>94</sup>

The ramifications of drought will be dramatically increased by land use changes, such as those that will be inflicted by PennEast. Increased stormwater runoff, reduced groundwater recharge, altering vegetative landscapes, reduced stream baseflow, and reduced recharge of drinking water supplies that will result from PennEast will magnify the adverse implications of climate change for groundwater supplies, drinking water supplies, stream flows and wetlands because there will be less water available for resources impacted by PennEast making them less resilient to these climate change induced periods of drought.

The absolute denial of any consideration of the combined effects of PennEast for recharge, groundwater and baseflow, coupled with the heightened anticipation of drought due to climate change, is inexcusable and fails to fulfill the NEPA review obligation.

For the actual pipeline itself there are also implications from the extreme weather events that will be brought to the region by climate change, including the extreme and more frequent downpours. Because open trench pipeline installations may unnaturally alter both stream bank and streambed (i.e., channel) stability, there is an increased likelihood of scouring within backfilled pipeline trenches.<sup>95</sup> This is because open trenches themselves, when backfilled, may not be compacted to

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<sup>94</sup> Union of Concerned Scientists, *Climate Change in Pennsylvania – Impacts and Solutions for the Keystone State*, Oct 2008

<sup>95</sup> See e.g. Fogg, J. and Hadley, H., 2007, Hydraulic Considerations for Pipelines Crossing Stream Channels. Technical Note 423. BLM/ST/ST-07/007+2880. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. 20 pp. <http://www.blm.gov/nstc/library/techno2.htm>; Doeing, B.J., Williams, D.T. and Bradley, J.B., 1997, Gas Pipeline Erosion Failures: January 1993 Floods, Gila River Basin, Arizona. In Storm - Induced Page 44 of 80

stable pre-trench sediment permeability conditions. Flooding rivers can scour river bottoms and expose pipelines to powerful water currents and damaging debris. The more extreme rainfall events brought by climate change will mean more extreme and erosive flooding events in streams crossed by PennEast, increasing the likelihood of stream scour, exposure and rupture. Additionally, unusually heavy rains associated with climate change, threaten to increase overall stream degradation and channel migration – thereby also exposing buried pipelines.

### Increased damage to crops

Climate change was identified in the DEIS as having adverse impacts for crops due to altered weather events and temperatures. Farmers along the pipeline route who have already been impacted by pipelines have identified the presence of pipelines as adversely impacting their crop yield. One farm has worked to document that the existence of a pipeline across his farm fields has reduced his crop yield by as much as 30% in a given year.<sup>96</sup>

Adding the PennEast pipeline to farm fields will reduce crop yield. Couple that with the altered temperature and weather patterns and the stressors on the crops will be magnified further reducing their ability to survive and produce as robustly as they had historically and as the farmers need them to in order to produce for their customers and to support the economic income they need to continue to sustain and operate their farms.

In addition, the USGCRP Climate Change Impacts in the United States Report states: “To date, all weed/crop competition studies where the photosynthetic pathway is the same for both species favor weed growth over crop growth as carbon dioxide is increased.”<sup>97</sup> This means that while crops impacted by the pipeline and climate change are already struggling to produce, they are also going to be more susceptible to being outcompeted by weeds, which will have further ramifications for crop production and for the increased use of herbicides on agricultural lands with both economic and health implications.

These kinds of effects were not even considered in the DEIS.

### Increased stress on native plants due to invasives

Climate change was identified in the DEIS as causing “increased stress on native vegetation is projected due to the spread of invasive insects and growth of invasive weeds such as kudzu”. “[M]any insect pests, pathogens, and invasive plants like kudzu appear to be highly and positively responsive to recent and projected climate change.”<sup>98</sup> As noted by Native Landscape expert Leslie Sauer permanent pipeline ROWs cause:

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Geologic Hazards, Case Histories from the 1992 - 1993 Winter in Southern California and Arizona; Geological Society of America; Reviews in Engineering Geology, Volume XI (ed. Robert A. Larson).

<sup>96</sup> See attached graphics re the Fulper Farm.

<sup>97</sup> Horton, R., G. Yohe, W. Easterling, R. Kates, M. Ruth, E. Sussman, A. Whelchel, D. Wolfe, and F. Lipschultz, 2014: Ch. 16: Northeast. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 16-1-nn.

<sup>98</sup> Horton, R., G. Yohe, W. Easterling, R. Kates, M. Ruth, E. Sussman, A. Whelchel, D. Wolfe, and F. Lipschultz, 2014: Ch. 16: Northeast. *Climate Change Impacts in the United States: The Third National* Page 45 of 80

“Increased wind movement facilitates movement of weedy propagules and invasive species deep into the forest where they find the way suddenly wide open for them with abundant new ground to colonize. Predators and parasitic birds like cowbirds use these corridors to access otherwise difficult to find prey.”<sup>99</sup>

The increased pressure on natives due to invasives inflicted by the PennEast pipeline will be exacerbated and magnified by the encouragement of invasives imposed by climate change, and vice versa. The two impacts will work synergistically with devastating effects for native species of both plant and animal.

### Movement of bird ranges

As identified in the DEIS, climate change will have implications for changing bird habitat forcing bird ranges to move northward and altering the arrival of migratory species. The PennEast Pipeline will be cutting down hundreds of acres of forest. “Fifty-seven percent of the pipeline right-of-way area, or approximately 446 acres, is currently forested and will permanently be altered from forest during pipeline operation. An additional 139 acres of forest will be removed for construction.”<sup>100</sup> In forested areas the habitat loss will not just be in the immediate footprint of the pipeline, but it will impact an additional 300 feet of forest on either side of the ROW.<sup>101</sup> This means that for every mile of pipeline cut through a forest an additional 12 acres of forest will be harmed. In addition, the pipeline will irreparably alter a tremendous number of wetlands (how many is unclear, as this comment and our attached reports document the incredibly inaccurate, misleading and deficient job PennEast and FERC, through this DEIS, did on assessing wetland impacts), including changing their functions and values.

The result will be to reduce available bird habitat, nesting grounds and feeding grounds. The invasive species problems noted above will further erode habitat and food resources for bird species.

The ramification of this lost habitat will be to make it harder for this northward evolution of species resulting from climate change. Climate change will force the northward migration, PennEast and climate change individually and combined will reduce the available food, habitat and nesting grounds available for these species in our region, thereby impeding their ability to adapt, survive and thrive.

These kinds of effects were not even considered by the DEIS.

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*Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 16-1-nn.

<sup>99</sup> Sauer, Leslie., *Achieving Higher Quality Restoration Along Pipeline Rights of Way*

<sup>100</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>101</sup> Nels Johnson, et al., *Natural Gas Pipelines*, The Nature Conservancy, 1 (December 2011); CNA, *The Potential Environmental Impacts of Fracking in the Delaware River Basin*, 2015; Cara Lee, Brad Stratton, Rebecca Shirer, Ellen Weiss, *An Assessment of the Potential Impacts of High Volume Hydraulic Fracturing (HVHF) on Forest Resources*, The Nature Conservancy, Dec. 19, 2011.

## Other Impacts Ignored by the DEIS and FERC

Other adverse impacts to the region from climate change that, combined with the PennEast pipeline would have more serious implications in need of consideration by the FERC DEIS which didn't even make it to FERC's DEIS list:

- “Suitable forest habitat for maple, black cherry, hemlock, and others is expected to shift northward...” This will threaten tourism as well as lucrative timber such as world-renowned black cherry.”<sup>102</sup>

The DEIS mentions the northward movement of bird habitat, but fails to recognize northward migrations of habitat for other species, as well as the environmental and economic implications of that northward migration. Given that PennEast will maintain a permanent footprint spanning hundreds of acres of what would otherwise be forest land, where migrating native plant species might otherwise settle, and that it will encourage invasive species that adversely impact and kill native plants including trees and shrubs, the implications of pipeline construction combined with climate change for forest species needing to migrate northward is important. The ecological as well as the recreation, social and economic affects must be among the issues considered.

- “Warming climate and shifting distributions and quality of forest habitat is expected to cause substantial changes in bird life. As many as half of the 120 bird species modeled in Pennsylvania could see at least 25-percent reductions in their suitable habitat. Species at greatest risk include the ruffed grouse, white-throated sparrow, magnolia warbler, and yellow-rumped warbler.”<sup>103</sup>

The habitat of Ruffed Grouse includes deciduous and mixed forest, dense undergrowth, overgrown pasture, scrub oak, thick shrubland, young forest, understory including in Carbon, Luzerne, Northampton, Bucks, Hunterdon, Lehigh Counties. These are all habitats and regions that will be cut and damaged by PennEast, and for which analysis of direct impacts, as well as impacts compounded by climate change, including for this species were not considered.

The habitat of White-throated Sparrow includes coniferous and mixed forest, dense thickets, secondary growth areas, around ponds or openings, forest edge including in Hunterdon, Luzerne, Northampton, Carbon, Lehigh, and Bucks. These are all habitats and regions that will be cut and damaged by PennEast, and for which analysis of direct impacts, as well as impacts compounded by climate change, including for this species were not considered.

The habitat of Magnolia Warbler includes coniferous and mixed forest especially young spruces, nests in trees, during migration- deciduous shrubs or low trees including in Luzerne, Northampton, Carbon, Lehigh, Bucks, and Hunterdon Counties. These are all habitats and regions that will be cut and damaged by PennEast, and for which analysis of direct impacts, as well as impacts compounded by climate change, including for this species were not considered.

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<sup>102</sup> Union of Concerned Scientists, *Climate Change in Pennsylvania – Impacts and Solutions for the Keystone State*, Oct 2008

<sup>103</sup> Union of Concerned Scientists, *Climate Change in Pennsylvania – Impacts and Solutions for the Keystone State*, Oct 2008

The habitat of Yellow-Rumped Warbler includes mature coniferous and mixed coniferous/deciduous forest, forest edge including in Luzerne, Northampton, Carbon, Lehigh, Bucks, and Hunterdon Counties. These are all habitats and regions that will be cut and damaged by PennEast, and for which analysis of direct impacts, as well as impacts compounded by climate change, including for this species were not considered.

The DEIS mentions the northward movement of bird habitat and altered migratory patterns, but it fails to discuss the actual loss of habitat due to climate change of a variety of bird species, including the ones noted above as being at risk. Given that the PennEast pipeline would destroy a variety of natural habitats important for bird species, including forest, wetlands, meadow and more that are important habitat for a variety of species, and that it would also invite in invasive plants and animals that will further degrade, damage or destroy habitat, the combined effect of a PennEast pipeline with climate change for the loss or degradation of bird habitat is an important consideration.

- Effects on Amphibians

Amphibians are important indicators of environmental health and water quality. The timing of amphibian breeding is largely driven by environmental cues such as temperature and moisture, and because of this, their breeding phenology may be directly affected by global warming. Amphibians in regions such as the northeastern United States (where the proposed PennEast pipeline would be) may be even more susceptible to increases in temperature. Amphibian species in the northeast spend a large portion of the year inactive, escaping either cold winters or hot summers. Subtle increases in temperature or moisture trigger them to emerge from their hibernacula in the spring. Immediately upon emergence, they migrate to ponds or streams to breed. As average air temperatures increase from climate change, amphibians will start to emerge and breed earlier in the year. If amphibians breed too early in the season, they may be more vulnerable to early snowmelt induced floods and early season freezes that are usually less common later in the season. Amphibians tricked by the warm temperatures from climate change may emerge too early and then die when a cold front comes in.

Amphibians are also affected by extreme weather events associated with climate change, particularly drought. In addition to requiring water for breeding, amphibians need to keep their skin moist to avoid drying up in the sun. Rain water, shade from trees, and moist soil are very important to amphibians. In drought conditions caused by climate change, long periods with no rain can be detrimental to amphibian populations. These effects are worsened by deforestation because it eliminates the shade that the trees provide. Shade keeps the soil on the forest floor moist by blocking the sun's rays. Many amphibians, particularly salamanders, burrow in this moist soil in between periods of rain. Without the shade from the canopy and with no rain, this soil is exposed to full sun exposure and quickly dries up and amphibians become desiccated. Natural gas pipeline construction involves the clearing of many acres of forest, so this is a prime example of natural gas infrastructure working hand-in-hand with climate change and compounding impacts. At the same time, FERC falsely states that vernal pools to be cut by the pipeline will only have temporary impacts or not significant sustaining impacts yet it ignores to consider the 1,000 feet of upland forest that amphibians using vernal pools require for parts of the year when they are not in their breeding vernal pool habitats. A pipeline cut adjacent and through a vernal pool or within 1,000 feet of a vernal pool can be a death sentence for migrating amphibians who may not be able to successfully cross the dry compacted

pipeline route to reach their seasonal vernal pool.<sup>104</sup> Predation also increases with these pipeline cuts.

In addition, local changes in the environment can decrease immune function and lead to pathogen outbreaks and elevated mortality in amphibians. Conditions can change to become more favorable for the growth of a pathogen. For example, the chytrid fungus (*Batrachochytrium dendrobatidis*) grows best in culture between 6-28 degrees C and dies at 32 degrees C. The chytrid fungus causes an infectious disease in amphibians called chytridiomycosis which has killed millions of amphibians worldwide and has affected about 30% of all amphibian species in the world. Climate change may make environmental conditions more conducive for this disease to spread as well as cause weakened immune systems, making it more difficult for amphibians to fight off the disease. This disease has been documented in Pennsylvania and New Jersey which are both home to multiple state listed amphibian species.

Clearly, these amphibian species are at great risk and they would be put at an even greater risk by the combined impacts of climate change and the construction of the PennEast pipeline.<sup>105</sup> The DEIS failed to consider these impacts.

### **The DEIS Alternatives Analysis is Fundamentally Flawed**

FERC cannot interpret the Project's purpose and need so narrowly that every conceivable alternative is ruled out by definition. See *Simmons v. U.S. Army Corps of Eng's*, 120 F.3d 664 (7th Cir. 1997) (cautioning agencies not to put forward a purpose and need statement that is so narrow as to "define competing 'reasonable alternatives' out of consideration (and even out of existence)"); *Nat'l Parks & Cons. Ass'n v. Bureau of Land Mgmt.*, 606 F.3d 1058, 1072 (9th Cir. 2009) (finding a purpose and need statement that included the agency's goal to address long-term landfill demand, and the applicant's three private goals was too narrowly drawn and constrained the possible range of alternatives in violation of NEPA). Only PennEast's proposed Project offers the means of meeting FERC's stated requirements, thus all alternatives are preordained to fail in comparison. Such a narrow statement of purpose and need, and failure to examine other system alternatives, undermines the NEPA process and will not be upheld. *Env'tl. Prot. Info. Ctr. v. U.S. Forest Serv.*, 234 F. App'x 440, 443 (9th Cir. 2007) (agencies cannot "define[] the objectives of the project so narrowly that the project [is] the only alternative that would serve those objectives").

FERC rejected co-locating the PennEast line along Transcontinental's Leidy Line gas transportation system for two reasons, but neither is sufficiently explained in the DEIS. Primarily FERC contends that because colocation would not "provide access to the delivery points" as the proposed project this alternative is rejected. However, considering the close proximity of these two right of ways, FERC never explains why those deliver points could not be accessed. Furthermore, FERC contends that "due to the amount of commercial, industrial, and residential development that has occurred adjacent to Transco's existing right-of-way" this alternative was rejected. However, FERC never explains how much of the right of way would be inaccessible nor how much additional

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<sup>104</sup> Delaware Riverkeeper Network Field Monitoring Report, *Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams*. Addendum to Comment for the PennEast Pipeline.

<sup>105</sup> Vredenberg, V., McDonald, M., & Sayre, T. (2008). *Climate Change. AmphibiaWeb: Information on amphibian biology and conservation, 2016, Berkeley, California*. Retrieved from <http://amphibiaweb.org/declines/ClimateChange.html>

greenfields would need to be constructed. It would seem that the environmental footprint of the proposed project would be less if collocated with Transco even if the right of way had to deviate at places. By failing to sufficiently examine other competing pipeline system alternatives FERC violates the Natural Gas Act's overriding purpose "to protect consumers against exploitation at the hands of natural gas companies." *United Distrib. Co. v. FERC*, 88 F.3d 1105, 1122 (D.C. Cir. 1996) (citation omitted). Neither NEPA nor the Natural Gas Act allows FERC to reject all alternatives except the Project in order to promote the pecuniary interests of its already identified project shippers. As such, the Environmental Assessment and Order are factually and legally deficient.

The DEIS Alternatives Analysis is fundamentally flawed. The analysis assumes as true the characterizations of "need" made by PennEast. In fact there are multiple analyses already on the record, as well as comments filed, in addition to this comment, that demonstrate there is in fact key for the PennEast pipeline project, and to the degree there is an assertion of need it is based upon a self-manufactured claim.

Of priority concern is FERC's failure in this DEIS to consider other mechanisms for achieving energy goals in the region that are not shale gas dependent – such as implementation of increased energy efficiency strategies and renewable energy strategies such as solar, wind, geothermal and environmentally protective hydro.

As discussed in the attached expert report from Key-Log Economics:

"Changes in energy markets due to energy efficiency gains and/or further market penetration by renewable alternatives to fossil fuels are reasonably foreseeable. For example, renewable energy accounted for 40% of new domestic power capacity installed (American Council On Renewable Energy, 2014), and the relative cost of producing power from renewable sources, which is already competitive, is falling (Randall, 2016; U.S. Energy Information Administration, 2016). Moreover, and as shown in Lander (2016), "there are 49.9% more resources available to meet peak day demand from local gas distribution companies in the region than is needed (p.9)." In light of these facts and related factors, FERC must consider alternatives that reflect the likely future reality in which the gas the PennEast pipeline would transport is not needed and/or is not a cost-effective choice for consumers or electric power generators. To do otherwise—that is, to focus narrowly on only transportation options—could lead to a federal action that imposes significant environmental effects and associated economic costs for no reason."

### **Continued Use of Segmentation in this DEIS is Improper**

The D.C. Circuit in *Delaware Riverkeeper v. FERC*, identified two tests for evaluating whether an agency has improperly segmented its review of a project. *Delaware Riverkeeper Network, et al. v. Federal Energy Regulatory Commission*, 753 F.3d 1304, at 1314-1315 (D.C. Cir. 2014). In the *Delaware Riverkeeper* case – as here – FERC failed both tests. First, the Court stated that for the purpose of segmentation review, an agency's consideration of the proper scope of its NEPA analysis should be guided by the "governing regulations," which were 40 C.F.R. § 1508.25(a). *Id.* The same analysis is required in the instant matter. Second, the Court in *Delaware Riverkeeper*, also stated that even if the segmentation analysis was guided instead by the test articulated in *Taxpayers Watchdog v. Stanley*, 819 F.2d 294 (D.C. Cir. 1987), FERC still unlawfully segmented its review of the projects. *Id.* As shown below, FERC here similarly fails both tests for improper segmentation review of the proposed Project.

An agency should prepare a single programmatic Environmental Impact Statement for actions that are “connected,” “cumulative,” or “similar,” such that their environmental effects are best considered in a single impact statement. *Am. Bird Conservancy, Inc. v. FCC*, 516 F.3d 1027, 1032 (D.C. Cir. 2008); 40 C.F.R. § 1508.25(a). “Actions are ‘connected’ or ‘closely related’ if they: (i) Automatically trigger other actions which may require environmental impact statements; (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously; [or] (iii) Are interdependent parts of a larger action and depend on the larger action for their justification.” *Hammond v. Norton*, 370 F. Supp. 2d 226, 247 (D.D.C. 2005) (quoting 40 C.F.R. § 1508.25(a)(1)). Similar actions have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. *Id.* at 246; 40 C.F.R. § 1508.25(a)(3). NEPA requires “agencies to consider the cumulative impacts of proposed actions.” *NRDC v. Hodel*, 865 F.2d 288, 297 (D.C. Cir. 1988) (“Hodel”). See also *TOMAC v. Norton*, 433 F.3d 852, 864 (D.C. Cir. 2006). An agency must analyze the impact of a proposed project in light of that project’s interaction with the effects of “past, current, and reasonably foreseeable future actions.” 40 C.F.R. § 1508.7.

“Piecemealing” or “segmentation” is the unlawful practice whereby a project proponent avoids the NEPA requirement that an EIS be prepared for all major federal actions with significant environmental impacts by dividing an overall plan into component parts, each involving action with less significant environmental effects. *Taxpayers*, 819 F.2d 294, 298 (D.C. Cir. 1987). Federal agencies may not evade their responsibilities under NEPA by “artificially dividing a major federal action into smaller components, each without a ‘significant’ impact.” *Coal. on Sensible Transp. v. Dole*, 826 F. 2d 60, 68 (D.C. Cir. 1987). See also 40 C.F.R. § 1508.27(b)(7).

The general rule is that segmentation should be “avoided in order to insure that interrelated projects, the overall effect of which is environmentally significant, not be fractionalized into smaller, less significant actions.” *Town of Huntington v. Marsh*, 859 F.2d 1134, 1142 (2d Cir. 1988). Without this rule, developers and agencies could “unreasonably restrict the scope of environmental review.” *Fund for Animals v. Clark*, 27 F. Supp. 2d 9, 16 (D.D.C. 1998) (“Fund”).

In addition to failing to meet the requirements of 40 C.F.R. § 1508.25(a), FERC also fails to satisfy the three of the factor test articulated in *Taxpayers*, thus demonstrating that FERC impermissibly segmented its NEPA analysis. *Taxpayers*, 819 F.2d 294 (D.C. Cir. 1987). To determine whether a project has been unlawfully segmented, “courts have considered such factors as whether the proposed segment (1) has logical termini; (2) has substantial independent utility; (3) does not foreclose the opportunity to consider alternatives[.]” *Taxpayers*, 819 F.2d at 298. In *Delaware Riverkeeper*, the court held that even if the court were to expand its analysis from Section 1508.25(a) to the factors in articulated in *Taxpayers*, FERC’s defense of its action was still deficient. *Delaware Riverkeeper*, 753 F.3d at 1314-16 (the court held that the projects did not have “(1) has logical termini; [or] (2). . . substantial independent utility.” (the court’s examination did not reach the remaining factor)). FERC failed to satisfy each of the factors identified in the *Taxpayers’* test.

A project lacks “independent utility” if it could not function or would not have been constructed in the absence of another project. *Wetlands Action Network v. U.S. Army Corps of Engineers*, 222 F.3d 1105, 1118 (9th Cir. 2000). See also *W. N.C. Alliance v. N.C. DOT*, 312 F. Supp. 2d 765, 774-775 (E.D.N.C. 2003) (project widening highway section lacked independent utility because it would leave a “bottleneck” of narrow highway to north, such that traffic congestion between the

termini of the project would be worsened until construction of later project widening bottleneck section).

It is clear that partners of the PennEast Pipeline Company, LLC are proposing additional projects that, given their connected ownership, physical connection, contemporaneousness in terms of time and space, and the planned route for the gas – are integral parts of the PennEast Pipeline project and should be considered as part of cumulative impacts of the PennEast Pipeline project and plan. Spectra Energy Partners is a “member company” in PennEast Pipeline Company, LLC and 10% owner of the PennEast Pipeline proposal. Spectra Energy is 100% owner of Texas Eastern Pipeline that will be interconnected with PennEast in/around Lambertville, NJ. Spectra Energy is currently planning for and proposing a new project called the Texas Eastern Marcellus to Market project (M2M) in which it clearly identifies, as a primary goal, the redirection and transfer to western markets of gas brought via the PennEast Pipeline that will transfer at/thru the compressor station in Lambertville, NJ. Spectra’s M2M project seeks to increase capacity along the Texas Eastern pipeline segment between the Lambertville NJ Compressor Station and Eagle (in Chester County PA) Compressor Station. The M2M project, consists of upgrades to existing lines including some new facilities. Indeed absent the PennEast pipeline project the M2M project is not viable.

The M2M project sketch map clearly documents Spectra Energy’s plan to receive most of its anticipated gas (over 62%) from the PennEast Pipeline. The map also confirms that Spectra Energy plans to send the gas *west* from Lambertville Station into Pennsylvania via its Texas Eastern systems. On its website, Spectra makes very clear that the proposed PennEast pipeline will be the primary source of gas that the M2M project will transport.

Specifically, according to the Spectra Energy website, the new M2M pipeline would receive the majority of its gas, 62.5%, (up to 125,000 dekatherms per day (Dth/d)) from the PennEast pipeline (this equates to over 11% of PennEast’s anticipated capacity).

Spectra is also pursuing the proposed Greater Philadelphia Expansion Project. The stated intent of the project is to increase the volume of gas Spectra can transport to the Philadelphia region from the Eagle Compressor Station – the same station that is part of Spectra’s proposed M2M Project. The Philadelphia region has been under discussion for an LNG export facility, which is one obvious pathway for future intended export of PennEast gas. This export facility must be disclosed and analyzed in addition to the Cove Point LNG export facility already identified by the Delaware Riverkeeper Network and Mr. Berman as a likely recipient of the gas. FERC did not conduct this analysis in the current DEIS.

The National Environmental Policy Act clearly requires FERC consideration of these interconnected projects obviously being contemplated and planned for in the same time frame by the same owner for delivery of the same gas. There exists a physical, functional, and temporal nexus that cannot be overlooked and FERC is now fully aware of these additional elements of the PennEast Pipeline project that is before FERC and freely available to the public for review and consideration. Spectra Energy clearly intends and plans for these projects to operate as an interconnected whole, and as such their cumulative impacts must be considered as part of the review of the PennEast Pipeline project and the M2M project when it is actually proposed.

The DEIS fails to undertake this mandated analysis.

**DEIS fails to address comments and experience that shows use of standard constructions practices will result in environmental violations and degradation.**

The DEIS asserts in multiple locations in multiple ways that the project will be constructed in full compliance with all applicable laws and that in temporary work spaces and restored areas the natural landscape will return to its former, or some altered but healthy ecological status. In fact, experience shows that neither is true. The Delaware Riverkeeper Network pointed this out in great detail in our comments to date, the fact that FERC fails to consider the reality of pipeline construction, and that construction is fraught with environmental violations and a failure of mitigation/restored areas to return to ecological health is a significant deficiency that ignores the reality and comments filed.

As the result of document reviews and field investigations during construction of three sections of pipeline -- the TGP 300 line upgrade, TGP Northeast Upgrade Project (NEUP), and Columbia 1278 pipeline -- in the Upper Delaware River Basin the Delaware Riverkeeper Network documented:

- over 60 instances where best management practices (BMPs) were not present, inadequate or not functioning or in need of repair, maintenance or reinforcement,
- 4 instances of fueling being conducted in wetlands or near waterbodies,
- dozens of instances of poor signage and staking and mapping errors which sometimes led to impacts off of the permitted Right of Way (ROW), loss of trees outside the ROW, and inaccurate mitigation calculations,
- thermal impacts, extreme (and unreversed) soil compaction, nutrient impacts, benthic invertebrate changes from pipeline cuts, including for streams with exceptional value, high quality and or C-1 anti-degradation classifications,
- discrepancies between pipeline company monthly compliance reports and what work and activities to meet compliance and avoid pollution were actually occurring or not occurring on the ground. We also noted excessive lag time in the filing and/or public release of construction reports making for difficult follow up in the field. We documented too few pipeline inspectors and a lack of oversight person-power for these extensive linear projects that spanned many miles and where work was going on simultaneously along the routes with little independent oversight.

Based on first hand observations and monitoring of these pipelines, it is clear that:

- Interstate natural gas pipeline projects result in a multitude of environmental impacts that inflict high levels of unnecessary ecological damage – this damage is not avoided, nor properly mitigated, despite the resource reports that are drafted or the guidance provided by FERC or other federal or state agencies;
- Violations of environmental laws are common place and an accepted part of pipeline construction – and compliance outweighs penalties and violations to the detriment of the environment and the public;
- Construction problems and potential violations are not properly responded to by the company, by FERC or by other state or federal agencies and mitigation does not undo the harms inflicted -as a result of both, pipelines inflict enduring and/or repetitive harms on natural resources; and

- Current or proposed guidance from FERC or other regulatory agencies do not prevent, avoid, or otherwise mitigate these ecological and public harms or the multitude of bad practices used by the pipeline companies.

Attached please find: *Field Monitoring Report, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Stream., Addendum to Comment for the PennEast Pipeline*, a compilation of Delaware Riverkeeper Network technical documents, reports and observations compiled as the result of field monitoring which support, inform and expand upon these conclusions. DRN's observations in the field demonstrate and document that construction, operation and maintenance practices like those being proposed by the PennEast pipeline company, even when followed in full compliance with regulatory standards, results in unavoidable, unmitigated and irreparable harm and violations of state water quality standards and wetlands protections. In addition, DRN monitoring has documented that over and above these impacts, violations of law are commonplace during pipeline construction, operation and maintenance and as a result the violations of law, including water quality standards and wetland protections, are further exacerbated.

The DEIS needs to build in a consideration of the inevitable impacts and implications of construction activity for the project that will necessarily involve violations of the laws governing the construction activity. No pipeline project of this scale is ever built without violations.<sup>106</sup>

### **DRBC legal authority misrepresented in the DEIS – thereby misleading the public and decision-making officials.**

The mission and authority ascribed to the DRBC in the DEIS is flagrantly incorrect and misleading. The authority of the DRBC is far broader than asserted by FERC in the DEIS. FERC's failure to understand and give due regard to DRBC's authority fails to ensure full and accurate information has been provided to the public and suggests that FERC anticipates authorizing pipeline actions that violate the law. DRBC's legal authority is not preempted by that of FERC, and therefore, DRBC retains its full authority to review, approve, approve with modifications and/or deny the PennEast pipeline project the DRBC docket it requires to proceed to construction, operation and maintenance.

Section 3.8 of the Compact provides in relevant part:

No project having a substantial effect on the water resources of the basin shall hereafter be undertaken by any person, corporation, or governmental authority unless it shall have been first submitted to and approved by FERC, subject to the provisions of Sections 3.3 and 3.5. FERC shall approve a project whenever it finds and determines that such project would not substantially impair or conflict with the comprehensive plan and may modify and approve as modified, or may disapprove any such project whenever it finds and determines that the project would substantially impair or conflict with such plan. FERC shall provide by regulation for the procedure of submission, review and consideration of projects, and for its determinations pursuant to this section.

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<sup>106</sup> See discussion in this comment and attachment titled: Delaware Riverkeeper Network *Field Monitoring Report, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams*. Addendum to Comment for the PennEast Pipeline.

In addition to the DRBC Rules of Practice and Procedure that apply to hydrostatic testing water withdrawals and wastewater discharges discussed in the DEIS, the DRBC Rules of Practice and Procedure (“RPP”) clearly subject natural gas pipelines and appurtenances to DRBC authority in the following additional circumstances<sup>107</sup>:

- 1) if the Executive Director of FERC specifically directs;
- 2) if any state or federal agency refers a project pursuant to specific RPP provision;
- 3) if the project in question crosses an existing or proposed reservoir or recreation area that has been incorporated into the Comprehensive Plan; and
- 4) if the project involves a significant disturbance of ground cover affecting water resources.

Also of significant legal relevance are the DRBC Special Protection Waters Regulations – because Section 3.8 review does clearly apply to the PennEast Pipeline Project; the Special Protection Waters regulations also clearly apply. In 1992, in response to a petition filed by the Delaware Riverkeeper Network, the DRBC launched the Special Protection Waters (“SPW”) program, which established regulations to protect existing water quality in the upper and middle sections of the non-tidal Delaware River, portions of which had been designated by the federal government as part of the National Wild and Scenic Rivers System in 1978. Following the federal designation of an additional 38.9 miles of the Delaware in the National Wild and Scenic Rivers System in 2000, and again in response to a petition filed by the Delaware Riverkeeper Network, in 2008 the DRBC expanded SPW coverage to include the River from the Delaware Water Gap National Recreation Area downstream to the head of tide at Trenton, New Jersey. The entire 197-mile non-tidal river is now included under the SPW regulations, which is believed to be the longest stretch of anti-degradation policy established on any river in the nation.

Article 3 of the Water Code, Section 3.10.3.A.2, establishes the strict anti-degradation standard that the DRBC applies to Special Protection Waters of the Watershed: “It is the policy of the Commission that there be no measurable change in existing water quality except towards natural conditions. . . .” Water Code Article 3, Section 3.10.3.A.2.e, requires that “[p]rojects subject to review under Section 3.8 of the Compact that are located in the drainage area of Special Protection Waters must submit for approval a Non-Point Source Pollution Control Plan that controls the new or increased non-point source loads generated within the portion of the project’s service area which is also located within the drainage area of Special Protection Waters.”

Given that the PennEast Pipeline project will, among other elements, cross DRBC Comprehensive Plan areas, will cause a significant disturbance of ground cover affecting water resources, will impact special protection waters, and the company has been notified it will be subject to DRBC jurisdiction by the Executive Director, the proposed PennEast Pipeline is subject to the full extent applicable of DRBC authority and is in need of a DRBC docket addressing all relevant impacts (not just those associated with hydrostatic testing) before it can proceed to and through any portion of the project’s construction and operation.

### **DEIS Data and Information Gaps Makes the Document Legally Deficient and Incomplete – a New and Complete Supplemental DEIS is Required.**

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<sup>107</sup> These provisions are in addition to others that may apply depending upon legal interpretation and the outcome of future legal actions and/or decision-making.

Missing Info according to the DEIS:

The DEIS is missing a tremendous amount of information. FERC acknowledges the huge data gaps throughout the DEIS document. Among the many information gaps identified by FERC itself are:

1. Evaluation of the presence of working and abandoned mines near the proposed crossing of the Susquehanna River;
2. Evaluation of liquefaction hazards along the pipeline route and at the compressor station site;
3. Final landslide hazard inventory;
4. Necessary mitigation measures and post construction monitoring plan for liquefaction hazards and landslide hazards;
5. Evaluations to support routine/mitigation measures through geologically hazardous areas;
6. Final landslide inventory;
7. Landslide mitigation measures with locations;
8. Post construction landslide monitoring plan;
9. Final karst mitigation plan;
10. Results of all geotechnical investigations, including karst areas, necessary for HDD planning and design;
11. Final planned design of each HDD crossing;
12. A revised/final list, based on final surveys, of water wells and springs within 150 feet of any construction workspace (500 feet in areas characterized by Karst terrain);
13. Identification of the management and field environmental professionals responsible for notification for contaminated sites;
14. Documentation of the final hydrostatic test water withdrawal sources and locations;
15. Documentation of all necessary permits and approvals for each hydrostatic test water withdrawal source;
16. Identification of special construction methods for construction in extremely saturated wetlands;
17. Justification for required additional workspace to accommodate special construction methods for extremely saturated wetlands;
18. A revised/final table of impacts on vernal pools within or near the proposed workspaces based on completed surveys;
19. An Invasive Plant Species Management Plan for use during construction and operation;
20. A Migratory Bird Conservation Plan;
21. Identification of appropriate seed mixes to be used during revegetation efforts;
22. Completed surveys identifying all potential suitable habitats for special status species in the project area;
23. Remaining site specific construction plans for all residences within 25 feet of the construction ROW and additional temporary workspaces (ATWS) including landowner approval;
24. Mitigation measures to minimize adverse impacts for the 7 residential developments, 3 commercial developments, 2 municipal developments and 1 hospital expansion identified as being within 0.25 miles of the project and its facilities;
25. Update on the status of the site specific crossing plans for each of the recreational and special interest areas listed as being crossed or otherwise affected by the pipeline;

26. Results of consultations with NRCS and the landowner of a known USDA easement crossing, including proposed mitigation measures to be implemented and copies of correspondence;
27. Documentation of PA and NJ State Historic Preservation Offices (SHPOs) regarding proposed avoidance, resource identification, recommendations, updated documentation, avoidance plans and evaluation reports/treatment plans;
28. Treatment plans or mitigation for National Register of Historic Places – eligible archaeological sites that cannot be protected from project impacts;
29. Identification of National Park Service concerns with regards to effects to trails and cultural resources;
30. A vibration monitoring plan and modification of blasting plan that include a review of potential effects to cultural resources;
31. Mitigation measures for noise levels at the proposed Kidder Compressor Station;

Given all of these self- identified missing pieces of the DEIS, coupled with the missing, inaccurate and deficient information documented in this and other comments, it is impossible for FERC to honestly assert it was able to conclude that: “construction and operation of the Project would result in some adverse environmental impacts, but impacts would be reduced to less-than-significant levels with the implementation of PennEast’s proposed and our recommended mitigation measures.”

In addition to the missing and deficient information identified by FERC, Delaware Riverkeeper Network experts have identified a multitude of deficiencies, inaccuracies and missing information discussed in the attached reports including, but not limited to, the following missing information:

1. DEIS Figure 3.3.1-3 which shows the layout of the proposed preferred route and the Bucks County Alternative fails to show the lateral pipeline to the proposed Gilbert Interconnect which requires crossing the Delaware River;
2. Full evaluation of alternatives 7 and 9 given their watershed protection benefits;
3. DEIS fails to consider the environmental ramifications of the open trenching method of wetland crossings, including impacts to groundwater flows that are so vital to the majority of wetlands impacted by this project;
4. The DEIS fails to disclose sufficient details about proposed water sources for hydrostatic testing;
5. HDD crossing plans including specific crossing area, specific methods to be used, location of mud pits, pipe assembly areas, all areas to be disturbed and/or cleared for construction, containment plans for spills, contingency plans, etc.;
6. HDD water discharge details including the specific volume of anticipated discharge, discharge method and impacts on receiving streams;
7. Standards used to guide HDD water withdrawals without preventing impacts on downstream ecological or human uses and needs;
8. The DEIS should provide a table of bedrock aquifers that includes relevant properties, including specific capacity statistics or well yields, and conductivity where available.
9. The DEIS needs to include map, analysis and evaluation of the recharge, runoff, pollution, vegetation, habitat, soil and erosion impacts resulting from the combination of soil type, slope, compaction potential and depth to bedrock for each section of pipeline along the proposed preferred route as well as alternatives.

10. The DEIS should include a complete inventory of springs and seeps within a quarter mile of the pipeline to adequately consider the changes which could occur due to pipeline construction.
11. The DEIS should present the result of a final karst study for the area and present plans for mitigating problems caused by constructing through karst or caused by rapid contaminant transport within karst.
12. The DEIS should include data or information regarding the mineral content of the soils to be crossed by the proposed pipeline and the results of leaching tests that should be required.
13. The DEIS should assess the potential for pipeline construction to generate acid generation or leach metals in all areas where it crosses mine spoil.
14. The DEIS should present avoidance and mitigation discussions focused on preventing the leaching and transport of acid and metals from the site.
15. The DEIS should provide the data and references supporting the DEIS assertion that “shallow groundwater ... generally have (sic) low arsenic concentrations and that high arsenic concentrations ... are the result of more mature groundwater interacting with geochemically susceptible and arsenic-enriched water bearing zones, which are often deeper wells” (DEIS, p 4-12).
16. The DEIS should provide the data and references supporting the DEIS assertion that there is “no indication that common construction activities that involve shallow excavation, such as home construction, has resulted in increased arsenic concentrations in water supply wells” (DEIS, p 4-12).
17. The arsenic analysis provided in the DEIS is insufficient to indicate that arsenic leaching from pipeline construction in the Newark Basin would not be a problem for shallow groundwater and therefore needs to legitimately and scientifically analyze this issue.
18. The DEIS should provide a plume map of groundwater contamination and a map showing soils contamination from the Palmerton Zinc Pile Superfund site and assess the implications of the various proposed pipeline routes for water, groundwater and drinking water contamination.
19. The DEIS failed to consider: How pipeline construction and operations could affect recharge and shallow groundwater flow in aquifers near the proposed pipeline; Preferential flow caused by trenching in the aquifer; Potential contaminant transport enhanced by the trenching; Groundwater drawdown caused by the trenching.
20. The DEIS fails to consider how the project construction would affect recharge rates, which are highly variable with the underlying geology, soil type and thickness, and topography controlling the actual recharge location.
21. As part of an analysis of preferential flow, the DEIS should also analyze the potential for the trench backfill to facilitate the movement of contaminants through the groundwater.
22. The DEIS fails to consider the pipeline trench as a pathway for contamination.
23. The DEIS fails to define and analyze a reasonable range of alternatives.
24. The DEIS overestimates asserted job and other economic benefits.
25. The DEIS fails to account for the public health impacts of the proposed project.
26. The DEIS fails to account for the social cost of carbon.
27. The DEIS fails to include an analysis of ecosystem services lost due to the construction, operation and maintenance of the pipeline.
28. The DEIS does not properly account for impacts to property values from construction, operation and maintenance of the pipeline.
29. The DEIS fails to require sufficient information to determine the potential extent of blasting at each stream or wetland crossing.

30. The DEIS fails to consider site specific conditions to determine whether blasting in stream channels may be required.
31. The DEIS fails to address that proposed pipeline construction practices and long-term maintenance of the ROW in a non-forested condition will alter land surface conditions and result in greater stormwater impacts.

The many deficiencies noted in the attached report by Dr. Jim Schmid regarding PennEast materials on wetlands carry forward into the DEIS data, analysis, and findings. Dr. Schmid's detailed analysis was based on filings by PennEast with FERC, the State of Pennsylvania, and elsewhere. Much of the detail provided in those other filings that were the basis of this analysis were not available as part of the DEIS.<sup>108</sup> Specifically, it is a marked deficiency that the DEIS does not include detailed wetland information necessary for expert review like that of Dr. Schmid to accurately review and determine the quality of the wetlands that are to be impacted. Dr. Schmid's report based on the materials provided to other regulatory agencies demonstrates just how deficient, inaccurate, and misleading PennEast has been, and FERC is now adopting PennEast's assertions whole cloth. FERC and PennEast had the opportunity to remedy these many deficiencies, inaccuracies, missing data and problems in the DEIS and yet chose not to remedy them or address them in the DEIS. For more detail on the items identified below see attached report by Dr. Schmid.

- The size (acreage) of some wetlands along the proposed pipeline were undermapped significantly.
- There are internal discrepancies in the reported acreage of many delineated wetlands in the PennEast documents upon which this DEIS is based.
- Most wetlands within and along the proposed pipeline right-of way (ROW) are not visibly flagged in the field making field verification and ground truth difficult.
- Some wetlands which should be classified as "exceptional value" pursuant to Pennsylvania law were incorrectly identified by the applicant as "other"
- An assessment of the functions and values of existing wetlands has not been done, and no evaluation of proposed impacts on the functions and values of wetlands has been done.
- Additional wetlands exist within approximately 19.4 miles of right-of-way (24% of the proposed pipeline Study Area) that have not been investigated because access was not (initially) granted. Impacts to those wetlands have not been acknowledged, calculated, or mitigated for.
- No "existing use" analysis of affected streams has been done, possibly leading to an undercount of the number and extent of Exceptional Value Wetlands.
- Bog turtle searches did not encompass the entire area requested by USFWS.
- Certain areas of suitable bog turtle habitat were not acknowledged by the applicant.

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<sup>108</sup> There does not appear to be any detailed wetland delineation information needed to compare to the detailed findings in Dr. Schmid's report. In Volume 1, there is only Table 4.4.2-1 on page 4-70 that is a summary claiming that 56 acres of wetlands would be affected by construction disturbance and 35 acres would be affected by operation disturbance. In Volume 3, Table G10 is a summary of Wetland and Waterbody Crossings but it doesn't provide the wetland type or the acreage. Table G11 shows the wetlands crossed in PA and Table G12 shows the wetlands crossed in NJ. Here the DEIS lists the wetland type but leaves out the Wetland ID numbers and acreage of each wetland. There does not seem to be tables for impacted wetlands and delineated wetlands; only wetlands crossed.

- FERC cannot develop an appropriate mitigation plan based on the information and analysis in the DEIS with regard to wetlands because the DEIS “provides no evidence that the functions and values of each wetland proposed to be impacted have been determined or evaluated.”
- The only information evaluating wetland quality is entirely missing from the DEIS. Specifically, the wetlands tables do not indicate the quality of the wetland impacted pursuant to the state classification of the wetland.
- Most of the wetlands data is unreliable because it is largely “based on available remote sensing mapping, and not on field-based investigations.”
- There are numerous “instances where wetlands shown on project drawings appear to be significantly under-mapped”

To the extent these deficiencies in accurately describing both the size and quality of the wetlands subject to construction for the Project, FERC cannot accurately determine the appropriate scope of mitigation necessary to compensate for these irreversible and unavoidable harms. For example, many of the wetlands in the Project area are not appropriately classified pursuant to the Pennsylvania Code and the requirements therein, thus preventing FERC and the public from considering the quality of the wetlands impacted. Indeed, there is no data in the DEIS analyzing wetland quality outside of this classification system, therefore it is critical that these classifications are exactly accurate (which they are not).

Other critical deficiencies include, but are certainly not limited to:

- “While the DEIS and the various Resource Reports and updates included in the PennEast application include information and statistics related to each of these (and other conditions), the DEIS utterly fails to examine these conditions as they relate to each other and potentially impact project conditions at stream and wetland crossings. For example, it is impossible, from the information presented in the DEIS and the PennEast application materials, to directly determine how many stream crossings of Exceptional Value streams in Pennsylvania will involve open cuts in areas that are currently forested conditions, on public lands, on steep slopes or erosive soils, or any combination of the above conditions that can impact water quality and that should inform pipeline location and construction decisions. It is impossible to easily determine if these crossings also include Additional Temporary Work Space (ATWS) areas within 50 feet of the waterbody that further increase disturbance and the potential for water quality impacts, or are located in geologic formations that may require blasting within the stream channel.

While the DEIS and PennEast application materials provide considerable data and tables in multiple locations and formats, neither the DEIS nor the PennEast application materials include any comprehensive compilation and evaluation of the data at stream and wetland crossings, or any indication that site specific conditions and their impact on water quality (or other environmental impacts) have informed decisions related to project location and project construction methods”<sup>109</sup>

- Many of the “dry crossings of streams are in areas of severely erodible soils (103 dry crossings), rugged terrain with slopes greater than 30% (34 dry crossings), and other (often multiple) site specific constraints that increase the likelihood and potential for adverse water quality impacts.

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<sup>109</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

Thirty (30) dry stream crossings are located at sites with both severely erodible soils and rugged terrain. This information must be gleaned from multiple sources within the PennEast application and is not presented comprehensively in either the PennEast application materials or the DEIS. The DEIS fails to consider these site specific conditions in determining pipeline location and suitability of construction methods to minimize impacts or protect water quality.”<sup>110</sup>

- “PennEast proposed to use HDD crossings for eleven crossings, including five waterbody crossings, but site specific plans will be prepared at a later date (DEIS, p 4.51). This means that aspects of the plans that could be critical at those crossings were not made available for public review as part of this DEIS. Such plans would include the “location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction” (Id.). These areas all have potential impacts far exceeding general pipeline construction. The DEIS should also justify that the crossing areas and methods are “the minimum needed to construct the crossing” (Id.), and that the public to be able to review this aspect of the design. The containment plans for spills of drilling mud and other contingency plans should also be included as important elements in the DEIS for discussion and review.”<sup>111</sup>

- Beyond a general list of potential impacts of pipelines construction on water resources, the DEIS “does not quantify either the existing conditions or describe how the pipeline would affect the existing conditions. For each water crossing, the DEIS could easily describe the stream velocities, expected range of flows, bank composition, bed sediment sizes and contaminants present on those sediments, riparian conditions, and stream type (Rosgen and Silvey 1996). Using this information the DEIS could make at least semi-quantitative descriptions of the impacts pipeline construction will cause to the stream.”<sup>112</sup>

- “The DEIS and supporting materials provided by PennEast fail to consider the unique, site specific conditions at each individual proposed stream and wetland crossing, and the corresponding potential adverse water quality impacts associated with stream crossings, including open cut crossings. The DEIS fails to comprehensively evaluate each stream crossing with regards to conditions such as water quality, erosive soils, existing land use and forested areas, existing slopes, riparian buffers, and the potential need for in-stream blasting. Lacking consideration of the site specific conditions at each crossing, the DEIS fails to require adequate location and construction recommendations to protect water quality, as well as construction techniques specific to conditions at each crossing. The proposed stream and wetland crossing locations, methods of construction, and long-term land use conditions appear to be based on the needs and preferences of PennEast and not informed by site specific conditions.”<sup>113</sup>

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<sup>110</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>111</sup> Tom Myers, Ph.D. *Technical Memorandum Review of Draft Environmental Impact Statement, Proposed PennEast Pipeline, Docket No. CP15-558-000, FERC\EIS: 0271D*, August 31, 2016

<sup>112</sup> Tom Myers, Ph.D. *Technical Memorandum Review of Draft Environmental Impact Statement, Proposed PennEast Pipeline, Docket No. CP15-558-000, FERC\EIS: 0271D*, August 31, 2016

<sup>113</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

- “Importantly, the supporting documentation provided by PennEast fails to provide stream and wetland crossing information in a manner that allows FERC and other reviewing agencies to evaluate the site specific conditions at each stream crossing...”<sup>114</sup>

- The DEIS fails to consider or even acknowledge stormwater impacts from pipeline construction, as no stormwater management is proposed or required for the pipeline area.<sup>115</sup>

- The DEIS analysis fails to legitimately examine the potential for landslides resulting from site preparation, construction activities, and post-construction changes to soil properties and vegetative cover (not just those triggered by seismic events) – the Erosion and Sediment Control Plan relied upon by FERC and PennEast to avoid this threat is, according to expert review, lacking with respect to any actual special measures proposed for steep sloped areas to prevent landslides from occurring.<sup>116</sup>

- The DEIS “evaluation of soil compaction impacts based primarily on a soil’s drainage classification is incorrect.”<sup>117</sup>

- “DEIS fails to consider the site specific conditions that will impact stormwater and erosion, including existing land cover, steep slopes, soil erosion potential, revegetation potential, and proximity to waterbodies, as well as pipeline maintenance practices. There is no correlation of site specific data and information related to the factors that impact stormwater runoff and erosion in the DEIS or supporting materials. The DEIS fails to evaluate the varying conditions that will impact stormwater and erosion, and correspondingly fails to require site specific construction techniques and stormwater management practices.”<sup>118</sup>

- “The DEIS and supporting application materials fail to address the permanent, long term changes to land use cover and soil conditions, and the corresponding increase in stormwater runoff and erosion. As a result of pipeline construction, there will be permanent long term water quality impacts related to stormwater runoff, including increases in the rate, volume, and frequency of stormwater runoff.”<sup>119</sup>

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<sup>114</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>115</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>116</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

<sup>117</sup> See discussion in: Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

<sup>118</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>119</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

- “FERC’s analysis and the resulting reliance on mitigation measures to address soil compaction impacts are short-sighted and inaccurate. With respect to soil related impacts, the DEIS greatly underestimates the potential for the alteration of soils traversed by the pipeline and the subsequent short- and long-term consequences of soil compaction. Additionally, FERC’s finding that the proposed mitigation measures will prevent any significant alteration of site soils or can successfully limit impacts attributable to such alterations is inaccurate as based on actual field assessments of “restored” pipeline ROWs.”<sup>120</sup>

- “The subsection of the plan dealing with spill prevention and control is contained in Sub-Section 13 of the E&SCP, is a single paragraph consisting of five (5) simple bullet points, none of which provide any direction of the actions that must be taken in the event of a spill. The Spill Prevention, Control, and Countermeasures Plan upon which FERC has based their findings is unreasonably simplistic, lacks any detail, and does not account for the highly sensitive and unique environments the pipeline will disturb.”<sup>121</sup>

- FERC relies upon PennEast’s Horizontal Directional Drilling (HDD) Inadvertent Returns and Contingency Plan for addressing potential impact to groundwater attributable to drilling wastes, asserting the plan provides sufficient protection. The reference provides only a “single bullet point that states, a site specific plan will be implemented that includes “a description of how an inadvertent release of drilling mud would be contained and cleaned up”. This statement provides no assurance or guidance (even in general) regarding the measures that PennEast takes to prevent such events or their response to such events.”<sup>122</sup>

- The DEIS and FERC’s assessment of hydrostatic testing impacts do not consider data generated on hydrostatic test water showing “phosphorus levels (total phosphorus) ranging from 0.03 mg/l to 0.07 mg/L; which is enough to stimulate an algae bloom” or test results showing that hydrostatic test “return water is typically very low in dissolved oxygen” which “could cause a temporary but significant impact to the organisms residing in a stream especially during low flow conditions or during the summer when DO saturation is low.”

- The DEIS and documents upon which it depends for its conclusions, “does not address potential groundwater contamination events associated with the operation and maintenance of the pipeline, including the long-term application of herbicides to control the growth of vegetation or the management of invasive plants within and adjacent to the pipeline ROW.”<sup>123</sup>

- The alignment sheets included in the DEIS fail to include mile posts – this is critical information for evaluating the claims, assertions and/or data included in and relied upon in the DEIS. In other documents, such as Resource Report 3, MPs are included. An EIS is supposed to be more comprehensive, so MPs should be marked on the alignment sheets. The absence of this critically

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<sup>120</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

<sup>121</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

<sup>122</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

<sup>123</sup> Princeton Hydro, *Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project*, September 2016.

important information renders the DEIS legally incomplete and unusable for purposes of public, agency or expert review or comment as it impedes the ability to ground truth and review the information, claims and data in the DEIS. Not including MPs can only be inferred as an attempt to provide vague information in response to the knowledge that experts and volunteers are ground truthing and investigating the claims asserted in the DEIS by PennEast and FERC.

- In addition, on alignments the original alignment aerials views and backgrounds on the plots are muted out; making it difficult for the landowners and public monitors to ground truth the information asserted. On other pipeline projects, maps are much more detailed and legible. Blurring and the lack of MPs is an attempt to avoid providing complete information to the public.

In addition, the failure to provide the public with GIS referenced routes and images so they could be plotted in interactive maps for the public to review files is grossly negligent and yet another way that the public has not been provided all of the information needed to engage in the DEIS review and comment process. Furthermore, PennEast's own pipeline route on its website as of 8/19/16 also includes only the September 2015 route as an interactive map. Where are the files showing the reroutes and the clear alignments proposed for those reroutes? And where are the electronic files for GIS plotting and for the public to make these maps on their own without extensive effort and resources? These files should be provided by the company as the route is updated. FERC's DEIS recommendation that alignment sheets be provided to the Secretary before construction is grossly inadequate for the public to comment or review the deviations being considered.

- The FERC DEIS states that approximately 0.13 acre of vernal pool habitats would be impacted by construction of the Project, with 0.11 acre permanently impacted during operation. Spot checks in short sections of already surveyed areas of the route make clear that many sensitive vernal pools and groundwater seeps and wetlands have been missed and not accurately depicted by field surveys or the DEIS.

- In Ted Stiles Preserve at Baldpate Mountain, an area that according to the DEIS and PE alignment sheet had been surveyed by PennEast, there was no flagging observed by Delaware Riverkeeper Network during a Field-Truthing site visit of the pipeline center line, or any of the wetlands or streams along the proposed pipeline route we encountered. In addition, an intermittent stream was not delineated on the PE alignment sheets nor was there flagging present to note this water feature despite the fact that the stream is delineated on Government mapping.<sup>124</sup>

**The FERC DEIS is filled with assertions that are false, inaccurate, misleading and/or deficient – these failings ensure this DEIS cannot be said to fulfill the requirements of NEPA.**

NEPA requires that the agency “adequately considered and disclosed the environmental impact of its actions. . .” *Baltimore Gas & Electric Co. v. Natural Res. Defense Council, Inc.*, 462 U.S. 87, 97-98 (1983); *see also Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1228 (9th Cir. 1998) (finding that the “goal of [NEPA] is to ensure that federal agencies infuse in project planning a thorough consideration of environmental values”).

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<sup>124</sup> Delaware Riverkeeper Network. *Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, Docket No. CP15-558*, September 2016.

A baseline is a practical requirement in a NEPA environmental analysis employed to identify the environmental consequences of a proposed agency action. *See American Rivers, Inc. v. FERC*, 201 F.3d 1186, n. 15 (9th Cir. 1999). It has been recognized that “[w]ithout establishing . . . baseline conditions . . . there is simply no way to determine what effect [an action] will have on the environment and, consequently, no way to comply with NEPA.” *Half Moon Bay*, 857 F.2d at 510; *see also N. Plains Res. Council*, 668 F.3d at 1085 (“without [baseline] data, an agency cannot carefully consider information about significant environment impacts. Thus, the agency fails to consider an important aspect of the problem, resulting in an arbitrary and capricious decision.”) (internal quotation marks and brackets omitted); Council on Environmental Quality, *Considering Cumulative Effects under the National Environmental Policy Act*, at 41 (January 1997) (“The concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process”); *see also* 40 C.F.R. § 1508.27(b)(3).

NEPA requires that the lead agency provide the data on which it bases its environmental analysis. *See Lands Council v. McNair*, 537 F.3d 981, 994 (9th Cir. 2008) (holding that an agency must support its conclusions with studies that the agency deems reliable) (overturned on other grounds). Such analyses must occur **before** the proposed action is approved, not afterward. *See LaFlamme v. FERC*, 852 F.2d 389, 400 (9th Cir. 1988) (“[T]he very purpose of NEPA’s requirement that an [environmental review] be prepared for all actions that may significantly affect the environment is to obviate the need for speculation by insuring that available data is gathered and analyzed prior to the implementation of the proposed action”) (internal citation and quotation marks omitted). This is consistent with NEPA’s twin aims of (1) ensuring that agencies carefully consider information about significant environmental impacts; and, (2) guaranteeing relevant information is available to the public. *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1998).

The missing and inaccurate information is a fundamental failing of the DEIS, and it prevents other state, federal and regional watershed agencies, and the public from having the data and information they need to assess the impacts of the proposed pipeline on water resources, habitat, wildlife, drinking water and human communities. The DEIS is designed to help inform sound decision-making, in its current deficient and erratic state this document is worthless for assessment and decision-making purposes.

The FERC DEIS is filled with assertions that are false, inaccurate, misleading and/or deficient, including, but not limited to:

The DEIS states:

“The authorized facility location(s) shall be as shown in the EIS, as supplemented by filed alignment sheets. As soon as they are available, and before the start of construction, PennEast shall file with the Secretary any revised detailed survey alignment maps/sheets at a scale not smaller than 1:6,000 with station positions for all facilities approved by the Order. PennEast shall file with the Secretary detailed alignment maps/sheets and aerial photographs at a scale not smaller than 1:6,000 identifying all route realignments or facility relocations, and staging areas, pipe storage-yards, new access roads, and other areas that will be used or disturbed and have not been previously identified in filings with the Secretary. Approval for each of these areas must be explicitly requested in writing. For each area, the request must include a description of the existing land use/cover type, documentation of landowner approval, whether any cultural resources or federally listed threatened or endangered

species will be affected, and whether any other environmentally sensitive areas are within or abutting the area. All areas shall be clearly identified on the maps/sheets/aerial photographs. Each area must be approved in writing by the Director of the OEP before construction in or near that area. This requirement does not apply to extra workspace allowed by PennEast's E&SCP Plan and/or minor field realignments per landowner needs and requirements that do not affect other landowners or sensitive environmental areas such as wetlands."

DRN Response:

All of this information must and should be included in, and subjected to, the DEIS review and comment process. Having provided such deficient information in the DEIS in the first instance, that PennEast and FERC are allowed to, out of the public process, remedy, review, agree upon, and use for construction purposes supplemental information evades the requirements of law and both undermines and evades the review of the public and the mandates of the public process.

There is an overall discrepancy – a missing mile – between the description of the pipeline proposal in the resource reports versus in the DEIS. The DEIS states that there will be 115.1 miles of 36 inch pipeline, while other documents, such as Resource Report 1, state that there will be approximately 114 miles of 36 inch pipeline. Most maps and GIS files of the project show a total length of 114.02 miles. The alignment has changed since September of 2015, and it's possible that these changes may have resulted in an extra mile of overall length and therefore an extra mile of potential environmental damage. Regardless, the reason for the change and the discrepancy in length should be remedied and clearly identified in all materials associated with this project, including being directly addressed in the DEIS and subject to public and agency review and comment.

DEIS states:

The 118.8 miles would consist of the following facilities:

- 115.1 miles of new 36-inch-diameter pipeline extending from Luzerne County, Pennsylvania to Mercer County, New Jersey;
- the 2.1-mile Hellertown Lateral consisting of 24-inch-diameter pipe in Northampton County, Pennsylvania;
- the 0.1-mile Gilbert Lateral consisting of 12-inch-diameter pipe in Hunterdon County, New Jersey; and
- the 1.5-mile Lambertville Lateral consisting of 36-inch-diameter pipe in Hunterdon County, New Jersey.

This characterization of the project is different than what the public was told elsewhere on the FERC docket.

DRN Response:

But Resource Report 1 (September 2015) says:

The Project will entail the construction of approximately 114 miles of 36-inch diameter pipeline from Luzerne County, Pennsylvania, to Mercer County, New Jersey. The Hellertown Lateral, an approximately 2.1-mile lateral of 24-inch diameter pipe, will be constructed in Northampton County, Pennsylvania. This lateral will serve as an Interconnect with Columbia Gas (TCO) and UGI Utilities, Inc. The Gilbert Lateral, an approximately 0.6-mile lateral of 12-inch diameter pipe, will extend from the mainline in Holland Township in Hunterdon County, New Jersey, to the Gilbert Electric Generating Station where it will interconnect with NRG REMA, LLC, and Elizabethtown Gas. The Lambertville Lateral, an approximately 1.4-mile lateral of 36-inch diameter pipe, will be constructed in Hunterdon County, New Jersey. This lateral will serve as an Interconnect with Algonquin and Texas Eastern. The associated aboveground infrastructure for the Project will consist of interconnect meter stations, mainline block valves, and a single compressor station and their appurtenant facilities and equipment (e.g., pig launchers/receivers, milepost markers, cathodic protection test posts, etc.).

Additionally, proposed HDD source locations and volumes provided in DEIS Table 4.3.2-7 differ from those provided in resource report 2 Table 2.4-1.

**The DEIS is riddled with Threatened and Endangered (T&E) data that is inconsistent, wrong, missing, or misleading thus failing to establish an effective baseline for the review**

Statement from the EIS:

“The red-shouldered hawk was identified by the NJDEP-NHP as potentially occurring within the Project area in Hunterdon and Mercer counties. No suitable habitat was identified within accessible properties that were surveyed by PennEast in 2015; however, suitable breeding habitat for this species may be present. PennEast has committed to conducting tree clearing to times outside of the March 1- July 31 breeding and nesting period for raptors. This timing restriction would minimize the impacts that the Project would have to this species. PennEast would also be required to follow all restrictions found in the MBTA related to impacts on migratory birds, and would be required to develop a Migratory Bird Conservation Plan developed in consultation with FWS (see Section 4.5).”

DRN Response:

The surveys missed two red-shouldered hawk nests and multiple adult and juvenile red-shouldered hawks that were observed in the area of MP 93.5 and MP 93.6 by Dennis and Joann Kager in Kingwood Township, NJ. The nests were adjacent to the ROW where the pipeline would go. Photographs and observational data were submitted to NJDEP and are presented to FERC now.

Statement from the EIS:

“The red-headed woodpecker was identified by the NJDEP-NHP as potentially occurring within the Project area in Hunterdon and Mercer counties, and it was identified during PennEast’s surveys at milepost 104.7. PennEast has committed to conducting tree clearing to times outside of the March 1- July 31 breeding and nesting period. This timing restriction would minimize the impacts that the Project would have on this species. PennEast would also be required to follow all restrictions found in the MBTA related to impacts on migratory birds,

and would be required to develop a Migratory Bird Conservation Plan developed in consultation with FWS (see Section 4.5).

DRN Response:

Red-headed woodpeckers were also observed and documented by DRN volunteer monitors at MP 93.5 – 93.6 and MP 95.1.

Statement from the EIS:

“Although no bog turtles have been found during Project-specific surveys, the Project would cross through and impact potential bog turtle habitat (including habitats in unsurveyed areas), and bog turtles could be present in unsurveyed areas. As a result, the Project *may affect and is likely to adversely affect* bog turtles.

“Therefore, our preliminary determination for the Indiana bat, northern long-eared bat, bog turtle, dwarf wedgemussel, and northeastern bulrush is that the Project *“may affect and is likely to adversely affect”* these species.”

DRN Response:

The conclusion of “absence” as a result of the Phase 2 presence/absence bog turtle surveys does not carry much weight when it is admitted that the project may affect the species and is likely to adversely affect the species because not all areas have been surveyed. The same can be said for the Indiana bat, northern long-eared bat, dwarf wedgemussel, and northeastern bulrush. FERC’s failure to evaluate the areas where there is likely to be an adverse impact to these species renders the DEIS factually and legally deficient pursuant to NEPA.

Statement from the EIS:

“Of the surveyed wetlands in Pennsylvania, seven met the field criteria (i.e., vegetation, hydrology and soils) to be considered potential bog turtle habitat, while two met the field criteria to be considered potential bog turtle habitat in New Jersey. Phase 2 surveys are currently on-going...”

DRN Response:

The EIS notes that 7 wetlands in PA are considered suitable bog turtle habitat. However, Save Carbon County hired an independent USFWS qualified bog turtle surveyor (Jason Tesauro) who identified 9 properties containing one or more suitable bog turtle wetlands in the Hunters Creek drainage (part of Aquashicola Creek watershed) alone. Tesauro’s report was posted on the FERC docket and also filed with the USFWS.

The following are areas that were identified to have suitable bog turtle habitat by Save Carbon County’s consultant (Jason Tesauro) in September of 2015 and were not surveyed or were left out of the report by PennEast’s consultant (AECOM) in July of 2015:

1. Angun property, MP 44.8

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel listed as unsurveyed on PennEast's March 2016 wetland delineation maps.

*"The area was small (~0.1 acre), but **clearly consistent with suitable bog turtle habitat criteria.**"* – Jason Tesauro on Angun property

2. Conner property, MP 44.9

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel listed as unsurveyed on PennEast's March 2016 wetland delineation maps.

3. Maroney property, MP 45

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel listed as unsurveyed on PennEast's March 2016 wetland delineation maps.

*"Collectively, these patches comprised 0.2 acres of **suitable bog turtle habitat.**"* – Jason Tesauro on Conner and Maroney properties

4. Knirnschild property, between MP 45 and 45.1

2 suitable bog turtle areas identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel was fully surveyed on PennEast's March 2016 wetland delineation maps.

*"The southern terminus of the Sei Pike valley (Knirnschild property--closest to the intersection of Sei Pike and Spruce Hollow Roads) contained the largest area of **suitable bog turtle habitat** along Sei Pike...The potential habitat area was approximately 0.4 acres."* – Jason Tesauro on Knirnschild property

5. Fernandez property, between MP 45 and 45.1

1 highly suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. One wetland, 052915\_JC\_1001\_PEM, is listed as unsuitable bog turtle habitat in AECOM's report. Part of parcel listed as fully surveyed and another part is listed as unsurveyed on PennEast's March 2016 wetland delineation maps.

*"...the Fernandez site contained a 0.2-acre elongated area of spring-fed marsh and shrub swamp situated between the base of the Spruce Hollow Rd embankment and the stream...The Fernandez site, although small, **contained highly suitable potential bog turtle habitat.**"* – Jason Tesauro on Fernandez property

6. Mosier property, between MP 45 and 45.1

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Part of parcel listed as unsurveyed and other part does not appear on PennEast's March 2016 wetland delineation maps.

*“The approximate size of the **suitable bog turtle habitat** on the Mosier property was 1 acre.” – Jason Tesauro on Mosier property*

7. Randy property, MP 45.2

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel does not appear on PennEast’s March 2016 wetland delineation maps.

8. Vees property, MP 45.7

1 suitable bog turtle area identified by Tesauro missing from AECOM July 2015 bog turtle survey report. One wetland east of the property, 051115\_JC\_1001\_PEM, is listed as unsuitable bog turtle habitat in AECOM’s report. Parcel does not appear on PennEast’s March 2016 wetland delineation maps.

*“The wetland contained a 1.5 acre spring fed marsh with deep mud and muck soils, rivulets, and shallow-water swales...Approximate habitat size: 0.54 acres...The two properties evaluated along the Hunters Creek contained a significant area of emergent and scrub-shrub wetlands, much of which **appeared suitable for bog turtles.**” – Jason Tesauro on Randy and Vees properties*

9. Anthony property, MP 45.9

2 highly suitable bog turtle areas identified by Tesauro missing from AECOM July 2015 bog turtle survey report. Parcel listed as unsurveyed on PennEast’s March 2016 wetland delineation report.

*“The wetland system on the Anthony property encompassing the headwaters above the farm’s outbuildings to the marsh along Stagecoach Road East **supports highly suitable bog turtle habitat.**” – Jason Tesauro on Anthony property*

The failure to accurately delineate these wetlands, and therefore failure to accurately classify them pursuant to the Pennsylvania Code, renders the DEIS legally and factually deficient.

Statement from the EIS:

Pennsylvania and New Jersey have enacted laws to designate and protect state listed species. In Pennsylvania, this state law is referred to as the Endangered Species Coordination Act (under Pennsylvania House Bill 1576); while the applicable state law is referred to as the Endangered Species Conservation Act of 1973 in New Jersey. This EIS provides information related to impacts on state listed species in compliance with these state laws.”

DRN Response:

A total of 8 NJ state threatened, endangered, or special concern mussel species are completely left out of the EIS. These species are as follows: triangle floater (threatened), brook floater (endangered), yellow lampmussel (threatened), eastern lampmussel (threatened), green floater (endangered), tidewater mucket (threatened), eastern pondmussel (threatened), and creeper (species of special concern). All eight of these species may potentially occur in various waterbodies

crossed by the project, based on the GIS range maps created by the Conserve Wildlife Foundation of New Jersey and the NJ Division of Fish and Wildlife found at:  
<http://conservewildlife.maps.arcgis.com/apps/MapJournal/index.html?appid=093a625e6fa044e191595e57dceee027&webmap=7fc0d5a9cd0f419a8fdd3d254b316752>

Image from DEIS:

TABLE 4.4.1-1			
Vernal Pools Potentially Crossed by the Project			
Milepost	Length of Crossing (Feet)	Acres Potentially Affected – Construction	Acres Potentially Affected - Operation
<b>Pennsylvania</b>			
MP 13.1	0	0	0
MP 25.2	0	0	0
MP 35.5	48	0.01	0.01
MP 52.4	25	0.03	0.03
MP 52.5	0	0	0
MP 52.6	67	0.09	0.07
<b>New Jersey</b>			
MP 89.5 <u>a/</u>	-	-	-
MP 90.5-90.8 <u>a/</u>	-	-	-
MP 98.5 <u>a/</u>	-	-	-
MP 102.5	0	0	0
MP 103.4-103.5 <u>a/</u>	-	-	-
MP 103.5	0	0	0
MP 103.5	0	0	0
Note: <u>a/</u> The areas identified at MP 89.5, MP 90.5-90.8, MP 98.5, MP 103.4-103.5 were based on review of the New Jersey GIS database for vernal pools (New Jersey Landscape Project Version 3.1 maps) and have not yet been field verified.			

Response:

In PA, one DRN volunteer monitor documented a vernal pool near MP 43.5 – 44 by observing wood frog egg masses (a vernal pool obligate species).

In NJ, volunteer monitors documented vernal pools near MP 95 – 95.5 and MP 107 – 109 by observing wood frog egg masses, wood frog tadpoles, and springtime fairy shrimp (vernal pool obligate species).

Potential vernal pool habitat at MP 107.8 – 107.9 is acknowledged in Resource Report 3 below:

Vernal Habitat in New Jersey

- MP 103.1- 103.2 : Mapped as vernal habitat – no vernal pool observed within the study corridor.
- MP 103.3-103.4: predominantly forested; potential vernal pool area mapped - observed to be outside of study corridor.
- MP 103.5- 103.7: northernmost portion of study corridor mapped as potential vernal area; no potential vernal habitat observed within the survey corridor.
- MP 107.8-107.9: Mapped as vernal habitat area – no potential vernal pools observed onsite. Site is forested, with rocky substrate & intermittent drainage features

Pa;

Since it was concluded that no potential vernal pools were observed onsite in Resource Report 3, this area was presumably left out of the EIS. However, our volunteer documenting vernal pool obligate species between MP 107 – 109 encompasses the area in question.

It must be noted that DRN volunteer monitors only walked certain sections of the pipeline route so many more vernal pools are likely missing from the mapping and DEIS.

With regards to Timber Rattlesnakes, the DEIS states:

PennEast conducted presence/absence and/or habitat surveys for this species in the summer of 2015. These surveys were conducted by a qualified herpetologist in potential habitat areas designated by the PFBC. Suitable habitat for this species was identified within the Project area and one timber rattlesnake was observed within the Project area in Pennsylvania during wetland field surveys in 2015. For areas that were identified as potential habitat, PennEast has committed to following the PFBC recommendations to minimize impacts on this species: which include spring presence surveys, avoiding the habitat during construction, and the restoration of gestation habitat following PFBC guidelines (PFBC 2010). PennEast has also committed to avoiding denning habitat identified near MP 39.2 and adhering to a 300 foot no disturbance buffer around these dens, as well as the use of rattlesnake monitor on-site during construction in suitable habitats between April 15 and October 15.

DRN Response:

The habitats that are listed in the DEIS as being surveyed are not complete and not protective of timber rattlesnakes and copperheads. DRN documented optimum timber rattlesnake habitat during assessments conducted in SGL 168 from at least MP 52.9 to 51.0 along Blue Mountain near Danielsville, PA. DEIS states that 51.1 to 51.6 was surveyed for timber rattlesnake but this only includes one section of this habitat and does not include all of the optimal habitat areas in that area of SGLs. There are other areas that should have been/should be the subject of Phase 1 and/or Phase 2 surveys but have not been<sup>125</sup>.

**The DEIS is legally inadequate in its failure to consider alternative routes or construction practices that could avoid and/or mitigate harm.**

As briefly discussed above, the DEIS fails to adequately consider the impacts of the proposed route, and alternative routes, and fails to fully consider the various construction alternatives that could both avoid and minimize impacts.

Fails to consider alternatives to avoid or mitigate the adverse impacts of soil compaction in natural areas.

FERC and PennEast presume in the DEIS and supporting materials “that there is no difference between the hydrologic response of a forested woodland and the compacted, post-construction pipeline right-of-way.” As a result, there is no consideration of construction practices to avoid or mitigate the harms inflicted on these natural resources and thereby prevent the ecological harm that

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<sup>125</sup> Delaware Riverkeeper Network. Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, Docket No. CP15-558, September 2016.

will result in the form of lost habitat, increased stormwater runoff, reduced groundwater infiltration and recharge, inability of vegetation to regrow etc.

As proposed for the PennEast Pipeline,

“Compaction in construction work spaces will not be restored by simply regrading to pre-existing contours, retilling at the surface, and reseeding the area as currently outlined in the permit application materials. Heavy equipment used in the construction of the pipeline will inherently compact work areas to depths deeper than conventional surface tilling can reach. Compaction creates conditions that inhibit the germination of plants and plant root growth. Existing topsoil will not be segregated and restored, but will be lost in the construction process. The establishment of vegetative cover within the pipeline ROW will be more difficult once surface soils are compacted, and forested woodland will not be restored.”<sup>126</sup>

“When vegetation regrowth is limited, the likelihood of accelerated erosion is increased. When runoff cannot infiltrate, is not slowed at the surface by vegetation, and has direct contact with exposed soils, sediments are much more likely to be transported to downhill streams and wetlands. This is of specific concern on significant portions of the pipeline right-of-way in proximity to stream crossings, where soils to be disturbed by pipeline construction are classified as Severe Erosion Potential (79), Poor Vegetation (122), and Rugged Terrain with slopes greater than 30% (28). These areas are especially prone to erosion and sediment transport to waterbodies.”<sup>127</sup>

The DEIS fails to recognize these impacts and fails to consider alternatives to avoid or mitigate the harms including constructions practices that reduce the removal of pre-existing vegetation, that limit the building envelope, and that prevent compaction during construction – practices discussed in the attached report by expert Leslie Sauer.

HDD construction method should be default location for waterways and wetlands crossings:

Pipeline projects can use a construction technique called Horizontal Directional Drilling (“HDD”) to construct the pipeline underneath waterways and wetlands, avoiding impacts entirely. For this type of crossing, a specialized drill rig is used to advance an angled borehole below the stream or wetland to be crossed and, using a telemetry guidance system, the borehole is steered beneath the stream or wetland and then back to the ground surface. The hole is then reamed to a size, adequate for the pipe to pass through, and the pipeline is then pulled back through the bore hole.

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<sup>126</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

<sup>127</sup> Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016

The records are replete with examples of pipeline projects that have utilized this technology. For example, the Tennessee Gas Pipeline Company's use of this technology to construct its Northeast Upgrade pipeline project under the Delaware River. *See* 42 Pa Bulletin 7478-7482. Additionally, the Columbia Gas Pipeline used HDD under Exceptional Value wetlands and at least seven streams for the Eastside Expansion Project. *See* Permit E15-846. Indeed, Tennessee Gas Pipeline Company recently described the viability of HDD technology in its application to the Department for Orion Pipeline Project.

In fact, the PennEast pipeline project will use HDD to avoid impacts to 74% of the 189 road crossings it will encounter, but for the stream crossings, 75% will be accomplished using open cut methods that have the greatest potential to inflict water quality harm, and long term damage to the creek and its riparian buffer. And, of the seventeen stream crossing locations to be accomplished by HDD, only four are not associated with a road crossing – making clear that the reason for the HDD alternative at those locations is the existence of the road, not an effort to protect the creek. Clearly FERC has prioritized protecting roadways over protecting streams.

Failing to mandate primary consideration and discussion of an HDD construction alternative for each and every wetland and waterway crossing fails to undertake the alternatives analysis mandated by NEPA. Indeed, in Pennsylvania HDD under exceptional value wetlands is required by the Pennsylvania Code.

#### Activities are proposed for damaging areas with no visible consideration of less damaging options

In Mercer Co. New Jersey, while a horizontal directional drill (HDD) is proposed under Pleasant Valley Rd. and an adjacent stream and wetland complex (between MP 105.5 and 106.0, the HDD entry point is proposed to be located at MP 105.4 and within a large PEM wetland complex (1002-PEM and 1001-PEM), and the exit point is proposed just adjacent another wetland complex and just north of and paralleling a stream where it appears from the faded aerial provided by PennEast that mature trees will need to be cut. And yet, it seems that there are obviously less impactful locations for both the entry and exit point that were not even considered<sup>128</sup>.

#### Blasting

The discussion on blasting (DEIS, p 4-58) concerns worker safety, not environmental impacts. In fact there are significant ramifications that result from blasting, among them is that blasting leaves nitrogen which can run off with stormflow and enter streams as nitrate or ammonia. Issues such as these, noise and other potential environmental impacts are overlooked by the DEIS. Alternatives that avoid blasting were not given due consideration.

#### Co-location – Alternative Footprints

The DEIS fails to provide an adequate level of detail regarding the selection of the proposed preferred route – it gives numbers of stream crossings, wetlands cut, forest acres lost, but fails to give the information necessary to assess or justify why alternatives with a reduced footprint with regards to some natural resources were rejected for the proposed preferred route.

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<sup>128</sup> Delaware Riverkeeper Network. *Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, Docket No. CP15-558*, September 2016.

In addition, the DEIS presumes that if the pipeline is co-located with a preexisting linear project that its impacts have been avoided or been minimized as compared to other options; such an outcome cannot be presumed. The co-location strategy proposed does not site the PennEast pipeline within the pre-existing ROW of these preexisting projects, it actually creates a second, adjacent footprint, thereby expanding the ROW footprint to accommodate the PennEast project. This expansion of the ROW requires new tree clearing, more soil compaction, new stream cuts and denuded buffers, etc. The value of the co-location in these areas is therefore less significant than stated in the DEIS.

Additionally, while the DEIS states that colocation is less impactful, in the Ted Stiles Preserve on Baldpate Mountain, the pipeline maps indicate that the pipeline would run adjacent to the existing ROW cutting through new habitat instead of being built within the current ROW footprint which means more habitat disturbed, trees cut, and an extension of forest fragmentation further into the woods.

As noted by Dr. Myers in his attached report:

- “An existing 50 to 100 foot wide treeless swath through a forest could be doubled as the result of the preference to following existing ROWs within a forest area. Such a width doubling could have foreseeable (but unanticipated by the DEIS) effects especially in valuable forest regions such as in Hickory Run State Park (Photo 5, p 17). In a wetland, such as in Photo 5, the area exposed to solar insolation could significantly increase which would both warm the water and increase evapotranspiration. The DEIS does not consider such factors in its comparison of alternatives.”

In other areas, where obvious opportunities for colocation, if within the pre-existing corridor, may reduce the pipeline footprint and impact, it seems an altogether ignored option. For example:

- In the Blue Mountain, part of SGL 168, Blue Mt Ski area is highly impacted with massive cuts for ski slopes yet it appears the pipe line proposed near the ski center would add an additional cut rather than utilize one of the current clear cut paths.
- While there is an existing Buckeye oil pipeline present in proximity to the proposed new greenfield PennEast route that already cuts across the steep slope and the Appalachian Trail (AT) within SGL 168, it is unclear why co-location is not considered for this area where such sensitive habitat, steep slopes, and cultural impacts are in jeopardy.
- Note -- the crossing of the Appalachian Trail by the proposed route is in a section that is only feet away from a scenic overlook and cliff outcropping – it is hard to imagine a more damaging location for harming this important recreational and cultural resource. This area is also prime rattlesnake habitat.

The DEIS fails to fully consider the advantages of alternative options for the construction route, instead relying on what PennEast proposes rather than an independent assessment amongst options.

The most obvious advantage of the Luzerne-Carbon alternative is that just 1.5 acres of wetland would be affected by construction while for the proposed preferred route, 12 acres would be affected. The DEIS does not compare wetland type or value, but the much smaller area for the alternative suggests it could be much less impactful. Also, the Luzerne-Carbon reach also includes the extremely saturated wetland 7 are just south of I-80 on the proposed route, which the DEIS describes as a

difficult area for construction (DEIS, p 4-69 and discussion below in Section 3.33). The DEIS alternatives comparison fails to consider the advantages of not constructing the pipeline through this wetland.

The DEIS notes the increase in stream crossings and small increase in forest area clearing in its rejection of the alternative (DEIS, p 3-11). The increases are not discussed regarding the quality of the streams or forest affected, nor does it consider the value of the wetlands not impacted, so the DEIS does not provide adequate evidence in support of the choice of the proposed route.”

Similar deficiencies in analysis are noted by Dr. Myers for the Bucks County alternative.

### ROW Use Damage by Vehicular Traffic

Dr. Tom Myers notes in his report the damage that is done on existing ROWs due to access by vehicular traffic, including off road vehicles. Dr. Myers provides expert analysis, and photographic evidence, of the damage done by this use of at least one of the existing ROW's PennEast proposes to use. Use of ROWs by off road vehicles is a common, known and foreseeable outcome of construction of the PennEast pipeline, and yet the DEIS fails to give the frequent, ongoing, repetitive and enduring damage to natural resources including waterways, wetlands, wildlife, habitat and restoration efforts by this known and foreseeable outcome its due attention. Statements that off road vehicles are prohibited by sign postings, gates, or web site announcements is not good enough. Discussion and commitment to enforceable measures that will demonstrably prevent this significant, repetitive and enduring impact is an essential element of avoiding known and foreseeable harm and requires due attention.

### **Construction of the PennEast Pipeline will bring demonstrable threats and harms to life, property, property rights and riparian rights**

The PennEast pipeline is a significant danger to human life and property. Pipelines are a serious source of human harm and property damage.

According to the Pipeline and Hazardous Materials Safety Administration<sup>129</sup>, in the most recent six years found on PHMSA's data portal for gas transmission lines (onshore) there have been over 100 fatalities or injuries requiring hospitalization and over \$880 million in damage as the result of 622 pipeline incidents. When explosions happen, the harm to people, property and the environment can be severe and costly. And the risk of accident, incident and harm is increasing. In addition to the actual physical harm that happens when there is an accident or incident, there is the ongoing psychological burden inflicted by the fear of accident, incident or explosion for those who are forced to live next to a gas pipeline, including those who are forced to live with a pipeline because of the power of eminent domain exercised by a pipeline company.

The DEIS asserts that:

“The frequency of significant incidents is strongly dependent on pipeline age.”

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<sup>129</sup> <https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages>  
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But in fact this determination is not supported by the evidence. In fact, the hazards of pipelines for human safety and property damage are increasing. According to a report by Pipeline Safety Trust:

“The gas transmission lines installed in the 2010s had an annual average incident rate of 6.64 per 10,000 miles over the time frame considered, even exceeding that of the pre-1940s pipes. Those installed prior to 1940 or at unknown dates had an incident rate of 6.08 per 10,000 miles.”<sup>130</sup>

The DEIS’s improper determination that pipelines constructed more recently are safer resulted in a flawed analysis and discussion of the health and safety ramifications of the proposed PennEast pipeline for communities. The focus of the DEIS on compliance with regulations does not excuse the failure to assess the fact that accidents, incidents and explosions are higher than in older, pre-1940 pipelines, and the need to consider why safety is on the decline and whether PennEast will be subjected to the same construction approaches that have made more modern pipelines less safe and more prone to catastrophic events.

In the DEIS, to diminish the serious health and safety threats and harms of pipelines, FERC uses the assertion that:

“The majority of fatalities from natural gas pipelines are associated with local distribution pipelines. These pipelines are not regulated by FERC; they distribute natural gas to homes and businesses after transportation through interstate transmission pipelines. In general, these distribution lines are smaller-diameter pipes and/or plastic pipes that are more susceptible to damage.”

But given that distribution pipelines are a normal and needed consequence of an interstate transmission line in order to take the induced fracked gas from the well pads into interstate commerce, the harms inflicted by distribution lines must be equally assessed and accounted for in the DEIS as a foreseeable, direct and induced consequence of the PennEast pipeline.

The effort by the DEIS to dismiss the devastation that gets inflicted when a pipeline explodes or does damage to a community through an accident or incident is, frankly, disgusting. The DEIS tries to dismiss the devastation to people and families suffered from an explosion of a pipeline, for example, by asserting that the harms associated with pipelines are less than with other activities:

The nationwide totals of accidental fatalities from various anthropogenic and natural hazards are listed in table 4.11.3-2 in order to provide a relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between accident categories should be made cautiously because individual exposures to hazards are not uniform among all categories. As indicated in table 4.11.3-2, the number of fatalities associated with natural gas facilities is much lower than the fatalities from natural hazards such as lightning, tornados, floods, earthquakes, etc.

In addition to the effort to diminish the devastation to a person or family suffered during an explosion by a natural gas pipeline, the dismissal fails to give the necessary context or assessment to fairly compare these uses. The necessary comparisons of potential for an incident to occur amongst

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<sup>130</sup> <https://www.snl.com/InteractiveX/Article.aspx?cdid=A-33791090-11060>

different threats versus the actual reality of a hazard is lacking in the DEIS analysis. Comparing apples to oranges does not work here.

The DEIS fails to fulfill the mandates of NEPA in all the ways identified in this comment and all its associated attachments and references. FERC must prepare a new, complete and accurate DEIS for public review, comment, hearing and consideration. Preparing a final EIS based on this overly deficient draft would be a violation of NEPA.

**To the extent FERC issues any letter orders to proceed with tree felling construction activity prior to the issuance of the Clean Water Act Section 401 water quality certifications, FERC is in violation of the Clean Water Act**

Section 401 of the CWA plainly requires “no [federal] license or permit shall be granted until the certification required by this section has been granted or waived.” 33 U.S.C. § 1341(a)(1); *City of Tacoma v. FERC*, 460 F.3d 53, 68 (D.C. Cir. 2006) (“without [Section 401] certification, FERC lacks authority to issue a license.”). The Supreme Court has stated that, consistent with the State’s primary enforcement responsibility under the CWA, Section 401 “requires States to provide a water quality certification *before* a federal license or permit can be issued....” *PUD No. 1 of Jefferson Cnty. v. Wash. Dept. of Ecology*, 511 U.S. 700, 707 (1994) (emphasis added). Likewise, the D.C. Circuit clearly held that “without [Section 401] certification, FERC lacks authority to issue a license.” *City of Tacoma v. FERC*, 460 F.3d 53, 68 (D.C. Cir. 2006). Until such time that the states of Pennsylvania and New Jersey issue their respective Section 401 water quality certifications FERC is prohibited from issuing letter orders authorizing any construction activity for the Project. This includes but is not limited to tree felling activities.

Submitted,



Maya K. van Rossum  
the Delaware Riverkeeper

**Attachments:**

Appendix 1: Table A-1. Active, proposed and reported natural gas wells in Pennsylvania, by county

Letter dated September 9, 2016 written by Key-Log Economics to Secretary Kimberly Bose & Deputy Secretary Nathaniel J. Davis.

*Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, Michelle Adams & Marc Henderson, Water Resources Engineers, Meliora Design, LLC, September 5, 2016.

Table A Attachment to *Professional Review & Comment...*, Meliora Design, LLC, September 5, 2016

*The Effects of the Proposed PennEast Pipeline on Exceptional Value Wetlands in Pennsylvania, Prepared for the Delaware Riverkeeper Network*, Schmid and Company, July 2016

Letter dated September 9, 2016 written by Schmid & Company, Consulting Ecologists to Maya K. van Rossum, the Delaware Riverkeeper.

*Technical Memorandum Review of Draft Environmental Impact Statement, Proposed PennEast Pipeline, Docket No. CP15-558-000, FERC\ EIS: 0271D, Tom Myers, Ph.D., August 31, 2016*

*Opinion on the PennEast Pipeline, Arthur Berman, Petroleum Geologist, Labrynth Consulting Services, Inc., September 11, 2016*

*Technical Review of Volume I FERC Draft Environmental Impact Statement Submitted for PennEast Pipeline Project, Princeton Hydro, September 2016*

*Field Monitoring Report, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams. Addendum to Comment for the PennEast Pipeline, Delaware Riverkeeper Network.*

*Review of INGAA Foundation Report, "Pipeline Impact to Property Value and Property Insurability", Key-Log Economics, March 11, 2015*

*Fulper Farm Grain Harvest Graphics, 4 Images, 2008-2012*

*Marcellus/Utica on Pace for Pipeliem Overbuild, Says Braziel, Natural Gas Intelligence, June 8, 2016*

*Achieving Higher Quality Restoration Along Pipeline Rights of Way, Leslie Sauer, May 2014*

*Professional Opinion of Proposed PennEast Pipeline Project, Arthur E. Berman, Petroleum Geologist, Labyrinth Consulting Services, Inc., February 26, 2015*

*Analysis of Public Benefit Regarding PennEast, Skipping Stone, March 9, 2016*

*Review of PennEast Pipeline Project Economic Impact Analysis, Jannette Barth, Pepacton Institute, April 4, 2016*

*Expert Report on the PennEast Pipeline Project Economic Impact Analysis for New Jersey and Pennsylvania, The Goodman Group Report, Nov 4, 2015*

*The Potential Environmental Impact from Fracking in the Delaware River Basin, Steven Habicht, Lars Hanson, and Paul Faeth, August 2015*

*Report on Phase 1 Bog Turtle Survey for Wetlands Associated with Hunters Creek, Towamensing Township, Carbon County, Pennsylvania, Jason Tesauro, September 5, 2015*

*Drilling Deeper: A Reality Check on U.S. Government Forecasts for a Lasting Tight Oil and Shale Gas Boom, J. David Hughes, Post Carbon Institute, October 2014*

*Revealed: Contractors Hired by FERC to Review A New Spectra Energy Pipeline Work for Spectra on a Related Project, Itai Vardi, Desmog, May 26, 2016*

*A Bridge Too Far: How Appalachian Basin Gas Pipeline Expansion Will Undermine U.S. Climate Goals*, Oil International, July 2016

*Climate Change in Pennsylvania: Impacts and Solutions for the Keystone State*, Union of Concerned Scientists, October 2008

*Climate Change Impacts and Solutions for Pennsylvania*, Union of Concerned Scientists, 2008

*The Changing Northeast Climate*, Union of Concerned Scientists, 2006

*Cumulative Land Cover Impacts of Proposed Transmission Pipelines in the Delaware River Basin*, Lars Hanson and Steven Habicht, May 2016

*Natural Gas Price Increase Inevitable*, Art Berman, The Petroleum Truth Report, February 21, 2016

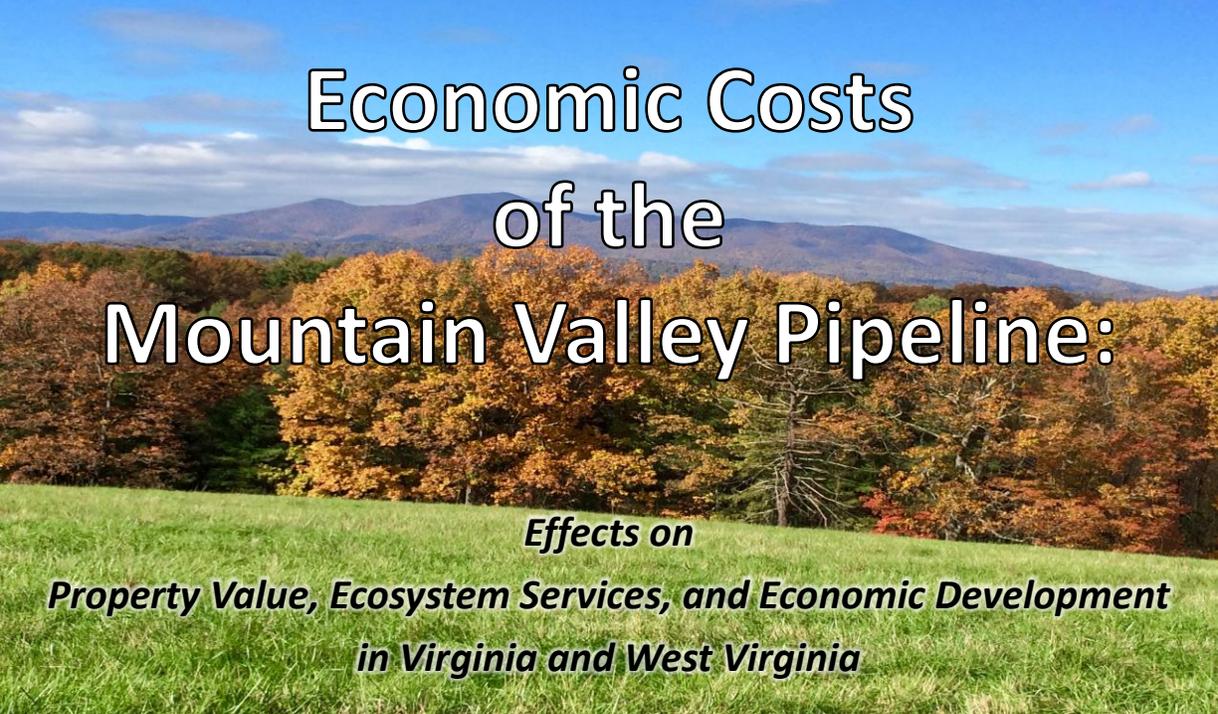
*Climate Change Impacts in the United States*, Radley Horton and Gary Yohe, May 2014

*Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, Christina Goldfuss, Council on Environmental Quality, August 1, 2016

*Pennsylvania Energy Impacts Assessment*, Nels Johnson, the Nature Conservancy, November 15, 2010

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 2, Key-Log  
Economics, Economic Costs of the Mountain Valley  
Pipeline, May 2016.**



# Economic Costs of the Mountain Valley Pipeline:

*Effects on  
Property Value, Ecosystem Services, and Economic Development  
in Virginia and West Virginia*

MAY 2016

*Report to:  
Protect Our Water, Heritage, Rights (The POWHR Coalition)  
[powhr.org](http://powhr.org)*

Spencer Phillips, PhD  
Sonia Wang  
Cara Bottorff

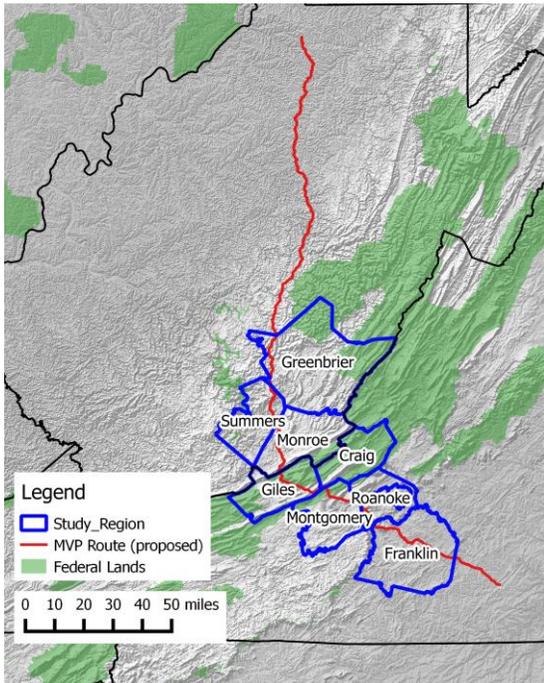


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## EXECUTIVE SUMMARY

The Mountain Valley Pipeline (MVP) is proposed to carry natural gas from the Marcellus and Utica Shale approximately 300 miles through 11 West Virginia and 6 Virginia counties before terminating at the existing Transcontinental pipeline compressor station in Pittsylvania County, Virginia. Mountain Valley Pipeline, LLC, which would construct and operate the pipeline as a joint venture of EQT Corporation and NextEra Energy, Inc., and some public officials have promoted the MVP as both environmentally safe and economically beneficial, providing economic opportunity for local communities along the proposed route.



**FIGURE 1: Eight-County Study Region**

Note: Roanoke County includes the independent cities of Salem and Roanoke

Sources: MVP route digitized from online maps and MVP LLC filings (<http://mountainvalleypipeline.info/maps/>); Study Region (counties), federal lands, and hill shade from USGS and [http://nationalmap.gov/small\\_scale/](http://nationalmap.gov/small_scale/)

Promised economic benefits, however, are only part of the impact the Federal Energy Regulatory Commission (FERC) must review before deciding whether to approve the construction and operation of the pipeline. Under its own policy and the more comprehensive requirements of the National Environmental Policy Act, FERC's review must consider the full range of environmental effects of the proposed pipeline. These include the various ways in which environmental effects would result in changes in human well-being—including economic benefits and costs. While estimates of the positive economic effects, including construction jobs and local tax payments, have been developed and promoted as reasons to move forward with the pipeline, no systematic consideration of the potential negative economic effects—economic costs—of the MVP has been completed.

To help fill the gap in current information, the POWHR (Protect Our Water, Heritage, Rights) coalition of community groups from an eight-county region in West Virginia and Virginia commissioned this independent research into key economic costs of the MVP. This region comprises Greenbrier, Monroe, and Summers Counties in West Virginia and Craig, Franklin, Giles, Montgomery, and Roanoke Counties in Virginia (Figure 1). The MVP's construction, operation, and presence would impose three types of costs on this region. First, the pipeline would impact property values along the approximately 143 miles

of pipeline proposed for the study region. Affected properties are those touched by the 50-foot-wide right-of-way, within the 1.4-mile-wide evacuation zone, and throughout the viewshed of the proposed pipeline. Second, construction and the ongoing operation of the pipeline would alter land use/land cover in ways that diminish the value of ecosystem services, such as aesthetics, water supply, and timber and food production. Third, and in part due to a loss of scenic and quality-of-life amenities, there would be decreases in visitation, in-migration, tourism, small business development, plus a loss of jobs and personal income those activities would otherwise support.

Considering this eight-county region alone, estimated one-time costs range from \$65.1 to \$135.5 million. These one-time costs comprise lost property value and the value of ecosystem services lost during construction. Annual costs following the construction period include lower ecosystem service productivity in the MVP's right-of-way, lower property tax revenue due to the initial losses in property value, and dampened economic development. These total between \$119.1 and \$130.8 million per year and would persist for as long as the MVP right-of-way exists—that is, in perpetuity. (See "At a Glance," page iii for details.) Putting the stream of costs

into present value terms<sup>1</sup> and adding the one-time costs, the total estimated cost of the MVP in the eight counties is between \$8.0 and \$8.9 billion.

The costs represented by the estimates presented here are what economists call “externalities,” or “external costs,” because they would be imposed on parties other than (external to) the company proposing to build the pipeline. Unlike the private (or internal) costs of the pipeline, external costs borne by the public do not affect the company’s bottom-line. From an economic perspective, the presence of externalities is what demands public involvement in decisions about the MVP. Without consideration of all of the costs of the project, too much pipeline (which may mean any pipeline at all) is the inevitable result. FERC must consider the true bottom line and ensure that the full costs of the pipeline, especially those external costs imposed on the public, are rigorously examined and brought to bear on its decision about whether or not to permit the MVP project to proceed.

For reasons explained in the body of this report, estimates of external costs developed as part of this study and reported here are conservative. One reason is simply that there are categories of impacts that are beyond the scope of the study. These impacts include changes to sites or landscapes that have historical or cultural significance. Like lost aesthetic quality or a decrease in the capacity of the landscape to retain soil, filter water, or sequester carbon, historical and cultural impacts matter to humans and, therefore, can be expressed as monetary value. We have also not included the cost to communities of increased emergency response planning and capacity necessary during the operation of the proposed pipeline or of increased law enforcement, road maintenance and repair, or other costs that would accompany its construction.<sup>2</sup>

Another important category of cost not counted here is “passive use value.” Passive use value includes the value to people of simply knowing an unspoiled natural area exists and the value of keeping such places unspoiled for the sake of some future direct or active use. In light of this, it is important to consider the estimates of economic costs provided here as a fraction of the total economic value put at risk by the proposed Mountain Valley Pipeline.

Finally, while this report covers many of the costs that *will* happen if the MVP is constructed and operated, it does not include an assessment of natural resource damage and other effects that *might* happen during construction and operation. For example, there is some probability that erosion of steep slopes and resulting sedimentation of streams and rivers will occur during construction. Similarly, there is some probability that there will be a leak and explosion somewhere along the length of the MVP during its lifetime. If, when, and where such events occur with the MVP, there will be clean-up and remediation costs, costs of fighting fires and reconstructing homes, businesses, and infrastructure, the cost of lost timber, wildlife habitat, and other ecosystem services, and most tragically, the cost of lost human life and health.<sup>3</sup> The magnitude of these damages, multiplied by the probability that they will occur, yields additional “expected costs,” which would then be added to the more certain costs estimated in this study. The same is true of the costs that could accrue after the MVP is no longer used and maintained.

To be clear, the costs estimated here—the effect on ecosystem services from clearing land for the pipeline corridor, the impact on land values resulting from buyers’ concerns about pipeline safety, and reductions in economic vitality stemming from changes in the landscape—will occur with or without any discreet or extreme events like landslides or explosions ever happening. These impacts and their monetary equivalents are simply part of what will happen in West Virginia and Virginia if the MVP is approved, built, and operated.

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<sup>1</sup> The present value of a perpetual stream of costs is the one-year cost divided by the 1.5% real discount rate recommended by the Office of Management and Budget for cost-benefit and cost-effectiveness analysis of public projects and decisions (Office of Management and Budget, 2015).

<sup>2</sup> As of this writing, a pilot study of these cost for one Virginia county in our study region is underway, with results expected in the coming weeks.

<sup>3</sup> While no one was killed in the incident, one need look no further than the recent explosion of Spectra Energy’s Texas Eastern gas transmission line in Pennsylvania to see such impacts. See, for example, <https://stateimpact.npr.org/pennsylvania/2016/05/04/pa-pipeline-explosion-evidence-of-corrosion-found/>

## At a Glance:

### The Mountain Valley Pipeline in Virginia and West Virginia *Craig, Franklin, Giles, Montgomery, and Roanoke Counties in Virginia and Greenbrier, Monroe, and Summers Counties in West Virginia*

- Miles of pipeline: 143
- Acres
  - In the construction corridor and temporary roads and workspaces: 2449
  - In the permanent right-of-way (ROW): 861
  - In permanent access roads and other facilities: 76
- Most impacted land cover types (ROW only): forest (664 acres) and pasture (142 acres)
- Parcels touched by ROW: 716
- Parcels in the 1.4-mile-wide evacuation zone: 8,221
- Residents and housing units in the evacuation zone: 20,389 people and 9,700 homes
- Parcels from which the pipeline would be visible: 78,553 or 31% of all parcels in the six counties for which detailed parcel data are available
- Baseline (no pipeline) property value at risk (and expected one-time cost due to the MVP):
  - In the ROW: \$125.9 million (\$5.3 to \$16.4 million)
  - In the evacuation zone: \$972.6 million (\$37.0 million)
  - In the viewshed: \$16.8 billion (to avoid double counting with lost aesthetic value under ecosystem services, this impact is not separately estimated)
- Total property value lost (a one-time cost): \$42.2 to \$53.3 million
- Resulting loss in property tax revenue (annual): \$243,500 to \$308,400
- Lost ecosystem service value, such as for water and air purification, recreational benefits, and others:
  - Over the two-year construction period (a one-time cost): between \$22.9 and \$82.2 million
  - In the ROW (annual): between \$4.1 and \$14.8 million
- Lost economic development opportunities due to the erosion of these counties' comparative advantages as attractive places to visit, reside, and do business. Under the scenarios described below, these could include:
  - Annual loss of recreation tourism expenditures of \$96.8 million that supports 1,073 jobs and \$24.3 million in payroll and generates \$4.8 million in state and \$2.6 million in local taxes
  - Annual loss of personal income of \$15.6 million due to slower growth in the number of retirees
  - Annual loss of personal income of \$2.1 million due to slower growth in sole proprietorships
- Total of estimated costs:
  - One-time costs (lost property value and lost ecosystem service value during construction) would total between \$65.1 to \$135.5 million
  - Annual costs (costs that recur year after year) would range from \$119.1 to \$130.8 million
    - Present discounted value of all future annual costs (discounted at 1.5%): \$7.9 to \$8.7 billion
  - One-time costs plus the discounted value of all future annual costs: \$8.0 to \$8.9 billion

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## ABBREVIATIONS AND TERMS

**BTM:** Benefit Transfer Method, a method for estimating the value of ecosystem services in a study region based on values estimated for similar resources in other places

**EIS:** Environmental Impact Statement, a document prepared under the National Environmental Policy Act analyzing the full range of environmental effects, including on the economy, of proposed federal actions, which in this case would be the approval of the Mountain Valley Pipeline

**ESV:** Ecosystem Service Value, the effects on human well-being of the flow of benefits from an ecosystem endpoint to a human endpoint at a given extent of space and time, or more briefly, the value of nature's benefits to people

**FERC:** Federal Energy Regulatory Commission, the agency responsible for preparing the EIS and deciding whether to grant a certificate of public convenience and necessity (i.e., whether to permit the pipeline)

**HCA:** High Consequence Area, the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure

**MVP:** Mountain Valley Pipeline, which in this report generally refers to the pipeline corridor itself

**MVP LLC:** Mountain Valley Pipeline, LLC, a joint venture of EQT Midstream Partners, LP, NextEra US Gas Assets, LLC, Con Edison Gas Midstream, LLC, WGL Midstream, Vega Midstream LLC, and RGC Midstream, will own and construct the proposed Mountain Valley Pipeline

**NEPA:** National Environmental Policy Act of 1970, which requires the environmental review of proposed federal actions, preparation of an EIS, and, for actions taken, appropriate mitigation measures

**ROW:** Right-of-Way, the permanent easement in which the pipeline is buried

## AUTHOR'S NOTE

We are grateful for the assistance of POWHR—for “Protect Our Water, Heritage, Rights” (information at [powhr.org](http://powhr.org))—coalition members and other groups in identifying local information sources and making contacts in the study region. These groups include Blue Ridge Land Conservancy, Border Conservancy, Chesapeake Climate Action Network, Greenbrier River Watershed Association, Preserve Bent Mountain, Preserve Craig, Preserve Franklin, Preserve Giles County, Preserve Greenbrier County, Preserve Monroe, Preserve Montgomery County, Va., Preserve the New River Valley, Preserve Roanoke, Roanoke Valley Cool Cities Coalition, Save Monroe, Summers County Residents Against the Pipeline, Virginia Chapter, Sierra Club, and Virginia Citizens Consumer Council.

We also thank Professor Stockton Maxwell of Radford University and his students John DeGroot and Bryan Behan for their assistance acquiring and processing spatial (GIS) data for the land value and visibility analyses. Key-Log Economics remains solely responsible for the content of this report, the underlying research methods, and the conclusions drawn. We have used the best available data and employed appropriate and feasible estimation methods but nevertheless make no claim regarding the extent to which these estimates will match the actual magnitude of economic effects if the MVP is built.

*Cover Photo from Franklin County, Virginia courtesy of David Sumrell*

## BACKGROUND

The proposed Mountain Valley Pipeline (MVP) is a high-volume transmission pipeline intended, as described in filings with the Federal Energy Regulatory Commission (FERC), to transport up to two million dekatherms per day of natural gas from the Marcellus and Utica Shale region in West Virginia to markets in the Mid- and South-Atlantic Region of the United States (Mountain Valley Pipeline LLC, 2015a). MVP LLC partners have also indicated that the pipeline could facilitate export of liquefied natural gas to India or other overseas markets (Adams, 2015).

The majority of the pipeline, and the entire portion in the eight-county region considered in this study (Figure 1), would consist of 42-inch diameter pipe and would be operated at a nominal pressure of 1,480 pounds per square inch gauge (PSIG).

Along the way, the MVP would cross portions of the Jefferson National Forest, the Appalachian Trail, the Blue Ridge Parkway, and other public conservation, scenic, and natural areas. Its permanent right-of-way and temporary construction corridor—50 and 125 feet wide, respectively—would also cross thousands of private properties. Pipeline leaks and explosions, should they occur, would cause substantial physical damage and require evacuation of even wider swaths, affecting perhaps tens of thousands of homes, farms, and businesses. Still wider, but more difficult to gauge and estimate, are the zones within which the construction, operation, and presence of the pipeline would affect human well-being by changing the availability of ecosystem services such as clean air, water supply, and recreational opportunities. This would occur as the pipeline creates an unnatural linear feature on a landscape that otherwise remains largely natural or pastoral and dampens the attractiveness of the affected region as a place to live, visit, retire, or do business.

To date, these negative effects and estimates of their attendant economic costs have not received much attention in the otherwise vigorous public debate surrounding the proposed MVP. This report, commissioned jointly by several regional and local groups, is both an attempt to understand the nature and potential magnitude of the economic costs of the MVP in a particular eight-county area, as well as to provide an example for FERC as it proceeds with its process of analyzing and weighing the full effects of the proposed MVP along its entire length and, by extension, throughout the region in which its effects will occur.

### Policy Context

Before construction can begin, the MVP must be approved by FERC. That approval, while historically granted to pipeline projects, depends on FERC's judgment that the pipeline would meet a public "purpose and need." Because the approval would be a federal action, FERC must also comply with the procedural and analytical requirements of the National Environmental Policy Act (NEPA). These include requirements for public participation, conducting environmental impact analysis, and writing an Environmental Impact Statement (EIS) that evaluates all of the relevant effects. Of particular interest here, such relevant effects include direct, indirect, and cumulative effects on or mediated through the economy. As the NEPA regulations state,

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (emphasis added, 36 CFR 1508.b).

It is important to note NEPA does not require that federal actions—which in this case would be approving or denying the MVP—necessarily balance or even compare benefits and costs. NEPA is not a decision-making law, but rather a law requiring decisions be supported by an as full as possible accounting of the reasonably foreseeable effects of federal actions on the natural and human environment. It also requires that citizens have opportunities to engage in the process of analyzing and weighing those effects.

Moreover, FERC’s own policy regarding the certification of new interstate pipeline facilities (88 FERC, para. 61,227) requires adverse effects of new pipelines on “economic interests of landowners and communities affected by the route of the new pipeline” be weighed against “evidence of public benefits to be achieved [by the pipeline]” (88 FERC, para. 61,227; Hoecker, Breathitt, & He’bert Jr., 1999, pp. 18–19). Further, “...construction projects that would have residual adverse effects would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects” (p. 23).

In principle, this policy is in line with the argument, on economic efficiency grounds, that the benefits of a project or decision should be at least equal to its cost, including external costs. However, the policy’s guidance regarding what adverse effects must be considered and how they are measured is deeply flawed. The policy states, for example, “if project sponsors...are able to acquire all or substantially all, of the necessary right-of-way by negotiation prior to filing the application...it would not adversely affect any of the three interests,” which are pipeline customers, competing pipelines, and “landowners and communities affected by the route of the new pipeline” (Hoecker et al., 1999, pp. 18, 26). The Commission’s policy contends the only adverse effects that matter are those affecting owners of properties in the right-of-way. Even for a policy adopted in 1999, this contention is completely out of step with long-established understanding that development that alters the natural environment has negative economic effects.

A further weakness of the FERC policy is that it relies on applicants to provide information about benefits and costs. The policy’s stated objective “is for the applicant to develop whatever record is necessary, and for the Commission to impose whatever conditions are necessary, for the Commission to be able to find that the benefits to the public from the project outweigh the adverse impact on the relevant interests” (Hoecker et al., 1999, p. 26). The applicant therefore has an incentive to be generous in counting benefits<sup>4</sup> and parsimonious in counting the costs of its proposal. Under these

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<sup>4</sup> MVP LLC has published estimates of economic benefits in the form of employment and income stemming from the construction and operation of the MVP (Ditzel, Fisher, & Chakrabarti, 2015a, 2015b). As has been well documented elsewhere, these studies suffer from errors in the choice and application of methods and in assumptions made regarding the long-run economic stimulus represented by the MVP. Most significantly, the studies make no mention of likely

circumstances, it seems unlikely that the Commission's policy will prevent the construction of pipelines for which the full costs are greater than the public benefits they would actually provide. Indeed, until just recently, FERC has never rejected a pipeline proposal (van Rossum, 2016).

Because MVP LLC failed to acquire a sufficient portion of the right-of-way and other federal agencies, including the US Forest Service, needed to evaluate how the MVP would affect resources under its stewardship, the Commission issued a Notice of Intent to prepare an EIS in February of 2015 (Federal Energy Regulatory Commission, 2015). The process began with a series of scoping meetings where members of the public could express their general thoughts on the pipeline as well as what effects should fall under the scope of the EIS. Interested parties also had the opportunity to submit comments online and through the mail.

Much of what FERC heard from citizens echoed and expanded upon the list of potential environmental effects listed in its Notice of Intent. Of those, several including "domestic water sources..., Appalachian Trail..., Residential developments and property values; Tourism and recreation" and others are particularly important as environmental effects that resonate in the lives of people. These effects can take the form of economic costs external to MVP LLC that would be borne by individuals, businesses, and communities throughout the landscape the MVP would traverse.

Based on a review of written comments submitted to FERC in January through March of 2015, citizens do seem to have emphasized these issues. Key issues include economic impacts, environmental degradation, public safety, property value effects, and issues related to cultural and historical resources (Pipeline Information Network, 2015).

## Study Objectives

Given the policy setting and what may be profound effects of the proposed MVP on the people and communities of Virginia and West Virginia, we have undertaken this study to provide information of two types:

1. An example of the scope and type of analyses that FERC could, and should, undertake as part of its assessment of the environmental (including economic) effects of the MVP.
2. An estimate of the potential magnitude of economic effects in this eight-county subset of the landscape where the MVP's environmental effects will be felt.

We do not claim the estimates below represent the total of all potential costs that would attend the construction, operation, and presence of the pipeline. Specifically, we have included several categories of cost: "passive-use value,"<sup>5</sup> including the value of preserving the landscape without a pipeline for

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economic costs, and their projections of long-term benefits extend far beyond the time period (of a year or so) within which economic impact analysis is either useful or appropriate. See Phillips (Phillips, 2015b) for details on these shortcomings.

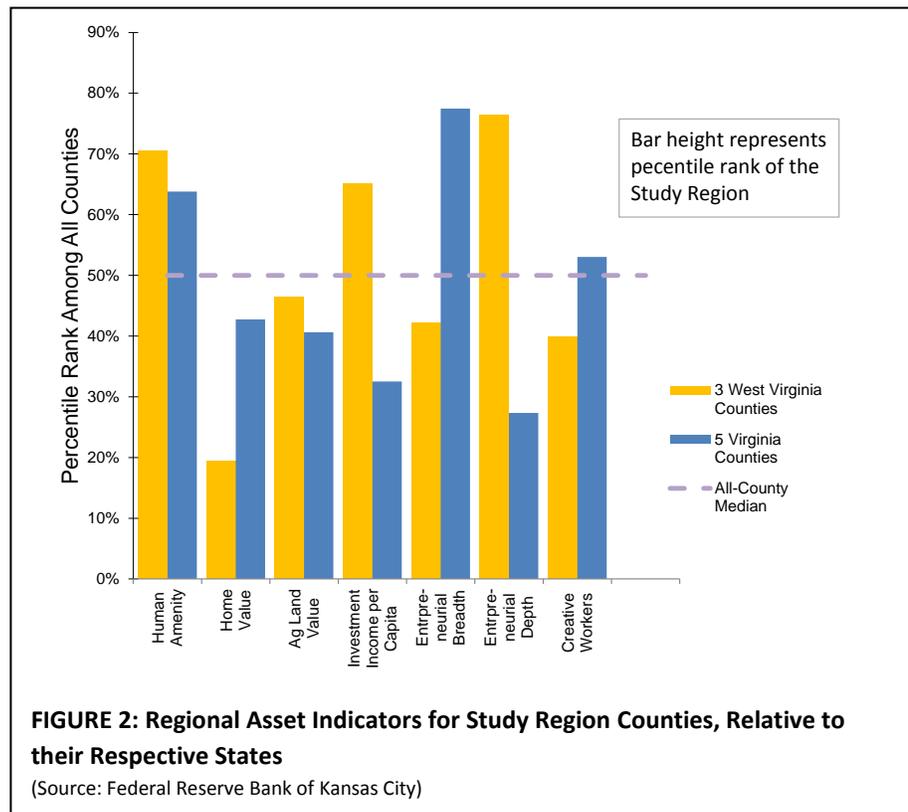
<sup>5</sup> Passive-use values include *option* value, or the value of preserving a resource unimpaired for one's potential future use; *bequest* value, which is the value to oneself of preserving the resource for the use of others, particularly future generations; and *existence* value, which is the value to individuals of simply knowing that the resource exists, absent any expectation of future use by oneself or anyone else. In the case of the MVP, people who have not yet visited the Blue Ridge Parkway or otherwise spent vacation time and dollars in the region are better off knowing that the setting for their planned activities is

future direct use, increases in the cost of community services like road maintenance and emergency response that may increase due to the construction and operation of the pipeline,<sup>6</sup> and probabilistic damages to natural resources, property, and human health and lives in the event of mishaps during construction and leaks/explosions during operation.

Therefore, our figures should be understood to be conservative, lower-bound estimates of the true total cost of the MVP in the sub-region and, of course, they do not include costs for the remainder of the region proposed for the MVP. We urge that the FERC augment the results of this study with its own similar analysis for the entire region and with additional research to determine the costs of community services and other relevant classes of costs not counted here.

### Current Economic Conditions in the Study Region

Our geographic focus is an eight-county region encompassing Craig, Franklin, Giles, Montgomery, and Roanoke counties in Virginia<sup>7</sup> as well as Greenbrier, Monroe, and Summers counties in West Virginia. This 3,964-square-mile region supports diverse land uses, including wild and pristine forests, both the Appalachian Trail and Blue Ridge Parkway, thriving cities, working farms, and extensive commercial timberland. These natural, cultural, and economic assets are among the reasons more than



a beautiful aesthetically pleasing landscape. What future visitors would be willing to pay to maintain that possibility would be part of the “option value” of an MVP-free landscape.

<sup>6</sup> As with communities impacted by the shale gas boom itself, communities along the pipeline can expect spikes in crime as transient workers come and go, more damage to roads under the strain of heavy equipment, increases in physical and mental illnesses including asthma, depression, anxiety, and others triggered by exposure to airborne pollutants, to noise, and to emotional, economic, and other stress. See, for example, Ferrar et al. (2013), Healy (2013), Fuller (2007), Campoy, (2012), and Mufson (2012).

<sup>7</sup> Two independent cities, Salem and Roanoke, lie within the geographic borders of Roanoke County. In this report, subject to some limitations where noted, statistics, estimates, and other information labeled as “Roanoke County” reflect totals for the County plus the two independent cities. The City of Radford at the southern edge of Montgomery County lies on the other side of the New River from the rest of the County, and is considered in this study to be far enough removed from the proposed MVP that it is not included in the statistics or estimates.

342,000 people call this region home and an even larger number visit each year for hiking, boating, sightseeing, festivals, weddings, and other events.

Statistics from the Center for the Study of Rural America, part of the Federal Reserve Bank of Kansas City, highlight the extent to which the region possesses the right conditions for resilience and economic success in the long run (Low, 2004). These data show that the study region has a higher human amenity index (based on scenic amenities, recreational resources, and access to health care), and strong entrepreneurship relative to most West Virginia or Virginia counties (Figure 2).<sup>8</sup> The West Virginia counties are stronger in terms of investment income per capita than the average for other West Virginia counties. The five Virginia counties have slightly more creative workers, as a percentage of the workforce, than the average for the Commonwealth.

More traditional measures of economic performance suggest the region is generally strong and resilient, though there are some differences among the Virginia and West Virginia Counties. From 2000 through 2014, for example:<sup>9</sup>

- Population in the study region grew by 9.6%, compared to a -0.5% loss of population for non-metro Virginia and West Virginia<sup>10</sup>
  - Population in the Virginia section of the study region grew by 10.5%, compared to a -0.2% loss of population for non-metro Virginia
  - Population in the West Virginia section of the study region grew by 0.8%, compared to a -1.1% loss of population for non-metro West Virginia
- Employment in the study region grew by 3.5%, compared to a -4.0% loss for non-metro Virginia and West Virginia
  - Employment in the Virginia section of the study region grew by 3.4%, compared to a -6.7% loss of employment for non-metro Virginia
  - Employment in the West Virginia section of the study region grew by 5.1%, compared to a 2.4% growth of employment for non-metro West Virginia
- Personal income in the study region grew by 20.6%, compared to 15.1% for non-metro Virginia and West Virginia
  - Personal income in the Virginia section of the study region grew by 20.7%, compared to 13.1% growth of personal income for non-metro Virginia

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<sup>8</sup> Note that the Kansas City Fed's statistics have not been updated since 2004-2006, and conditions in and outside the study region have undoubtedly changed. Some of these relative rankings may no longer hold.

<sup>9</sup> These data are from Headwaters Economics (2015), US Bureau of Economic Analysis (2015), and US Bureau of the Census (2014, 2015).

<sup>10</sup> "Non-metro Virginia" and "Non-metro West Virginia" comprises those counties that are not a part of a federally defined metropolitan statistical area (MSA). While the Virginia counties in the study region are in MSAs, each of the study region counties are predominantly rural in landscape and character and are much more like other non-metro counties than they are like Northern Virginia or Tidewater, for example. Therefore, we believe that averages for non-metro Virginia provide a more appropriate point of comparison than statistics that include the Commonwealth's more urban areas. None of the West Virginia counties in the study region are part of an MSA.

- Personal income in the West Virginia section of the study region grew by 19.7%, compared to 19.6% growth of personal income for non-metro West Virginia
- On average, earnings per job in the study region are higher, by about \$7,400/year, than the average for non-metro Virginia and West Virginia
  - Earnings per job in the Virginia section of the study region are higher, by about \$9,300/year, than the average for non-metro Virginia
  - Earnings per job in the West Virginia section of the study are lower, by about \$5,100/year than the average for non-metro West Virginia
- Per capita income is higher in the study region, by \$4,100/year, than the average for non-metro Virginia and West Virginia
  - Per capita income in the Virginia section of the study region is higher, by about \$4,400/year, than the average for non-metro Virginia
  - Per capita income in the West Virginia section of the study region, while growing, is lower, by about \$1,400/year, than the average for non-metro West Virginia
- The unemployment rate in the study region is 2.5%, compared to 2.3% for non-metro Virginia and West Virginia, during 2000-2014
  - The unemployment rate in the Virginia section of the study region is 2.9%, compared to an unemployment rate of 3.2% for non-metro Virginia, during 2000-2014
  - The unemployment rate in the West Virginia section of the study region is 0.3%, compared to an unemployment rate of 1.0% for non-metro West Virginia, during 2000-2014

These trends are consistent with what regional economists McGranahan and Wojan have called the “Rural Growth Trifecta” of outdoor amenities, a creative class of workers, and a strong “entrepreneurial context” (innovation-friendliness) (2010). Individual workers, retirees, and visitors are attracted to the natural beauty of the region while entrepreneurs are attracted by the quality of the environment, by the quality of the workforce, and by existing support from local government. Workers, for their part, are retained and nurtured by dynamic businesses that fit with the landscape and lifestyle that attracted them to the region in the first place. As further indication of this dynamic, consider since 2000:<sup>9</sup>

- The region’s population growth has been primarily due to in-migration
- The proportion of the population 65 years and older has increased from 14.5% to 15.5%
- Proprietors’ employment is up by 28.9%
- Non-labor income (primarily investment returns and age-related transfer payments like Social Security) is up by 39.0%.

These trends suggest entrepreneurs and retirees are moving to (or staying in) this region, bringing their income, expertise, and job-creating energy with them.

Temporary residents—tourists and recreationists attracted to the natural amenities of the region—and the businesses that serve them are also important parts of the region’s economy. Tourists spent more

than \$1.2 billion in the study region in 2014. The companies that directly served those tourists employed 11,642 people, or 15.4% of all full- and part-time workers (Dean Runyan Associates, 2015; Headwaters Economics, 2015; Virginia Tourism Corporation, 2015).

It is in this context the potential economic impacts of the MVP must be weighed and the apprehension of the region's residents understood. Many believe the construction and operation of the pipeline will kill, or at least dampen, the productivity of the proverbial goose that lays its golden eggs in the region. This could result in a slower rate of growth in the region and worse economic outcomes. More dire is the prospect that businesses will not be able to maintain their current levels of employment. Just as retirees and many businesses can choose where to locate, visitors and potential visitors have practically unlimited choices for places to spend their vacation time and expendable income. If the study region loses its amenity edge, other things being equal, people will go elsewhere, and this region could contract.

Instead of a "virtuous circle" with amenities and quality of life attracting/retaining residents and visitors, who improve the quality of life, which then attracts more residents and visitors, the MVP could tip the region into a downward spiral. In that scenario, loss of amenity and risk to physical safety would translate into a diminution or outright loss of the use and enjoyment of homes, farms, and recreational and cultural experiences. Some potential in-migrants would choose other locations and some long-time residents would move away, draining the region of some of its most productive members. Homeowners would lose equity as housing prices follow a stagnating economy. With fewer people to create economic opportunity, fewer jobs and less income will be generated. Communities could become hollowed out, triggering a second wave of amenity loss, out-migration, and further economic stagnation.

## ENVIRONMENTAL-ECONOMIC EFFECTS AND WHERE THEY WOULD OCCUR

In the remainder of this report, we follow this potential cycle and estimate three distinct types of economic consequences.

First, corresponding to the direct biophysical impacts of the proposed pipeline, are effects on ecosystem services—the benefits nature provides to people for free, like purified water or recreational opportunities, that will become less available and/or less valuable due to the MVP's construction and operation. Second are effects on property value as owners and would-be owners choose properties farther from the pipeline's right-of-way, evacuation zone, and viewshed. Third and finally are more general economic effects caused by a dampening of future growth prospects or even a reversal of fortune for some industries.

We begin with an exploration of the geographic area over which these various effects will most likely be felt.

### **Impact Zones within the Study Region**

Construction of the pipeline corridor itself would require clearing an area at least 125 feet (38.1 m) wide. (It would be wider in some areas depending on slope.) After construction, the permanent right-

of-way (ROW) would be 50 feet wide along the entire length of the pipeline. Within the construction zone and right-of-way is where the greatest disruption of ecosystem processes will occur, so these zones are where reductions in ecosystem service value (ESV) emanate. Since we are estimating ecosystem service values at their point of origin, we will focus on the ROW and the construction zone, as well as temporary and permanent access roads, temporary workspaces, and permanent surface infrastructure.

Operated at its intended pressure and due to the inherent risk of leaks and explosions, the pipeline would present the possibility of having significant human and ecological consequences within a large “High Consequence Area” and an even larger evacuation zone. A High Consequence Area (HCA) is “the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure” (Stephens, 2000, p. 3). Using Stephens’ formula, the HCA for this pipeline would have a radius of 1,095 feet (333.9 m). The evacuation zone is defined by the distance beyond which an unprotected human could escape burn injury in the event of the ignition or explosion of leaking gas (Pipeline Association for Public Awareness, 2007, p. 29). There would be a potential evacuation zone with a radius of at least 3,583 feet (1092.1 m).<sup>11</sup> (See map, Figure 3, for a close-up of these zones in part of the study region.) An explosion would undoubtedly affect ecosystem processes within the HCA and possibly the evacuation zone, but given the probability of an explosion at a particular point along the pipeline at a given time is small, we do not include the additional effects *on ecosystem service value* due to explosion in the cost estimates.

Effects on land value are another matter, and it is reasonable to consider land value impacts through both the high consequence area and the evacuation zone. As Kielisch (2015) stresses, the value of land is determined by human perception, and property owners and would-be owners have ample reason to perceive risk to property near high-pressure natural gas transmission pipelines. Traditional news reports, YouTube, and other media reports attest to the occurrence and consequences of pipeline leaks and explosions, which are even more prevalent for newer pipelines than for those installed decades ago (Smith, 2015). Information about pipeline risks translates instantly into buyers’ perceptions and, therefore, into the chances of selling properties exposed to those risks, into prices offered for those properties, and, for people who already own such properties, diminished enjoyment of them (Freybote & Fruits, 2015).

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*“I saw no other option than to cancel my home building project once the MVP was proposed to cross the property.”*

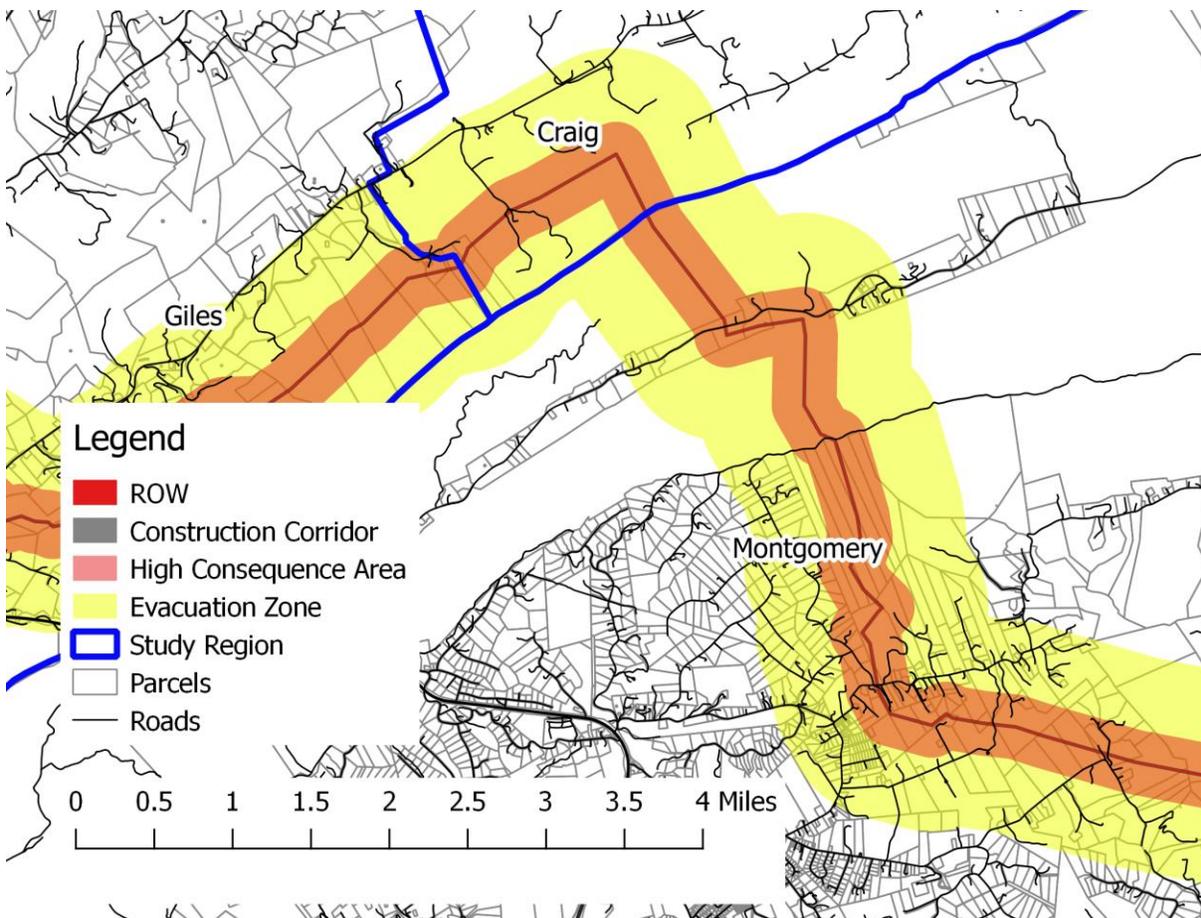
— *Christian Reidys, Blacksburg, VA*

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In addition, loss of view quality would be expected for properties both near to and far from the pipeline corridor. Unlike leaks and explosions, view quality impacts will occur with certainty. If the pipeline is built, people will see the corridor as a break in a once completely forested hillside, and their “million-

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<sup>11</sup> The maximum operating pressure proposed for the MVP is 1,480 PSIG, but the source data for this evacuation distance is a table with pressure in 100 PSIG increments. The full evacuation distance would be between 3,583 feet and 3,709 feet, the distance recommended for a 42” pipeline operated at 1,500 PSIG. The upshot for this study is a slightly more conservative estimate of the effect of the MVP on property value.



**FIGURE 3: Right-of-Way, Construction, High Consequence, and Evacuation Areas**

Note that the overlay of the HCA (in rose) and the evacuation zone (in yellow) shows up as the orange band in the map. The ROW covers much of the construction corridor, leaving a thin band of grey visible.

Sources: MVP route digitized from online maps and MVP LLC filings (<http://mountainvalleypipeline.info/maps/>); Counties and roads from USGS (<http://nationalmap.gov>); Parcels from public records in Giles and Montgomery County, respectively. (Parcel boundaries are not available in electronic form for Craig County.)

dollar” view will be diminished. Therefore, for our analysis of land value, we consider any place where there is considerable potential to see the pipeline corridor to be within its direct impact zone. (See map, Figure 7, in the land value section for the results of the visibility analysis.)

Beyond the loss of ecosystem services stemming from the conversion of land in the ROW, the loss of property value resulting from the chance of biophysical impacts, or the certainty of impacts on aesthetics, the proposed MVP would also diminish physical ecosystem services, scenic amenity, and passive-use value that are realized or enjoyed beyond the evacuation zone and out of sight of the pipeline corridor. The people affected include residents, businesses, and landowners throughout the study region, as well as past, current, and future visitors to the region. The impacts on human well-being would be reflected in economic decisions such as whether to stay in or migrate to the study region, whether to choose the region as a place to do business, and whether to spend scarce vacation time and dollars near the MVP instead of in some other place.

To the extent the MVP causes such decisions to favor other areas, less spending and slower economic growth in the study region would be the result. A secondary effect of slower growth would be further reductions in land value, but in this study we consider the primary effects in terms of slower population, employment, and income growth in key sectors. Table 1 summarizes the types of economic values considered in this study and the zones in which they are estimated.

**TABLE 1: Geographic Scope of Effects**

A check mark indicates those zones/effects for which estimates are included in this study. The "X's" indicate areas for future study.

Values / Effects	Right-of-Way and Construction Zone	High Consequence Area	Evacuation Zone	Pipeline Viewshed	Entire Study Region	The World Beyond the Study Region
Ecosystem Services	✓	a	a	a,b	x <sup>a,b</sup>	x
Land / Property Value	✓ <sup>c</sup>	✓ <sup>d</sup>	✓ <sup>d</sup>	✓ <sup>e</sup>	x	n/a
Economic Development Effects	f	f	f	f	✓	n/a

Notes:

- a. Changes in ecosystem services that are felt beyond the ROW and Construction zone may be key drivers of “Economic Development Effects,” but they are not separately estimated to avoid double counting.
- b. With the exception of the impact on visual quality, we do not estimate the spillover effects of alteration of the ecosystem within the ROW on the productivity of adjacent areas. The ROW, for example, provides a travel corridor for invasive species that could reduce the integrity and ecosystem productivity of areas that, without the MVP would remain core ecological areas, interior forest habitat, etc.
- c. We estimate land value effects for the ROW but not for the construction zone.
- d. Properties in the HCA are treated as though there is no additional impact on property value relative to the impact of being in the evacuation zone.
- e. To avoid double-counting, changes in property value due to an altered view from the property are considered to be part of lost aesthetic value under the “Ecosystem Services” section.
- f. Economic development effects related to these subsets of the study region are included in estimates for the study region.

## EFFECTS ON ECOSYSTEM SERVICE VALUE

The idea that people receive benefits from nature is not at all new, but “ecosystem services” as a term describing the phenomenon is more recent, emerging in the 1960s (Millennium Ecosystem Assessment, 2003). “Benefits people obtain from ecosystems” is perhaps the simplest and most commonly heard

definition of ecosystem services (Reid et al., 2005). Other definitions abound, including the following from Gary Johnson of the University of Vermont:

Ecosystem services are the effects on human well-being of the flow of benefits from an ecosystem endpoint to a human endpoint at a given extent of space and time (2010).

This definition is helpful because it emphasizes services are not necessarily things—tangible bits of nature—but rather, they are the effects on people of the functions of the natural world. It also makes clear ecosystem services happen or are produced and enjoyed in particular places and at particular times.

No matter the definition, different types of ecosystems (forest, wetland, cropland, urban areas) produce different arrays of ecosystem services, and/or produce similar services to greater or lesser degrees. This is true for the simple reason that some ecosystems or land uses produce a higher flow of benefits than others.

“Ecosystem services” is sometimes lengthened to “ecosystem goods and services” to make it explicit that some are tangible, like physical quantities of food, water for drinking, and raw materials, while others are truly services, like cleaning the air and providing a place with a set of attributes that are conducive to recreational experiences or aesthetic enjoyment. We use the simpler “ecosystem services” here. Table 2, lists the provisioning, regulating, and cultural ecosystem services included in this study.

At a conceptual level, we estimate the potential effects of the MVP on ecosystem service value by identifying the extent to which the construction and long-term existence of the pipeline would change land cover or land use, resulting in a change in ecosystem service productivity. Lower productivity, expressed in dollars of value per acre per year, means fewer dollars’ worth of ecosystem service value produced each year.

Construction would essentially strip bear the 125-foot-wide construction corridor. Once construction is complete and after some period of recovery, the 50-foot-wide right-of-way will be occupied by a different set of ecosystem (land cover) types than were present before construction. By applying per-acre ecosystem service productivity estimates (denominated in dollars) to the various arrays of ecosystem service types, we can estimate ecosystem service value produced per year in the periods before, during, and after construction. The difference between annual ecosystem service value *during* construction and *before* construction is the annual loss in ecosystem service value *of* construction. The difference between the annual ecosystem service value during ongoing operations (i.e., the value produced in the ROW) and the before-construction baseline (no pipeline) is the annual ecosystem service cost that will be experienced indefinitely.

**TABLE 2: Ecosystem Services Included in Valuation**

<b>Provisioning Services<sup>a</sup></b>
<p><b>Food Production:</b> The harvest of agricultural produce, including crops, livestock, and livestock by-products; the food value of hunting, fishing, etc.; and the value of wild-caught and aquaculture-produced fish.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Forest</p>
<p><b>Raw Materials:</b> Fuel, fiber, fertilizer, minerals, and energy.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest</p>
<p><b>Water Supply:</b> Filtering, retention, storage, and delivery of fresh water—both quality and quantity—for drinking, watering livestock, irrigation, industrial processes, hydroelectric generation, and other uses.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest, Water, Wetland</p>
<b>Regulating Services<sup>a</sup></b>
<p><b>Air Quality:</b> Removing impurities from the air to provide healthy, breathable air for people.</p> <p><b>Associated land uses<sup>b</sup>:</b> Shrub/Scrub, Forest, Urban Open Space</p>
<p><b>Biological Control:</b> Inter- and intra-specific interactions resulting in reduced abundance of species that are pests, vectors of disease, or invasive in a particular ecosystem.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture, Grassland, Forest</p>
<p><b>Climate Regulation:</b> Storing atmospheric carbon in biomass and soil as an aid to the mitigation of climate change, and/or keeping regional/local climate (temperature, humidity, rainfall, etc.) within comfortable ranges.</p> <p><b>Associated land uses<sup>b</sup>:</b> Pasture/Forage, Grassland, Shrub/Scrub, Forest, Wetland, Urban Open Space, Urban Other</p>
<p><b>Erosion Control:</b> Retaining arable land, stabilizing slopes, shorelines, riverbanks, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest</p>
<p><b>Pollination:</b> Contribution of insects, birds, bats, and other organisms to pollen transport resulting in the production of fruit and seeds. May also include seed and fruit dispersal.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest</p>
<p><b>Protection from Extreme Events:</b> Preventing and mitigating impacts on human life, health, and property by attenuating the force of winds, extreme weather events, floods, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forests, Urban Open Space, Wetland</p>
<p><b>Soil Fertility:</b> Creation of soil, inducing changes in depth, structure, and fertility, including through nutrient cycling.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest</p>
<p><b>Waste Treatment:</b> Improving soil and water quality through the breakdown and/or immobilization of pollution.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest, Water, Wetland</p>
<p><b>Water Flows:</b> Regulation by land cover of the timing of runoff and river discharge, resulting in less severe drought, flooding, and other consequences of too much or too little water available at the wrong time or place.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forests, Urban Open Space, Urban Other</p>
<b>Cultural Services<sup>a</sup></b>
<p><b>Aesthetic Value:</b> The role that beautiful, healthy natural areas play in attracting people to live, work, and recreate in a region.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest, Pasture/Forage, Urban Open Space, Wetland</p>
<p><b>Recreation:</b> The availability of a variety of safe and pleasant landscapes—such as clean water and healthy shorelines—that encourage ecotourism, outdoor sports, fishing, wildlife watching, hunting, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Forest, Water, Wetland, Urban Open Space, Urban Other</p>

Notes:

- a. Descriptions follow Balmford (2010, 2013), Costanza et al. (1997), Reid et al. (2005), and Van der Ploeg, et al. (2010).
- b. “Associated Land Uses” are limited to those for which per-unit-area values are available in this study.

In addition to the ROW and construction corridor, the MVP would require the construction of various temporary and permanent access roads, temporary work areas, and several areas for maintenance facilities. All temporary roads and temporary work areas are treated as though they are part of the construction zone. Permanent roads and installations are treated separately. Note that many of the access roads already exist and will simply be used for pipeline access. Since there is no change in the land use for those roads, there is no loss in ecosystem service value associated with them. It is only when areas are converted from forest, pasture, or other land covers to the developed use (a road or surface facility) that ecosystem service value is altered.

This overall process is illustrated in Figure 4 and the details of our methods, assumptions, and calculations are described in the following two sub sections.

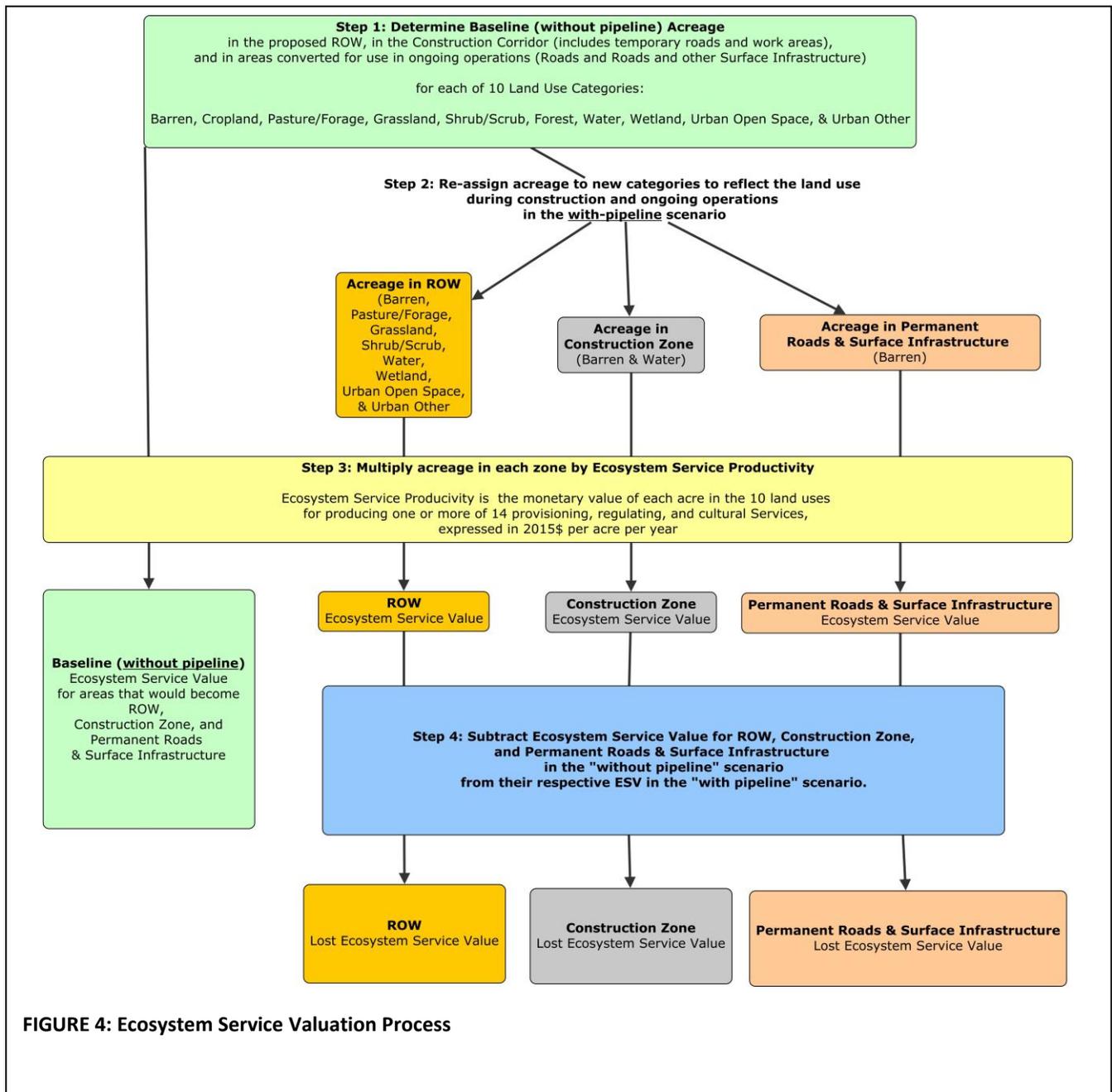


FIGURE 4: Ecosystem Service Valuation Process

## Ecosystem Service Estimation Methods

Economists have developed widely used methods to estimate the monetary value of ecosystem services and/or natural capital. The most widely known example was a study by Costanza et al. (1997) that valued the natural capital of the entire world. That paper and many others employ the “benefit transfer method” or “BTM” to establish a value for the ecosystem services produced or harbored from a particular place.<sup>12</sup> According to the Organization for Economic Cooperation and Development, BTM is “the bedrock of practical policy analysis,” particularly in cases such as this when collecting new primary data is not feasible (OECD, 2006).

As the name implies, BTM takes a rate of ecosystem benefit delivery calculated for one or more “source areas” and applies that rate to conditions in the “study area.” As Batker et al. (2010) state, the method is very much like a real estate appraiser using comparable properties to estimate the market value of the subject property. It is also similar to using an existing or established market or regulated price, such as the price of a gallon of water, to estimate the value of some number of gallons of water supplied in some period of time. The key is to select “comps” (data from source areas) that match the circumstances of the study area as closely as possible.

Typically, values are drawn from previous studies estimating the value of various ecosystem services from similar land cover or ecosystem types. Also, it is benefit (in dollars) per-unit-area-per-year in the source area that is transferred and applied to the number of hectares or acres in the same land cover/biome in the study area. For example, data for the source area may include the value of forest land for recreation. In that case, one would apply the per-acre value of recreation from the source area’s forestland to the number of acres of forestland in the study area. Multiplying that value by the number of acres of forestland in the study area produces the estimate of the value of the study area’s forests to recreational users. Furthermore, it is important to use source studies that are from regions with underlying economic, social, and other conditions similar to the study area.

Following these principles as well as techniques developed by Esposito et al. (2011), Esposito (2009), and Phillips and McGee (2014, 2016a), and as illustrated in Figure 4, we employ a four-step process to evaluate the short-term and long-term effects of the MVP on ecosystem service value in our study region. The steps are described in greater detail below, but in summary, they are:

1. Assign land and water in the study to one of 10 land uses based on remotely sensed (satellite) data in the National Land Cover Dataset (NLCD) (Fry et al., 2011). This provides the array of land uses for estimating baseline or “without MVP” ecosystem service value.
2. Re-assign or re-classify land and water to what the land cover would most likely be during construction and during ongoing operation.
3. Multiply acreage by per-acre ecosystem service productivity (the “comps,”) (in dollars per acre per year) to obtain estimates of annual aggregate ecosystem service value under the baseline/no MVP scenario, for the construction corridor (and period), and for the ROW during

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<sup>12</sup> See also Esposito et al. (2011), Flores et al. (2013), and Phillips and McGee (2014) for more recent examples.

ongoing operation.

For simplicity and given the two-year construction period, we assume the construction corridor will remain barren for a full two-year period. We recognize revegetation will begin to occur soon after the trench is closed and fill and soil are returned, but it will still be some time until something like a functioning ecosystem has actually been restored.

4. Subtract baseline (no pipeline) ESV from ESV (with pipeline) for the construction period (and in the construction corridor) and from ESV during ongoing operations (in the ROW) to obtain estimates of the ecosystem service costs imposed annually during the construction and operations period, respectively.

### Step 1: Assign Land to Ecosystem Types or Land Uses

The first step in the process is to determine the area in the 10 land use groups in the study region. This determination is made using remotely sensed data from the National Land Cover Database (NLCD) (Fry et al., 2011). Satellite data provides an image of land in one of up to 21 land cover types at the 30-meter level of resolution;<sup>13</sup> 15 of these land cover types are present in the study region (Table 3 and Figure 5).

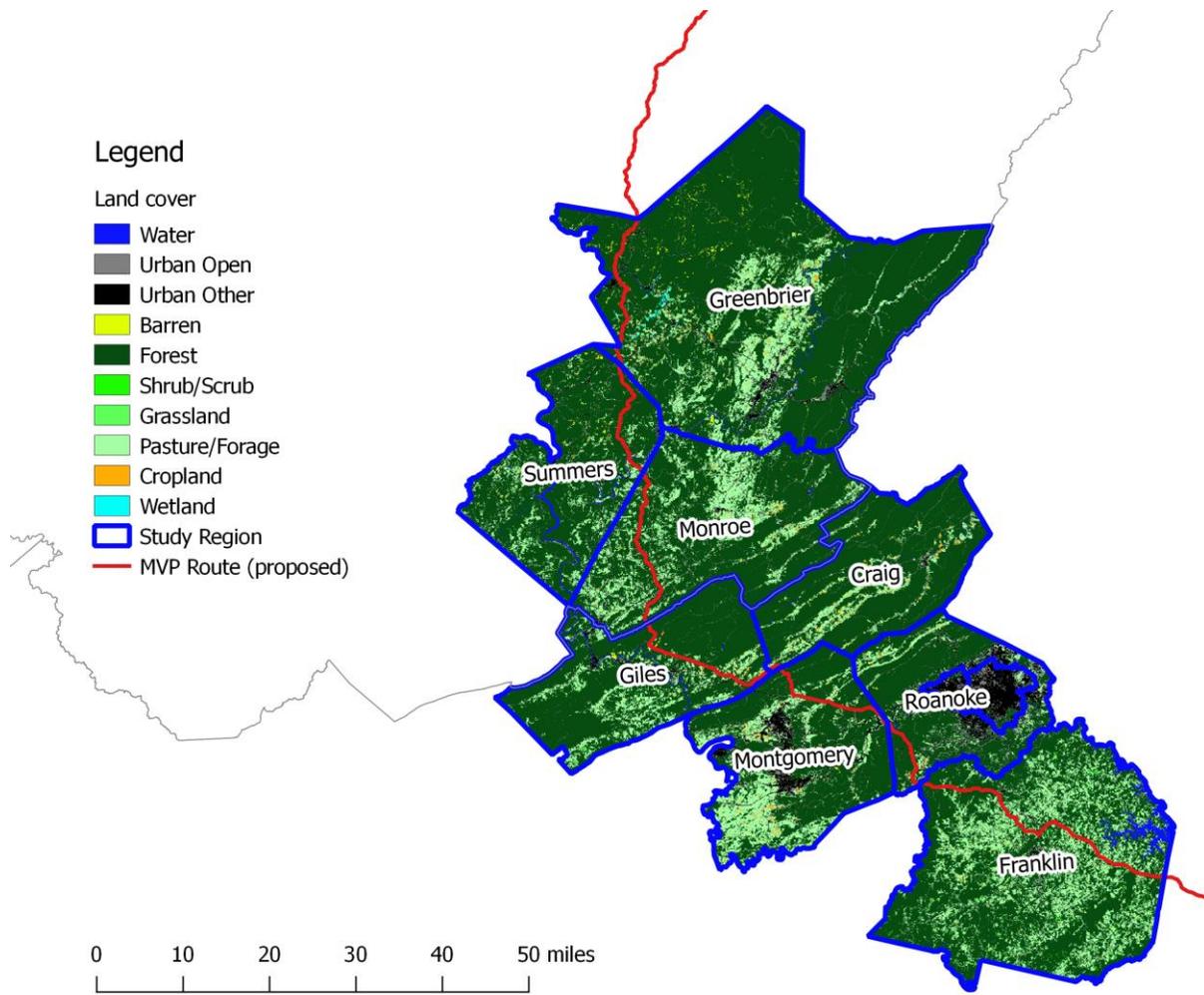
**TABLE 3: Land Area Affected By MVP, Study Region Total (See Also Figure 6)**

Land Use	Baseline acreage in ROW	Baseline acreage in construction corridor, including temp work zones, etc.	Baseline acreage in permanent surface infrastructure
Urban Other	6.6	22.9	1.3
Urban Open Space	23.9	85	3.3
Wetland	0.5	1.4	0
Water	0.8	2.5	0
Forest	663.7	1781.4	54
Shrub/Scrub	0.5	2	0
Grassland	3.6	10.5	0.4
Pasture/Forage	141.5	485.3	15.6
Cropland	11.9	32.3	0.9
Barren	8.2	26.1	0.2
<b>Total</b>	<b>861.2</b>	<b>2449.4</b>	<b>75.7</b>

Looking forward to the final step, we will use land use categories to match per-acre ecosystem value estimates from source areas to the eight-county study region. Unfortunately, value estimates are not available for all of the detailed land use categories present in the region. We therefore simplify the NLCD classification by combining a number of classifications into larger categories for which per-acre

<sup>13</sup> Because 30 meters is wider than the right-of-way and not much narrower than the 125-foot construction corridor, we resample the NLCD data to 10m pixels, which breaks each 30m-by-30m pixel into 9 10m-by-10m pixels. This allows for a closer approximation of the type and area of land cover in the proposed ROW and construction corridor.

values are more available. Specifically, low-, medium-, and high-intensity development are grouped as “urban other,” and deciduous, evergreen, and mixed forest are grouped as “forest.”

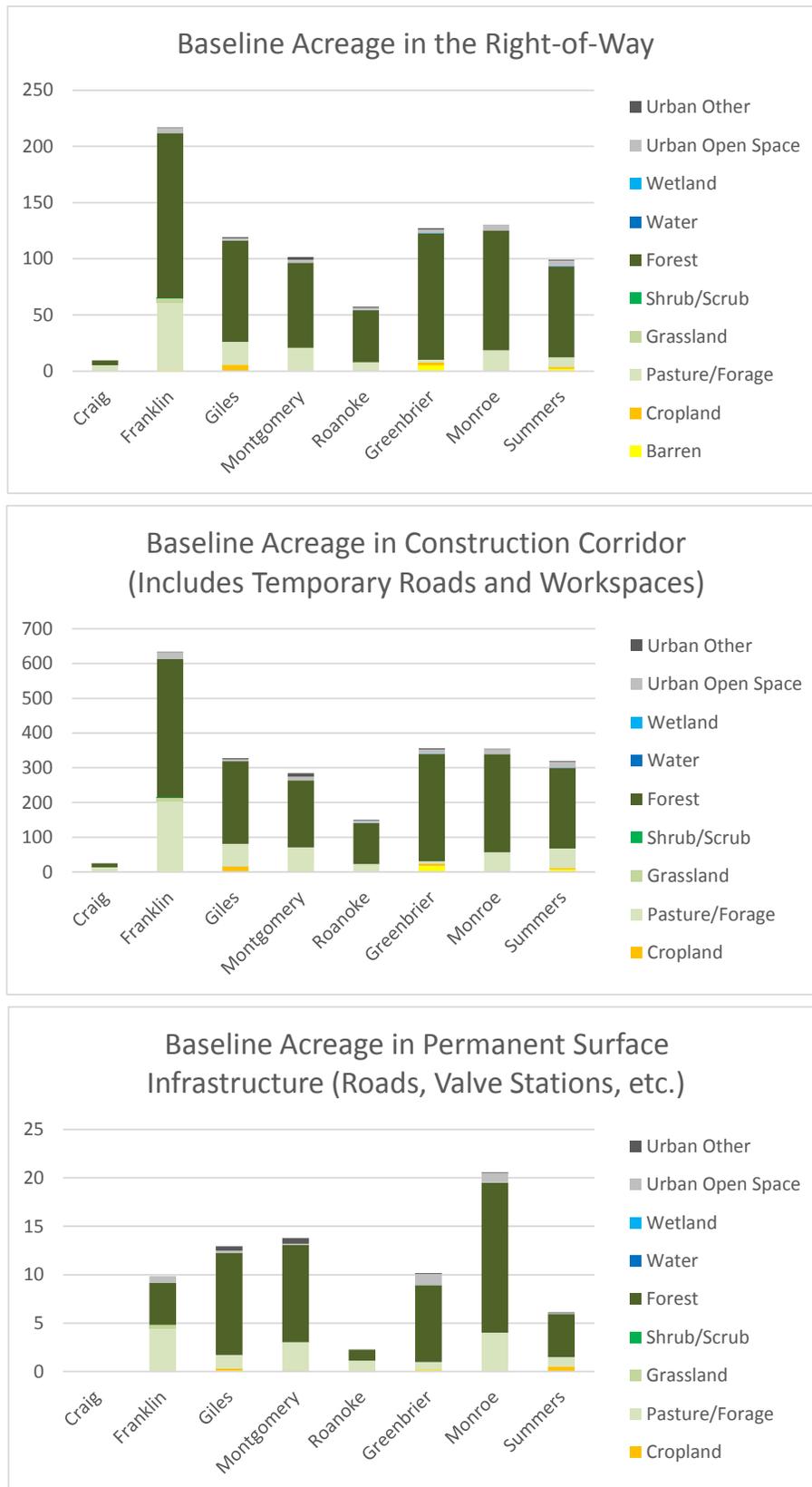


**FIGURE 5: Land Use in the Study Region, as Classified for Ecosystem Service Valuation**

Land cover for the entire study region is shown to display the overall range and pattern of land use. The ecosystem service valuation itself covers only those portions of the study region that would be occupied by the MVP right-of-way and construction corridor.

Sources: Land Cover from National Land Cover Database (Fry, et al. 2011); MVP route digitized from online maps and MVP LLC filings (<http://mountainvalleypipeline.info/maps/>); Counties from USGS (<http://nationalmap.gov>).

In addition and for two reasons, we add land in the NLCD category of “woody wetlands” to the “forest” category for two reasons. First, these wetlands would normally become forest in the study region (Johnston, 2014; Phillips & McGee, 2016a). Second, wetlands possess some of the highest per-acre values for several ecosystem services. To avoid over-estimating the ecosystem services contribution of “woody wetlands,” we count them as “forest” instead of “wetland.”



**FIGURE 6: Baseline (Pre-MVP) Land Use, by County, in the Row, Construction Zones, and Permanent Surface Infrastructure. (See also Table 3.)**

In the end, at least for baseline (no pipeline) conditions, we have land in 10 land uses. The total area that would be disturbed in the construction corridor and temporary roads and other work areas is 2,449 acres, of which 861 acres would be occupied by the permanent right-of-way. An additional 76 acres would be devoted to permanent access roads and other installations on the surface. Figure 6 shows the distribution of acreage in the ROW, construction zone, and in land needed for permanent surface infrastructure by county and pre-MVP, or baseline land use.

**Step 2: Re-assign Acreage to New Land Cover Types for the Construction and Operation Periods**

We assume all land in the construction corridor will be “barren” or at least possess the same ecosystem service productivity profile as naturally-occurring barren land for the duration of the construction period. Water will remain water during construction. Table 4 lists the reassignment assumptions in detail.

**TABLE 4: Land Cover Reclassification**

<b>NLCD Category</b>	<b>Reclassification for Baseline</b>	<b>Reclassification for Construction</b>	<b>Reclassification for Ongoing Operation in the ROW</b>	<b>Reclassification for Ongoing Operation Roads and Surface Infrastructure</b>
<b>Barren Land</b>	Barren	Barren	Barren	Barren
<b>Cultivated Crops</b>	Cropland	Barren	Pasture/Forage	Barren
<b>Pasture/Hay</b>	Pasture/Forage	Barren	Pasture/Forage	Barren
<b>Grassland/Herbaceous</b>	Grassland	Barren	Grassland	Barren
<b>Shrub/Scrub</b>	Shrub/Scrub	Barren	Shrub/Scrub	Barren
<b>Deciduous Forest</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Evergreen Forest</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Mixed Forest</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Woody Wetlands</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Open Water</b>	Water	Water	Water	Barren
<b>Emergent Herbaceous Wetlands</b>	Wetland	Barren	Wetland	Barren
<b>Developed, Open Space</b>	Urban Open Space	Barren	Urban Open Space	Barren
<b>Developed, Low Intensity</b>	Urban Other	Barren	Urban Other	Barren
<b>Developed, Medium Intensity</b>	Urban Other	Barren	Urban Other	Barren
<b>Developed, High Intensity</b>	Urban Other	Barren	Urban Other	Barren

Within the ROW, and for the indefinite period following construction—during ongoing operations—we assume pre-MVP forestland will become shrub/scrub, and cropland will become pasture/forage. We

recognize some pre-MVP cropland may be used for crops after construction has been completed, but as expressed in comments to FERC and elsewhere, and as we discovered through personal interviews with agricultural producers in the region, it seems likely that the ability to manage acreage for row crops will be greatly curtailed, if not eliminated entirely by the physical limits imposed by the MVP and by restrictions in easements to be held by MVP LLC. These include limits on the weight of equipment that could cross the corridor at any given point and difficulty using best soil conservation practices, such as tilling along a contour, which may be perpendicular to the pipeline corridor. (This would require extra time and fuel use that could render some fields too expensive to till, plant, or harvest.) Reclassifying cropland as pasture/forage (which is a generally less productive ecosystem service) recognizes these effects while also recognizing some sort of future agricultural production in the ROW (grazing and possibly haying) could be possible.

An additional effect not captured in our methods is long-standing harm to agricultural productivity due to soil compaction, soil temperature changes, and alteration of drainage patterns due to pipeline construction. As agronomist Richard Fitzgerald (2015) concludes, "it is my professional opinion that the productivity for row crops and alfalfa will never be regenerated to its existing present 'healthy' and productive condition [after installation of the pipeline]." Thus, the true loss in food and other ecosystem service value from pasture/forage acreage would be larger than our estimates reflect.

Permanent access roads and sites for main line valves are assumed, post construction, to remain in the "barren" land use and produce the corresponding level of ecosystem services.

### **Step 3: Multiply Acreage by Per-Acre Value to Obtain ESV**

After obtaining acreage by land use in the construction corridor and the ROW, we are ready to multiply those acres times per-acre-per-year ecosystem service productivity (in dollar terms) to obtain total ecosystem service value in each area and for with- and without-pipeline scenarios. Per-acre ecosystem service values are obtained primarily from a database of more than 1,300 estimates compiled as part of a global study known as "The Economics of Ecosystems and Biodiversity" or "the TEEB" (Van der Ploeg et al., 2010).<sup>14</sup> The TEEB database allows the user to select the most relevant per-unit-area values, based on the land use/land cover profile of the study region, comparison of general economic conditions in the source and study areas, and the general "fit" or appropriateness of the source study for use in the study area at hand. After eliminating estimates from lower-income countries and estimates from the U.S. that came from circumstances vastly different from Virginia and West Virginia, we identified 91 per-acre estimates in the TEEB that adequately provide approximations of ecosystem service value in our study region.<sup>15</sup>

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<sup>14</sup> Led by former Deutsche Bank economist, Pavan Sukhdev, the TEEB is designed to "[make] nature's values visible" in order to "mainstream the values of biodiversity and ecosystem services into decision-making at all levels" ("TEEB - The Initiative," n.d.). It is also an excellent example of the application of the benefit transfer method.

<sup>15</sup> Among those U.S. studies included in the TEEB database that we deemed inappropriate for use here were a study from Cambridge Massachusetts that reported extraordinarily high values for aesthetic and recreational value and the lead author's own research on the Tongass and Chugach National Forests in Alaska. The latter was excluded due to the vast differences in land use, land tenure, climate, and other factors between the source area and the current study region.

After selecting the best candidate studies and estimates in the TEEB database, we still had some key land use/ecosystem services values (such as food from cropland) without value estimates. To fill some of the most critical gaps, we turned to other studies that examined ecosystem service value in this general region (Phillips, 2015a; Phillips & McGee, 2016b) and to specific data on cropland and pasture/hayland value from Virginia Cooperative Extension and the National Agricultural Statistics Service (Lex & Groover, 2015; USDA National Agricultural Statistics Service, 2016).

For several land cover-ecosystem service combinations, either multiple source studies were available or the authors of those studies reported a range of dollar-per-acre ecosystem service values. We are therefore able to report both a low and a high estimate based on the bottom and top end of the range of available estimates.

In the end, we have 165 separate estimates from 61 unique source studies covering 67 combinations of land uses and ecosystem services. (See Appendix A to this report for a full list of the values and sources that yielded these estimates.) This is still a fairly sparse coverage, given there are 140 possible combinations of the 10 land uses and 14 services. Therefore, we know our aggregate estimates will be lower than they would be if dollar-per-acre values for all 14 services were available to transfer to each of the 10 land use categories in the study region. It is possible to live with that known underestimation, or it is possible to assign per-acre values from a study of one land-use-and-service combination to other combinations. Doing so would introduce unknown over- or perhaps under-estimation of aggregate values. We prefer to take the first course, knowing our estimates are low/conservative and urge readers to bear this in mind when interpreting this information for use in weighing the costs of the proposed MVP.

After calculating acreage and per-acre ecosystem service values, we now calculate ecosystem service value per year for each of the four area/scenario combinations. To repeat, these annual values are:

- Baseline (no pipeline) ecosystem service value in the proposed construction corridor
- Ecosystem service value in the construction corridor during construction
- Baseline (no pipeline) ecosystem service value in the proposed right-of-way
- Ecosystem service value in the right-of-way during the (indefinite) period of ongoing operations<sup>16</sup>

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<sup>16</sup> Note that while the ROW and construction corridors overlap in space, they do not overlap in time, at least not from an ecosystem services production standpoint. During construction, the land cover that would eventually characterize the ROW will not exist in the construction corridor. Thus, there is no double counting of ecosystem service values or of costs from their diminution as a result of either construction or ongoing operations.

Value calculations are accomplished according to this formula

$$\text{ESV per year} = \sum_{i,j} [(\text{Acres}_j) \times (\$/\text{acre}/\text{year})_{i,j}]$$

Where:

$\text{Acres}_j$  is the number of acres in land use (j)  
 $(\$/\text{acre}/\text{year})_{i,j}$  is the dollar value of each ecosystem service (i) provided from each land use (j) each year. These values are drawn from the TEEB database and other sources listed in Appendix A.

#### Step 4: Subtract Baseline “without MVP” ESV from ESV in “with MVP” Scenario

With the steps above complete, we now estimate the cost in ecosystem service value of moving from the baseline (no pipeline) or status quo to a scenario in which the MVP is built and operating.

The cost of construction is the ESV from the construction corridor during construction, minus baseline ESV for the construction corridor, multiplied by two. The multiplication by two is due to the conservative assumption that revegetation and restoration to a land use that is functionally different from barren land will take at least two years.

The ecosystem service cost of ongoing operations is ESV from the ROW in the “with MVP” scenario minus the baseline ESV for the ROW. This will be an annual cost borne every year in perpetuity.

### Ecosystem Service Value Estimates

In the baseline or “no pipeline” scenario, the construction corridor and land slated for temporary roads and workspaces produces between \$11.4 and \$41.1 million per year in ecosystem service value. The largest contributors to this total (at the high end) are aesthetic value, water supply, and protection from extreme events. Under a “with MVP” scenario, and not surprisingly given the temporary conversion to bare/barren land, these figures drop to near zero, or between \$451 and \$3,552 per year for each of the two years. Taking the difference as described above, estimated per-year ecosystem service cost of the MVP’s construction would be between \$11.4 and \$41.1 million, or between \$22.8 and \$82.2 million over two years in the eight-county study region (Table 5).

The ecosystem service costs for the ROW are predictably smaller on a per-year basis, but because they will persist indefinitely, the cumulative effect will be much higher. Under the “with MVP” scenario, using minimum values, the annual ecosystem service value from the ROW falls from \$4.2 million to about \$160,000 for an annual loss of over \$4.1 million. At the high end of the range, the ecosystem service value of the ROW would fall from \$15.3 million to about \$436,000 for an annual loss of \$14.8 million in the study region (Table 6).

**TABLE 5: Ecosystem Service Value Lost to the Construction Corridor and Temporary Roads and Workspaces in Each of Two Years, Relative to Baseline, by Ecosystem Service (2015\$)**

Ecosystem Service	Study Region			
	Baseline (low)	Loss (low)	Baseline (high)	Loss (high)
Aesthetic Value	8,046,503	(8,046,503)	32,491,871	(32,491,871)
Air Quality	666,647	(666,647)	680,270	(680,270)
Biological Control	12,524	(12,524)	30,044	(30,044)
Climate Regulation	209,199	(209,199)	228,236	(228,236)
Erosion Control	15,104	(15,104)	146,466	(146,466)
Protection from Extreme Events	1,447,945	(1,447,945)	1,482,118	(1,482,118)
Food Production	10,929	(10,929)	10,929	(10,929)
Pollination	369,769	(369,769)	433,706	(433,706)
Raw Materials	43,763	(43,763)	297,240	(297,240)
Recreation	64,090	(63,722)	967,718	(965,459)
Soil Formation	12,837	(12,837)	41,061	(41,061)
Waste Treatment	22,692	(22,666)	527,395	(527,369)
Water Supply	84,501	(84,444)	2,306,613	(2,305,346)
Water Flows	417,057	(417,057)	1,444,340	(1,444,340)
<b>Total</b>	<b>11,423,559</b>	<b>(11,423,108)</b>	<b>41,088,007</b>	<b>(41,084,455)</b>

Most of this loss is due to the conversion of forestland to shrub/scrub. Shrub/scrub naturally increases its share of overall ecosystem service value in the “with pipeline” scenario. Those gains are dwarfed, however, by the loss of much more productive forests. Similarly, the ecosystem-service value of cropland falls due to its assumed transition to pasture/forage. While there is some gain in the pasture/forage category, there is a net loss of ecosystem service value from the two agricultural land uses of between \$1,000 and \$28,000 per year.<sup>17</sup>

**TABLE 6: Ecosystem Service Value Lost Each Year Post Construction in Right-Of-Way, Relative to Baseline, by Ecosystem Service (2015\$)**

Ecosystem Service	Study Region			
	Baseline (low)	Loss (low)	Baseline (high)	Loss (high)
Aesthetic Value	2,985,838	(2,945,731)	12,089,964	(12,040,073)
Air Quality	248,102	(222,539)	251,931	(222,539)
Biological Control	4,062	(1,673)	10,554	(8,166)
Climate Regulation	68,141	(32,887)	75,238	(39,900)
Erosion Control	4,926	12,931	51,847	(26,014)

<sup>17</sup> Note that due to differences in the range of dollars-per-acre estimates available for the various combinations of land use and ecosystem service, there are some instances where an apparent gain at the low end turns into a loss at the high end. For example, and based on the estimates available from the literature, the minimum value for erosion control from shrub/scrub acres is higher than the minimum for forests. Because we assume that forests return to shrub/scrub after the pipeline is in operation, this translates into a net increase in erosion regulation. At the high end, however, available estimates show a higher erosion control value for forests than for shrub/scrub. Thus, the high estimate shows a net loss of erosion control benefits. It is important, therefore, to keep in mind that these estimates are sensitive to the availability of underlying per-acre estimates.

<b>Protection from Extreme Events</b>	536,977	(529,386)	547,721	(529,386)
<b>Food Production</b>	3,308	(1,043)	3,308	(1,043)
<b>Pollination</b>	137,114	(133,628)	160,576	(153,309)
<b>Raw Materials</b>	16,306	(16,278)	110,739	(110,711)
<b>Recreation</b>	18,729	1,738	355,391	(332,073)
<b>Soil Formation</b>	4,641	(4,083)	15,136	(14,579)
<b>Waste Treatment</b>	8,197	(7,182)	194,147	37,326
<b>Water Supply</b>	31,478	(31,450)	859,334	(857,620)
<b>Water Flows</b>	155,301	(152,619)	536,635	(529,356)
<b>Total</b>	4,223,118	(4,063,831)	15,262,520	(14,827,442)

Finally, the establishment of permanent access roads and other surface installations will entail the conversion of land from various uses to what, from an ecosystem services perspective, will function as barren land. These areas amount to a total of only 76 acres across the study region, so the effect on ecosystem service values are correspondingly small, at least when compared to the impact of the construction zone and ROW. As with the ROW, however, these effects would occur year after year for as long as the MVP exists. The annual loss of ecosystem service value from these areas under a “with MVP” scenario would range from \$350,000 to \$1.2 million.

It bears repeating the benefit transfer method applied here is useful for producing first-approximation estimates of ecosystem service impacts. For several reasons, we believe this approximation of the effect of the MVP’s construction and operation on ecosystem service values is too low rather than too high. These reasons include:

- The estimates include only the loss of value that would otherwise emanate from the ROW, construction corridors, access roads, temporary workspaces, and other surface installations themselves.

The estimates do not account for the extent to which the construction and long-term presence of the MVP could damage the ecosystem service productivity of adjacent land. During construction, the construction corridor itself could be a source of air and water pollution that may compromise the ability of surrounding or downstream areas to deliver ecosystem services of their own. For example, if sediment from the construction zone that reaches surface waters, the sediment will cause those streams and rivers to lose some of their ability to provide clean water, food (fish), recreation, and other valuable services. This reduced productivity may persist well after construction is complete.<sup>18</sup>

- Over the long term, the right-of-way would serve as a pathway by which invasive species or wildfire could more quickly penetrate areas of interior forest habitat, thereby reducing the natural

<sup>18</sup> This is not a small risk. As noted by the Dominion Pipeline Monitoring Coalition “pipeline construction over steep Appalachian mountains creates significant runoff and slope-failure problems” (Webb, 2015b). In one example, multiple problems during and after construction of a relatively small pipeline on Peters Mountain in Giles County caused extensive erosion and damage to waterways (Webb, 2015a). The coalition points out that “the potential for water resource problems will be greatly multiplied for the proposed larger projects [like the MVP], both in terms of severity and geographic extent.”

productivity of those areas and imposing direct costs on communities and landowners in the form of fire suppression costs, lost property, and the costs of controlling invasive species.

- Finally, these estimates reflect only those changes in natural benefits that occur due to changes in conditions on the surface of the land. Particularly because the proposed pipeline would traverse areas of karst topography there is well-founded concern that subsurface hydrology could be affected during construction and throughout the lifetime of the pipeline (Jones, 2015; Pyles, 2015). Blasting and other activities during construction could alter existing underground waterways and disrupt water supply. There is also a risk that sediment and other contaminants could reach groundwater supplies if sinkholes form near the pipeline during construction or afterwards.

## EFFECTS ON PROPERTY VALUE

### Land Price Effects

To say the impacts and potential impacts of the MVP on private property value are important to people along its proposed route would be an extreme understatement. The Pipeline Information Network (2015) reviewed all MVP comments submitted to FERC in the first three months of 2015. Some 60% of these comment letters mentioned property value or property rights concerns. Landowners and Realtors along the proposed route of the Mountain Valley Pipeline report have abandoned building plans, seen lower than expected appraisals, and have had buyers walk away from properties potentially affected by the MVP (Adams, 2016). At least one ROW landowner has been told by two insurance agencies that rates would likely increase for properties like hers if, indeed, coverage remains available at all (Roston, 2015).

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*“I never met a client who would choose, for a family home, a property with a 42” pipeline full of explosive gas over a similar property without such an environmental and personal-safety hazard.”*

*– Patricia Tracy, Realtor  
Blacksburg, Virginia*

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While it is impossible to know precisely how large an effect the specter of the MVP has already had on land prices, there is strong evidence from other regions that the effect would be negative. In a systematic review, Kielisch (2015) presents evidence from surveys of Realtors, home buyers, and appraisers demonstrating natural gas pipelines negatively affect property values for a number of reasons. Among his key findings relevant to the MVP:

- 68% of Realtors believe the presence of a pipeline would decrease residential property value.
- Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%.)
- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.
- More than three quarters of the Realtors view pipelines as a safety risk.

- In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36-inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (2015, p. 7).

Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%.<sup>19</sup> This loss in value provides the mid-level impact in our estimates. A much greater loss (and higher estimates) would occur if one were to consider the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.<sup>20</sup> In our estimates, however, we have used the smaller effect (-10.5%) based on the assumption that sellers will eventually find one of the buyers still willing to buy the pipeline-easement-encumbered property.

- Based on five “impact studies” in which appraisals of smaller properties with and without pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%” (Kielisch, 2015, p. 11). The average rises to a range of -12% to -14% if larger parcels are considered, possibly due to the loss of subdivision capability.

These findings are consistent with economic theory about the behavior of generally risk-averse people. While would-be landowners who are informed about pipeline risks and nevertheless decide to buy property near the proposed MVP corridor could be said to be “coming to the nuisance,” one would expect them to offer less for the pipeline-impacted property than they would offer for a property with no known risks.

Kielisch’s findings demonstrate that properties on natural gas pipeline rights-of-way suffer a loss in property value. Boxall, Chan, and McMillan (2005), meanwhile, show that pipelines also decrease the value of properties lying at greater distances. In their study of property values near oil and gas wells, pipelines, and related infrastructure, the authors found that properties within the “emergency plan response zone” of sour gas<sup>21</sup> wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.

The risks posed by the MVP would be different – it would not be carrying sour gas, for example—but there are similarities between the MVP scenario and the situation in the study that makes their finding particularly relevant. Namely, the emergency plan response zones (EPZs) are defined by the health and safety risks posed by the gas operations and infrastructure. Also, in contrast to MVP-cited studies

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<sup>19</sup> Half of the buyers would offer 21% less, and the other half would offer 0% less; therefore the expected loss is  $0.5(-21\%) + 0.5(0\%) = -10.5\%$ .

<sup>20</sup> This is the expected value calculated as  $0.622*(-100\%)+0.189*(-21\%)+0.189*(0\%)$ .

<sup>21</sup> “Sour” gas contains high concentrations of hydrogen sulfide and poses an acute risk to human health.

showing no price effects (see “Claims that pipelines have no effect on property value may be invalid,” below), the Boxall study examines prices of properties for which landowners must inform prospective buyers when one or more EPZs intersect the property.

The MVP has both a high consequence area (HCA) and an evacuation zone radiating from both sides of the pipeline defined by health and safety risks. Whether disclosed or not by sellers, prospective buyers are likely to become informed regarding location of the property relative to the MVP’s HCA and evacuation zones or, at a minimum, regarding the presence of the MVP in the study region.

In addition to the emerging body of evidence that there is a negative relationship between natural gas infrastructure and property value, there have been many analyses demonstrating the opposite analog. Namely, it is well-established that amenities such as scenic vistas, access to recreational resources, proximity to protected areas, cleaner water, and others convey positive value to real property.<sup>22</sup> There are also studies demonstrating a negative impact on land value of various other types of nuisance that impose noise, light, air, and water pollution, life safety risks, and lesser human health risks on nearby residents (Bixuan Sun, 2013; Bolton & Sick, 1999; Boxall et al., 2005). The bottom line is that people derive greater value from, and are willing to pay more for, properties that are closer to positive amenities and farther from negative influences, including health and safety risks.

**Claims that pipelines have no effect on property value may be invalid.**

Both FERC and MVP LLC have cited several studies purporting to show that natural gas pipelines (and in one case a liquid petroleum pipeline) have at most an ambiguous and non-permanent effect on property values. In its final EIS regarding the Constitution Pipeline, for example, FERC cited two articles concluding, in brief, that effects on property value from the presence of a pipeline can be either positive or negative, and that decreases in values due to a pipeline explosion fade over time (Diskin, Friedman, Peppas, & Peppas, 2011; Hansen, Benson, & Hagen, 2006). In its filing, MVP LLC cites additional studies drawing similar conclusions based on comparison of market and/or assessed prices paid for properties “on” or “near” a pipeline versus those farther away (Allen, Williford & Seale Inc., 2001; Fruits, 2008; Mountain Valley Pipeline LLC, 2015b; Palmer, 2008).

While the studies differ in methods, they are similar in that each fails to take into account two factors potentially voiding their conclusions entirely. First, the studies do not consider that the property value data used do not represent prices arising from transactions in which all buyers have full information about the subject properties. Second, for the most part, the definition of nearness to the pipelines may be inappropriate or inadequate for discerning actual effects on property value of that nearness.

Economic theory holds that for an observed market price to be considered an accurate gauge of the value of a good, all parties to the transaction must have full information about the good. If, on the other hand, buyers lack important information about a good, in this case whether a property is near a potential hazard, they cannot bring their health and safety concerns—their risk aversion—to bear on

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<sup>22</sup> Phillips (2004) is one such study that includes an extensive review of the literature on the topic.

their decision about how much to offer for the property. As a result, buyers' offer prices will be higher than they would be if they had full information.

As Albright (2011) notes in response to the article by Disken, Friedman, Peppas, & Peppas (2011):

The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchaser had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on, near or across their property. ... I believe that the authors' failure to confirm that the purchasers in any of the paired sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undercut the authors' work product and the conclusions set forth in the article. (p.5)

Of the remaining studies, only Palmer (2008) gives any indication that any buyers were aware of the presence of a pipeline on or near the subject properties. For Palmer's conclusion that the pipeline has no effect on property value to be valid, however, it must be true that **all** buyers have full information, and this was not the case.

The study by Hansen, Benson, and Hagen (2006) actually reinforces the conclusion that when buyers know about a nearby pipeline, market prices drop. The authors found that property values fell after a deadly 1999 liquid petroleum pipeline explosion in Bellingham, Washington. They also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

We do not think it is appropriate to conclude from this study (as FERC did in the case of the Constitution Pipeline) that natural gas transmission pipelines would have no effect on land prices in today's market. In contrast to Bellingham homebuyers in the months and years after the 1999 explosion, today's homebuyers can query Zillow to see the history of land prices near the pipeline and explore online maps to see what locally undesirable land uses exist near homes they might consider buying. They also have YouTube and repeated opportunities to find and view news reports, citizens' videos, and other media describing and depicting such explosions and their aftermath. Whether the pre-explosion prices reflected the presence of the pipeline or not, it is hard to imagine that a more recent event and the evident dangers of living near a fossil fuel pipeline would be forgotten so quickly by today's would-be homebuyers.

Online based tools have changed the ways people shop for homes. We are now in a real world much closer to the competitive economic model that assumes all buyers have full information about the homes they might purchase. Anyone with an eye toward buying property near the proposed MVP corridor would quickly learn that the property is in fact near the corridor, that there is a danger the property could be adversely affected by the still-pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health and environmental effects. Accordingly, the price buyers would offer for a home near the MVP will be lower than the price offered for another farther away or in another community or region entirely.

The second problem with the studies is that while they purport to compare the price of properties near a pipeline to properties not near a pipeline, many or in some cases all of the properties counted as “not near” the pipelines are, in fact, near enough to the subject pipelines that health and safety concerns could influence prices. In both studies written by the Interstate Natural Gas Association of America (INGAA) the authors compare prices for properties directly on a pipeline right-of-way to prices of properties off the right-of-way. However, in almost all cases the geographic scope of the analysis was small enough that most or all of the properties not on the right-of-way are still within the pipelines’ respective evacuation zones (Allen, Williford & Seale Inc., 2001; Integra Realty Resources, 2016).<sup>23</sup>

The 2016 INGAA study suffers from the same problems, including the comparison of properties “on” and “off” the six pipelines analyzed when a majority of the “off” properties are within the pipelines’ evacuation zones. In eight of the case studies—those for which a specific distance from pipeline was reported—an average of 72.5% of the “off” properties were actually within the evacuation zone. (We estimated the evacuation zone based on available information about the pipelines’ diameter and operating pressure.) For the other two pipelines, the study reported a simple “yes” or “no” to indicate whether the property abutted the pipeline in question. For these cases, we assume the author’s methods, while flawed, are at least consistent from one case study to the next meaning it is likely at least 50% or more of the comparison properties (the “off” properties) are in fact within the evacuation zone.

To adequately compare the price of properties with and without a particular feature, there needs to be certainty that properties either have or do not have the feature. It is a case where one actually does need to compare apples to oranges. However, because there is no variation in the feature of interest (i.e., the majority of properties are within the evacuation zone), the study is only looking at and comparing “apples.” In this case, the feature of interest is the presence of a nearby risk to health and safety. With no variation in that feature, one would not expect a systematic variation in the price of the properties. By comparing apples to apples when it should be comparing apples to oranges, the INGAA study reaches the forgone and not very interesting conclusion that properties that are similar in size, condition, and other features including their location within the evacuation zone of a natural gas pipeline have similar prices.

To varying degrees, the other studies cited by FERC and in MVP LLC’s filing suffer from the same problem. Fruits (2008), who analyzes properties within one mile of a pipeline that has a 0.8-mile-wide-evacuation zone (0.4 miles on either side), offers the best chance that a sizable portion of subject properties are in fact “not near” the pipeline from a health and safety standpoint. He finds that distance from the pipeline does not exert a statistically significant influence on the property values, but he does not examine the question of whether properties within the evacuation zone differ in price from comparable properties outside that zone. A slightly different version of Fruits’ model, in other words, could possibly detect such a threshold effect. Such an effect would show up, of course, only if the

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<sup>23</sup> This is based on a best estimate of the location of the pipelines derived from descriptions of the pipelines location provided in the study (only sometimes shown on the neighborhood maps) and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

buyers of the properties included in the study had been aware of their new property's proximity to the pipeline.

In short, one cannot conclude from these flawed studies' failure to identify a negative effect of pipelines on property value that no such effect exists. To evaluate the effects of the proposed MVP on property value, FERC and others must look to studies (including those summarized in the previous section) in which buyers' willingness to pay is fully informed about the presence of nearby pipelines and in which the properties bought are truly different in terms of their exposure to pipeline-related risks.

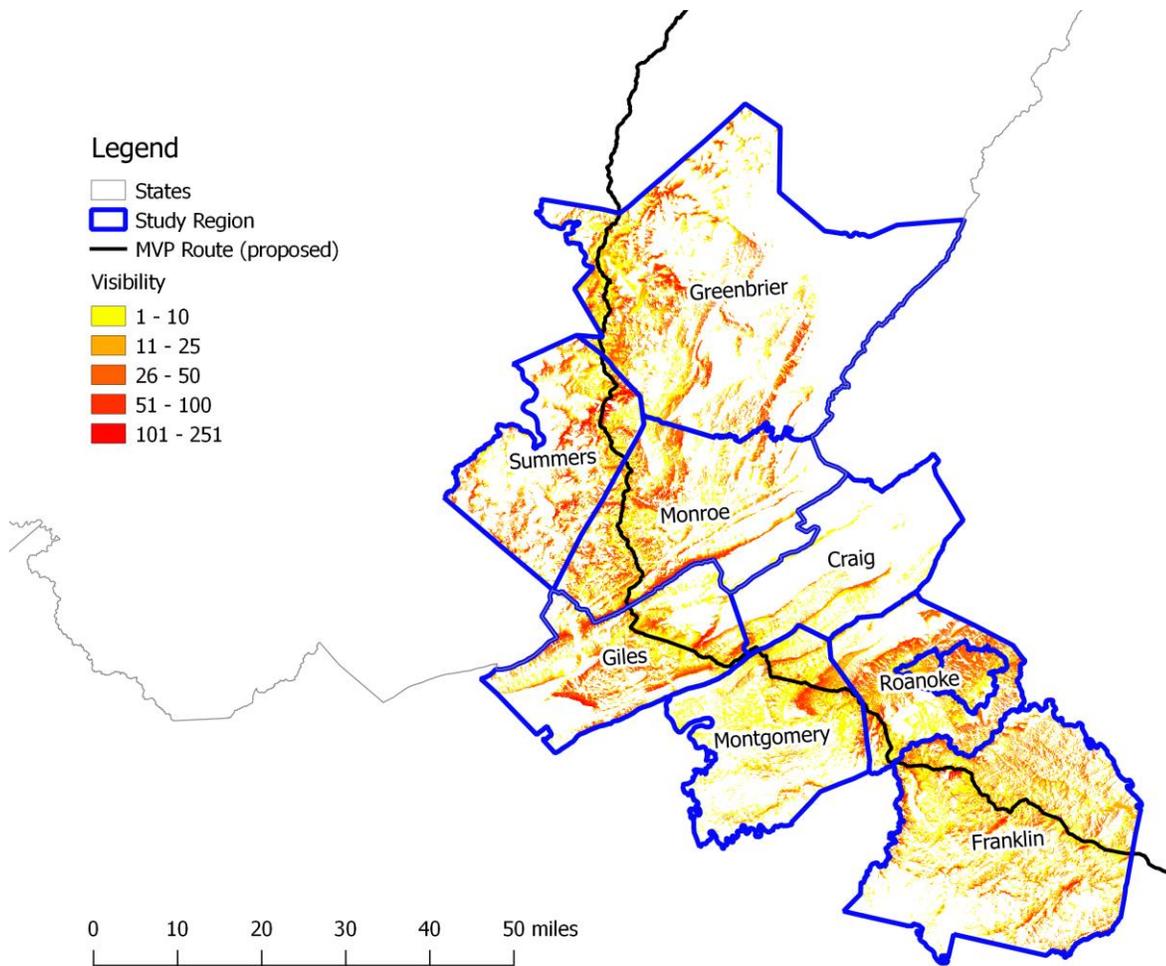
## Visual Effects and Viewshed Analysis

Information about how the visual effects of natural gas transmission pipelines are reflected in property value is scarcer than information related to health and safety effects. On one hand, we know better views increase property value. Conversely, utility corridors from which power lines can be seen decrease property values (by 6.3% in one study) (Bolton & Sick, 1999). This suggests that a pipeline corridor reduces property value either by impairing a good view or, if like power lines, by simply being unattractive. It is reasonable to conclude that the proposed MVP would have effects on property value that are mediated through visual effects, but the literature to date does not offer clear guidance on how large or strong the effects may be. We therefore have not included separate estimates of the impact of the MVP on property value in the viewshed. Moreover, we do not wish to double-count a portion of the impact of the MVP on "Aesthetics," which is already included among the ecosystem service value effects.

We do want to know, however, how many properties might suffer a portion of that lost aesthetic value. To keep the estimate conservative, we only count properties with a higher-than-average likelihood the MVP corridor could be seen from them. To determine this for each parcel, a GIS-based visibility analysis provides an estimate of how many points along the pipeline could potentially be seen from each 30m-by-30m spot in the study region. To keep the computing needs manageable, we analyzed a sample of points placed at 100m intervals along the proposed MVP route.

Because weather, smog, and other conditions limit the distance at which one can see anything in the mountains and valleys of Virginia and West Virginia, we restricted the scope of analysis for any given point on the pipeline to spots in the study region that lie within a 25-mile radius. We analyzed a section of the MVP beginning 25 miles north of the western boundary of Greenbrier County, West Virginia that extended to a point 25 miles east of the eastern boundary of Franklin County, Virginia.

By tallying the number of points on the pipeline corridor that could be seen from each spot in the study region and then connecting those spots to parcel boundaries, we obtain an estimate of how much of the pipeline could be seen from some spot within a given parcel. In Figure 6, yellow spots on the maps are points where between 1 and 10 points on the pipeline are visible, whereas orange and red spots have a view of up to as many as 251 points. Since each point represents 100 meters of pipeline, there are places in the study region where 25.1 km, or 15.6 miles, of pipeline corridor could be visible.



**FIGURE 7: Visibility of the Proposed Mountain Valley Pipeline**

The color of each point on the map indicates the number of waypoints, spaced 100m apart along the MVP route and within 25 miles, that could be seen from each point. Note that the analysis is based on elevation only and does not take into account the extent to which buildings or trees may mask views of the pipeline corridor.

Sources: MVP route digitized from online maps and MVP LLC filings (<http://mountainvalleypipeline.info/maps/>); Counties from USGS (<http://nationalmap.gov>); Visibility analysis thanks to Bryan Behan and Stockton Maxwell of Radford University.

Taking into account those spots on nearly every parcel from which the MVP corridor is not visible, the average of the maximum number of points visible from a parcel is 10. This serves as our threshold for identifying parcels from which the pipeline would be “visible.” Parcels containing no locations (again each spot is a 30m-by-30m square) from which more than 10 pipeline points are visible are considered to have no view of the pipeline. By this rule, and out of 253,880 parcels in the study region, 78,553 parcels, or just under one-third, would have a potential view of the pipeline.<sup>24</sup> The total value of these properties is currently \$16.8 billion.

This a potential view of the pipeline because other visual obstructions, such as trees or buildings, are not taken into account. In particular, smaller parcels in more densely developed areas could be at elevations relative to the pipeline which would make it possible to see the MVP corridor, but the house

<sup>24</sup> Because GIS parcel maps are unavailable for Craig and Monroe Counties, those counties are not included in these figures.

next door may block that view. The restriction of our analysis to those parcels that have comparatively many spots from which to potentially see the pipeline mitigates this limitation of our GIS analysis. The reason is simply that smaller urban lots have very few 30-meter-square spots to begin with. A parcel has to be at least 10 spots in size (2.2 acres), with the pipeline visible from every spot, to cross the 10-spot threshold.

## Parcel Values

For five of the eight counties in the study region, GIS data on parcel boundaries and corresponding tabular data with parcel value was obtained from the jurisdictions' public records. For the remaining three counties, electronic data on parcel boundaries, parcel values, or both were unavailable. In those cases, we adopted variations on a second-best approach to ensure more complete coverage of land value effects.

- Summers County, WV parcel boundaries were available, but the corresponding parcel values were not. We therefore used median house value from the US Census Bureau's American Community Survey (ACS) (2014) as a proxy. After adjusting the ACS figures for inflation, we attached those values to each parcel, according to which block group the parcel occupies.<sup>25</sup>
- Monroe County, WV parcel boundaries are viewable via the County's online map service, which allowed us to develop a list of parcels crossed by the ROW and those that overlap the evacuation zone. Similar to Summers County, we used median house value from ACS as a proxy for parcel value.
- For Craig County, parcel maps and corresponding parcel values are not available. MVP's route map, however, does show the 10 parcels crossed by the (ROW) through the County's southwest corner. We assume that 10 more parcels would be within the evacuation zone. For parcel value, we use the same proxy from ACS.

Two other features of the parcel data required adjustments prior to performing any land value impact calculations. First, the Giles County data had instances in which two or more individual tracts in different parts of the County are listed on a single tax record with a single property value. The consequence is that the value of all of the land connected to such multi-tract tax records would be swept up with the value of just those tracts actually crossed by the proposed ROW, or in the evacuation zone. To avoid overstating impacts, we split the multi-tract parcels into separate tax records and assigned each tract its own value based on its size and the per-acre value of the original multi-tract parcel.

The second remaining issue deals with public land that is unlikely to be sold and therefore does not possess any market value. To ensure these properties would not inflate overall property value effects, we used the "Protected Areas Database" from the National Gap Analysis Program to identify fee-owned conservation properties, such as portions of the Jefferson National Forest and state, county, and

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<sup>25</sup> Because many parcels overlap block group boundaries, each parcel is assigned to a block according to whether its centroid, or geometric center, lies within the block group.

municipal parks (Conservation Biology Institute, 2012). Once identified, we set the value of all such properties equal to zero.

With all of these adjustments made, there remains the comparatively straightforward matter of identifying parcels of six types for which one could expect some effect of the MVP on the value. In order of increasing distance from the pipeline itself, these are:

1. Parcels crossed by the right-of-way  
(716 parcels, with total value (before MVP) of \$125.9 million)
2. Parcels crossed by the construction corridor  
(768 parcels, with total value (before MVP) of \$132.6 million)
3. Parcels at least partially within the high consequence area (HCA)  
(2,333 parcels, with total value (before MVP) of \$320.6 million)
4. Parcels at least partially within the evacuation zone  
(8,221 parcels, with total value (before MVP) of \$972.6 million)
5. Parcels from which the pipeline would be visible (as defined in the previous section)  
(78,553, with total value (before MVP) of \$16.8 billion, not counting Monroe or Craig County)<sup>26</sup>

Note there is overlap among these zones. All ROW parcels are within the construction, HCA, and evacuation zones, for example. To avoid double counting we apply only one land value effect to any given parcel. ROW parcels are assumed to suffer no further reduction in value due to their location within the evacuation zone.

We have not considered the construction corridor separately this analysis. Even though the additional 52 parcels and \$6.7 million in value (relative to parcels in the ROW) are not trivial, we do not have a basis for estimating a change in value that is separate from or in addition to the change due to the parcels' proximity to the ROW or their location within the evacuation zone.

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*[Upon learning of the proposed MVP route through my property,] I immediately put the land on the market, disclosing its [bisection] by the pipeline...I was told by a realtor that a sale was out of the question, as the land had lost its value for building.... As of now I have not received any offers except ones that make a purchase contingent on the pipeline not being built. Apparently buyers do care.*

*- Christian M. Reidys, Ph.D.  
Montgomery County Landowner*

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Furthermore, we treat parcels in the HCA and in the evacuation zone the same way and apply a single land value change to all parcels in the evacuation zone. Arguably, there should be a larger effect on parcels in the HCA than those only in the evacuation zone. Living with the possibility of having to evacuate one's home at any time day or night could have a

smaller effect on property value than living with the possibility of not surviving a "high consequence" event and, therefore, not having the chance to evacuate at all. We do not have data or previous study

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<sup>26</sup> Monroe and Craig County are excluded because we do not have the necessary GIS parcel boundary data.

results that allow us to draw such a distinction, so instead we apply the lower evacuation zone effect to all HCA and evacuation zone parcels.

To summarize, Table 7 repeats a portion of Table 1, but with the property value effects in place of check marks.

**TABLE 7: Summary of Marginal Property Value Effects**

Values / Effects	Right-of-Way (Low, Medium, & High Effects)	High Consequence Area	Evacuation Zone	Pipeline Viewshed
Land / Property Value	-4.2% <sup>a</sup> -10.5% <sup>b</sup> -13.0% <sup>c</sup>		-3.8% <sup>d</sup>	Impact included with Ecosystem Services

Notes:

- a. Kielisch, Realtor survey in which 56% of respondents expected an effect of between -5% and -10% ( $0.56 \times -7.5\% = -4.2\%$ ).
- b. Kielisch, buyer survey in which half of buyers still in the market would reduce their offer on a property with a pipeline by 21% ( $0.50 \times -0.21 = -10.5\%$ ).
- c. Kielisch, appraisal/impact studies showing an average loss of between -12% and -14% (-13% is the midpoint)
- d. Boxall, study in which overlap with an emergency planning zone drives, on average, a 3.8% reduction in price. We apply this reduction ONLY to those parcels in the evacuation zone that are not also in the ROW or within one half mile of the compressor station.

### Estimated Land Value Effects

Following the procedures outlined in the previous section, our conservative estimate for costs of the proposed MVP would include between \$42.2 million and \$53.3 million in diminished property value. Some of the most intense effects will be felt by the owners of 716 parcels in the path of the right-of-way, who collectively would lose between \$5.3 million and \$16.4 million in property value. Some 8,221 additional parcels lie outside the ROW but are within or touching the evacuation zone. These parcels’ owners would lose an estimated \$37.0 million (Table 8). A far greater number of parcels, 78,553, would experience a loss in value due to diminished quality of the view from their properties.

Based on median property tax rates in each county, these one-time reductions in property value would result in reductions in property tax revenue of between \$243,500 and \$308,400 per year (Table 9). To keep their budgets balanced in the face of this decline in revenue, the counties would need to increase tax rates, cut back on services, or both. The loss in revenue would be compounded by the likelihood that the need for local public services, such as road maintenance, water quality monitoring, law enforcement, and emergency preparedness/emergency response could increase. The MVP could drive up expenses while driving down the counties’ most reliable revenue stream.<sup>27</sup>

<sup>27</sup> We recognize that MVP anticipates making tax payments, but because those payments are tied to net income from the operation of the pipeline, they may fluctuate from year to year or disappear entirely if pipeline operations become unprofitable.

**TABLE 8: Summary of Land Value Effects, by Zone and County**

Area	Effects in Right-of-Way			Effects in Evacuation Zone
	Realtor Survey (4.2%)	Buyer Survey (10.5%) <sup>a</sup>	Impact Studies (13.0%)	Boxall Study (3.8%)
<b>Study Region</b>	-5,288,289	-13,220,723	-16,368,514	-36,958,088
<b>Virginia Portion</b>	-4,484,041	-11,210,102	-13,879,174	-30,656,302
<b>Craig</b>	-60,223	-150,557	-186,404	-54,487
<b>Franklin</b>	-2,138,174	-5,345,434	-6,618,157	-14,855,120
<b>Giles</b>	-792,099	-1,980,248	-2,451,735	-4,174,604
<b>Montgomery</b>	-714,101	-1,785,252	-2,210,312	-7,009,533
<b>Roanoke</b>	-779,444	-1,948,611	-2,412,566	-4,562,557
<b>West Virginia Portion</b>	-804,248	-2,010,620	-2,489,339	-6,301,786
<b>Greenbrier</b>	-186,961	-467,402	-578,688	-1,438,278
<b>Monroe</b>	-382,228	-955,571	-1,183,088	-3,321,634
<b>Summers</b>	-235,059	-587,647	-727,563	-1,541,874

**TABLE 8: Continued**

Area	Total of ROW and Evacuation Zone Effects		
	Low	Medium	High
<b>Study Region</b>	-42,246,377	-50,178,810	-53,326,601
<b>Virginia Portion</b>	-35,140,343	-41,866,404	-44,535,476
<b>Craig</b>	-114,710	-205,045	-240,892
<b>Franklin</b>	-16,993,293	-20,200,554	-21,473,277
<b>Giles</b>	-4,966,703	-6,154,852	-6,626,339
<b>Montgomery</b>	-7,723,634	-8,794,785	-9,219,845
<b>Roanoke</b>	-5,342,002	-6,511,168	-6,975,123
<b>West Virginia Portion</b>	-7,106,034	-8,312,406	-8,791,125
<b>Greenbrier</b>	-1,625,239	-1,905,680	-2,016,966
<b>Monroe</b>	-3,703,862	-4,277,204	-4,504,721
<b>Summers</b>	-1,776,933	-2,129,522	-2,269,438

In addition to factors that make our estimates of the effects on property value conservative,<sup>28</sup> there is one other factor that makes the estimates of effects on property taxes lower than expected if the MVP is permitted. Some portion of properties in the ROW are currently undeveloped but still assessed at a

<sup>28</sup> These factors include using the lower expected price reduction from the buyer survey and applying the same price reduction to the entire evacuation zone (including the HCA).

value that assumes a single house site. Depending on where and how the ROW crosses these properties, it is likely that some will lose their potential usefulness for future residential or other development. In those cases, the assessed value (which by law reflects market value) will fall, and tax revenue generated by future development will never materialize.

**TABLE 9: Effects on Local Property Tax Revenue**

Area	Median Tax Rate (% of Value) <sup>a</sup>	Lost Property Tax Revenue		
		Low	Medium	High
<b>Study Region</b>		-243,476	-289,966	-308,414
<b>Virginia Portion</b>		-217,097	-259,111	-275,783
<b>Craig</b>	0.50%	-574	-1,025	-1,204
<b>Franklin</b>	0.47%	-79,868	-94,943	-100,924
<b>Giles</b>	0.72%	-35,760	-44,315	-47,710
<b>Montgomery</b>	0.67%	-51,748	-58,925	-61,773
<b>Roanoke</b>	0.92%	-49,146	-59,903	-64,171
<b>West Virginia Portion</b>		-26,379	-30,855	-32,631
<b>Greenbrier</b>	0.42%	-6,826	-8,004	-8,471
<b>Monroe</b>	0.36%	-13,334	-15,398	-16,217
<b>Summers</b>	0.35%	-6,219	-7,453	-7,943

a. Source: Property Taxes By State (Virginia Counties and Independent Cities) (propertytax101.org, 2015).

## EFFECTS ON ECONOMIC DEVELOPMENT

Across the study region, county-level economic development plans recognize the importance of a high quality of life, a clean environment, and scenic and recreational amenities to the economic future of people and communities. Franklin County’s Comprehensive Plan, for example, states that “the County wishes to maintain its rural character and scenic views...” (Franklin County Planning Commission, 2007). Greenbrier County’s Comprehensive Plan notes the County’s melding of old and new economy businesses (farming and high tech, for example) and recognizes that “a healthy environment is central to citizens' health, welfare, and quality of life” (Greenbrier County Planning Commission, 2014).

The MVP would undermine the progress toward these visions if the loss of scenic and recreational amenities, the perception and the reality of physical danger, and environmental and property damage were to discourage people from visiting, relocating to, or staying in the study region. Workers, businesses, and retirees who might otherwise choose to locate along the MVP’s proposed route will instead pick locations retaining their rural character, productive and healthy landscapes, and promise for a higher quality of life.

This is already occurring in the region. With the possibility of the MVP looming, business plans have stalled and the real estate market has slowed. Study region residents are also concerned about the effect the MVP could have on the economy. Based on the Pipeline Information Network’s review of comment letters submitted in the first three months of 2015, more than half mentioned the economy,

### **Forgone Economic Development: Sustainable Agriculture**

Owners Patti and Constantine Chlepas describe their 23-acre Birdsong Farm as “pristine land in the heart of Monroe County.” They use organic practices to produce natural raw honey and natural beeswax products. In part because pesticides are threatening honeybee operations worldwide, Birdsong Farm is an oasis from which the Chlepas can sell bees to and serve as mentors for apiarists in other places that have been hit hard. With the proposed MVP right-of-way adjacent to their property—and the likelihood that the ROW would be maintained using chemical defoliant that could harm bees—the owners are concerned that their core business would be wiped out. The Chlepas have put on hold their planned investment in a pick-your-own strawberry operation and a new line of business selling locally-grown fresh strawberries, strawberry plugs, and value-added products to sell in an on-site store. Birdsong Farm was planning to hire employees to help run their local operation. However, because of the MVP, they cancelled their grant to build a high tunnel greenhouse, and estimate the long-term loss in revenue to the County may run as high as half a million dollars.

with property value, tourism, recreation, and agriculture looming large in citizens’ concerns (Pipeline Information Network, 2015).

These fears are consistent with research results from this region and around the country demonstrating that quality of life is often of primary importance when people choose places to visit, live, or do business. As Niemi and Whitelaw state, “as in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth in the southern Appalachians. This influence occurs through the so-called people-first-then-jobs mechanism, in which households move to (or stay in) an area because they want to live there, thereby triggering the development of businesses seeking to take advantage of the households’ labor supply and consumptive demand” (1999, p. 54). They note that decisions affecting the supply of amenities “have ripple effects throughout local and regional economies” (p. 54).

Along similar lines, Johnson and Rasker (1995) found that quality of life is important to business owners deciding where to locate a new facility or enterprise and whether to stay in a location already chosen. This is not surprising. Business owners value safety, scenery, recreational opportunities, and quality of life factors as much as residents, vacationers, and retirees.

It is difficult to predict just how large an effect the MVP would have on decisions about visiting, locating to, or staying in the study region. Even so, based on information provided by business owners to FERC and as part of this research, we can consider reasonable scenarios for how the MVP might affect key portions of the region’s overall economy.

The study region’s residents believe the MVP will harm the travel and tourism industry. In the words of the owner of one recreation and tourism business in Summers County, West Virginia, the MVP would “completely destroy the use, purpose, business operation, well, commercial septic system, two rental houses, and public campground on [the] property,” with one-time losses valued at \$800,000, not to mention the owners loss of livelihood and employment (Berkley, 2015). While more systematic research could provide refined estimates of the impact of natural gas transmission pipelines on recreation and tourism spending, one plausible scenario is that the impact is at

least as high as the minimum of these business owners' reported expectations. If the MVP were to cause a 10% drop in recreation and tourism spending from the 2014 baseline, the MVP could mean \$96.8 million less in travel expenditures each year. Those missing revenues would otherwise support roughly \$24.3 million in payroll, \$2.6 million in local tax revenue,

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***Recognizing that a healthy environment is central to citizens' health, welfare, and quality of life, Greenbrier County strongly supports the wise stewardship of our natural environment, including air and water resources, agricultural and forest resources, and geologic resources, with special emphasis on the protection of environmentally sensitive areas and features (springs, sinkholes, caves, other karst features, floodplains, and wetlands) which contribute to overall environmental health and citizens' quality of life.***

*—Greenbrier County Comprehensive Plan*

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\$4.8 million in state tax revenue, and 1,073 jobs in the eight-county region's recreation and tourism industry each year.<sup>29</sup> In the short run, these changes multiply through the broader economy as recreation and tourism businesses buy less from local suppliers and fewer employees spend their paychecks in the local economy. As with the reduction in local property taxes, lost tax revenue from a reduction in visitation and visitor spending would squeeze local governments trying to meet existing public service needs as well as those additional demands created by the MVP.

Along similar lines, retirement income is an important economic engine that could be adversely affected by the MVP. In county-level statistics from the US Department of Commerce, retirement income shows up in investment income and as age-related transfer payments, including Social Security and Medicare payments. In the study region, investment income grew by 0.8% per year from 2000 through 2014, and age-related transfer payments grew by 5.8% per year. During roughly the same time period (through 2013), the number of residents age 65 and older grew by 15.1% (1.2% per year), and this age cohort now represents 15.5% of the total population.<sup>2</sup>

It is difficult to precisely quantify the effect of the MVP on retirement income, but given the expression of concern from residents about changes in quality of life, safety, and other factors influencing retirees' location decisions, it is important to consider that some change is likely. Here, we consider what just a *10% slowing of the rate of increase* might entail. Such a scenario entails an annual decrease in investment income and age-related transfer payments of approximately \$15.6 million. That loss would ripple through the economy as the missing income is not spent on groceries, health care, and other services such as restaurant meals, home and auto repairs, etc.

The same phenomenon also applies to people starting new businesses or moving existing businesses to communities in the study region. This may be particularly true of sole proprietorships and other small businesses who are most able to choose where to locate. As noted, sole proprietors account for a large and growing share of jobs in the region. If proprietors' enthusiasm for starting businesses in the study

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<sup>29</sup> Raw data on travel expenditures is from the Virginia Tourism Corporation (2015) and Dean Runyan Associates (2015). This reduction in economic activity would be in addition to the lost recreation benefits (the value to the visitors themselves over and above their expenditures on recreational activity) that are included with ecosystem service costs above.

region were dampened to the same degree as retirees' enthusiasm for moving there, the 10% reduction in the rate of growth would mean 722 fewer jobs and \$2.0 million less in personal income.

For "bottom line" reasons (e.g., cost of insurance) or due to owners' own personal concerns, businesses in addition to sole proprietorships might choose locations where the pipeline is not an issue. If so, further opportunities for local job and income growth will be missed.

These are simple scenarios and the actual magnitude of these impacts of the MVP will not be known unless and until the pipeline is built. Even so, and especially because the pipeline is promoted by supporters as bringing some jobs and other economic benefits to the region, it is important to consider the potential for loss.

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***A pipeline route through here will destroy our farm business. Our customers drive here for the scenery and tranquility as much as for the fresh blueberries. Construction of a pipeline this large does not fit into this picture. Our customers would recoil and take their business elsewhere.***

*—Shirley & Lewis Woodall  
Craig County, Virginia*

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## CONCLUSIONS

The full costs of the proposed Mountain Valley Pipeline in the eight-county study area and beyond are wide-ranging. They include one-time costs like reductions in property value and lost ecosystem services during pipeline construction, which we estimate to be between \$65.1 and \$135.5 million. Plus there are ongoing costs like lost property tax revenue, diminished ecosystem service value, and dampened economic growth that would recur year after year for the life of the pipeline. Our estimates of the annual costs range from \$119.1 to \$130.8 million per year. Most of these costs would be borne by residents, businesses, and institutions in Craig, Franklin, Giles, Montgomery, Roanoke, Greenbrier, Monroe, and Summers Counties.

By contrast, the MVP's one local benefit is much smaller. It is an estimated average tax payment of \$6.1 million per year (for the five Virginia counties) and \$4.5 million per year (for the 3 West Virginia counties) through 2025 (Ditzel, Fisher, & Chakrabarti, 2015a, p. 15, 2015b, p. 13). Other MVP-promoted benefits, such as jobs from the MVP's construction and operation and those stemming from lower energy costs, would accrue primarily in other places (Ditzel et al., 2015a, 2015b).<sup>30</sup>

The decision to approve or not approve the MVP does not hinge on a simple comparison of estimated benefits and estimated costs. The scope and magnitude of the costs outlined here, however, reflect an important component of the full extent of the MVP's likely environmental effects that must be considered when making the decision. Impacts on human well-being, including but not limited to those that can be expressed in dollars-and-cents, must be taken into account by the Federal Energy Regulatory Commission and others weighing the societal value of the Mountain Valley Pipeline.

If these considerations and FERC's overall review result in selection of the "no-action" alternative and the Mountain Valley Pipeline is never built, most of the costs outlined in this report will be avoided. It

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<sup>30</sup> Due to issues with the methods and assumptions used in the MVP-sponsored studies, the benefit estimates they present may be inflated. See Phillips (2015b) for a review.

is *most*, but not *all* costs because there has already been the cost of delaying implementation of business plans, the cost of houses languishing on the market, and the cost to individuals of the stress, time, and energy diverted to concern about the pipeline rather than what would normally (and more productively) fill their lives.

Another possible scenario is that the FERC, considering the impacts of the MVP *as currently proposed* on ecosystem services, property values, and economic development, would conduct a thorough analysis of all possible alternatives. Those alternatives may include using existing gas transmission infrastructure (with or without capacity upgrades), routing new gas transmission lines along existing utility and transportation rights-of-way, and/or scaling down permitted new pipeline capacity to match regional gas transmission needs (as opposed to permitting pipelines on a company-by-company basis). In this case, estimates of these impacts should inform the choice of a preferred alternative that minimizes environmental damage and, thereby, minimizes the economic costs to individuals, businesses, and the public at large.

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**APPENDIX A:  
CANDIDATE PER-ACRE VALUES FOR LAND-USE AND ECOSYSTEM SERVICE  
COMBINATIONS**

As explained under “Effects on Ecosystem Service Value,” the benefit transfer method applies estimates of ecosystem service value from existing studies of “source areas” to the “study area,” which in this case is the proposed MVP corridor. This application is done on a land-use-by-land-use basis. So, for example, values of various ecosystem services associated with forests in the source area are applied to forests in the study area. The table below lists all of the values from source area studies considered for our calculations.

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/Acre/year	Source Study
Cropland	Aesthetic	35.01	89.23	(Bergstrom, Dillman, & Stoll, 1985)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Biological Control	14.38	204.95	(Cleveland et al., 2006)
	Erosion	27.31	72.55	(Pimentel et al., 2003) *
	Food	33.25	33.25	(Lex & Groover, 2015)
	Pollination	10.14	10.14	(Brenner Guillermo, 2007) *
	Pollination	13.89	13.89	(Robinson, Nowogrodzki, & Morse, 1989)
	Pollination	47.43	1,987.97	(Winfree, Gross, & Kremen, 2011)
	Recreation	18.77	18.77	(Brenner Guillermo, 2007) *
	Recreation	2.16	5.02	(Knoche & Lupi, 2007)
	Soil Fertility	7.28	7.28	(Pimentel, 1998) *
	Soil Fertility	115.23	115.23	(Pimentel et al., 2003)
	Waste	132.26	132.26	(Perrot-Maître & Davis, 2001) *
Grasslands	Aesthetic	102.38	116.61	(Ready, Berger, & Blomquist, 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015) *
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Pasture	Aesthetic	102.38	116.61	(Ready et al., 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015)
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/Acre/year	Source Study
Pasture, cont'd	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Shrub/Scrub	Air Quality	37.26	37.26	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Climate	7.27	7.27	(Croitoru, 2007) *
	Erosion	22.75	22.75	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Pollination	1.41	7.10	(Robert Costanza, Wilson, et al., 2006)
	Recreation	3.95	3.95	(Haener & Adamowicz, 2000)
	Waste	46.35	46.35	(Croitoru, 2007) *
	Waste	0.10	324.35	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
Forest	Aesthetic	4,439.71	18,141.99	(Nowak, Crane, Dwyer, & others, 2002)
	Air Quality	372.57	372.57	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Biological Control	8.91	8.91	(Wilson, 2005) *
	Biological Control	2.54	2.54	(Brenner Guillermo, 2007) *
	Climate	67.45	67.45	(Brenner Guillermo, 2007) *
	Climate	56.89	56.89	(Robert Costanza, d'Arge, et al., 2006)
	Erosion	61.87	61.87	(Brenner Guillermo, 2007) *
	Erosion	3.09	36.09	(Zhou, Al-Kaisi, & Helmers, 2009)
	Extreme Events	797.66	797.66	(Weber, 2007)
	Food	0.13	0.13	(Wilson, 2005) *
	Pollination	202.87	202.87	(Brenner Guillermo, 2007) *
	Raw Materials	24.53	24.53	(Wilson, 2005) *
	Raw Materials	166.82	166.82	(Weber, 2007)
	Recreation	152.66	152.66	(Brenner Guillermo, 2007) *
	Recreation	1.29	4.55	(Cruz & Benedicto, 2009) *
	Recreation	1.56	1.56	(Kniivila, Ovaskainen, & Saastamoinen, 2002) *
	Recreation	37.13	45.50	(Prince & Ahmed, 1989)
	Recreation	2.79	503.97	(Shafer, Carline, Guldin, & Cordell, 1993)
	Soil Fertility	6.09	6.09	(Brenner Guillermo, 2007) *
	Soil Fertility	19.97	19.97	(Weber, 2007)
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	8.66	8.66	(Cruz & Benedicto, 2009) *
	Waste	265.79	266.89	(Lui, 2006)
	Water	204.39	204.39	(Brenner Guillermo, 2007) *
	Water	47.39	47.39	(Cruz & Benedicto, 2009) *
	Water	1,292.23	1,292.23	(Weber, 2007)
	Water Flows	230.01	230.01	(Mates, 2007)
Water Flows	797.66	797.66	(Weber, 2007)	

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/Acre/year	Source Study
Water	Recreation	446.31	446.31	(Brenner Guillermo, 2007) *
	Recreation	155.36	914.10	(Cordell & Bergstrom, 1993)
	Recreation	304.18	437.19	(Mullen & Menz, 1985)
	Recreation	148.68	148.68	(Postel & Carpenter, 1977)
	Waste	10.72	10.72	(Gibbons, 1986) *
	Water	512.74	512.74	(Brenner Guillermo, 2007) *
	Water	22.98	22.98	(Gibbons, 1986) *
Wetland	Aesthetic	38.46	38.46	(Amacher & Brazee, 1989) *
	Air Quality	75.50	98.02	(Jenkins, Murray, Kramer, & Faulkner, 2010)
	Climate	1.84	1.84	(Wilson, 2005) *
	Climate	157.73	157.73	(Brenner Guillermo, 2007) *
	Extreme Events	228.06	369.85	(Wilson, 2005) *
	Extreme Events	110.06	4,583.26	(Brenner Guillermo, 2007) *
	Extreme Events	304.18	304.18	(Robert Costanza, Farber, & Maxwell, 1989)
	Extreme Events	278.77	278.77	(Robert Costanza & Farley, 2007)
	Extreme Events	1,645.59	7,513.98	(Leschine, Wellman, & Green, 1997)
	Raw Materials	50.16	50.16	(Everard, Great Britain, & Environment Agency, 2009)
	Recreation	80.71	80.71	(Bergstrom, Stoll, Titre, & Wright, 1990)
	Recreation	1,716.76	1,761.89	(Brenner Guillermo, 2007) *
	Recreation	109.30	429.97	(Robert Costanza et al., 1989)
	Recreation	1,041.04	1,041.04	(Creel & Loomis, 1992)
	Recreation	88.06	994.50	(Gren & Söderqvist, 1994) *
	Recreation	71.11	71.11	(Gren, Groth, & Sylven, 1995) *
	Recreation	208.01	208.01	(Kreutzwiser, 1981)
	Recreation	209.51	209.51	(Lant & Roberts, 1990) *
	Recreation	648.57	4,203.82	(Whitehead, 1990)
	Waste	141.56	141.56	(Wilson, 2005) *
	Waste	67.02	67.02	(Breau, Farber, & Day, 1995)
	Waste	1,050.34	1,050.34	(Brenner Guillermo, 2007) *
	Waste	170.05	170.05	(Gren & Söderqvist, 1994) *
	Waste	35.20	35.20	(Gren et al., 1995) *
	Waste	551.02	551.02	(Jenkins et al., 2010)
	Waste	209.51	209.51	(Lant & Roberts, 1990) *
	Waste	5,027.28	5,027.28	(Meyerhoff & Dehnhardt, 2004) *
	Waste	10,881.15	10,881.15	(Lui, 2006)
	Water	1,934.84	2,407.52	(Brenner Guillermo, 2007) *
	Water	622.77	622.77	(Creel & Loomis, 1992)
	Water	18.19	18.19	(Folke & Kaberger, 1991) *
	Water Flows	3,741.87	3,741.87	(Brenner Guillermo, 2007) *
Water Flows	3,920.69	3,920.69	(Leschine et al., 1997)	
Water Flows	4,329.70	4,329.70	(UK Environment Agency, 1999)	

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/Acre/year	Source Study
Urban Open Space	Aesthetic	1,006.06	1,322.31	(Qiu, Prato, & Boehrn, 2006)
	Air Quality	32.46	32.46	(G. McPherson, Scott, & Simpson, 1998)
	Air Quality	192.35	192.35	(G. E. McPherson, 1992)
	Climate	1,134.38	1,134.38	(G. E. McPherson, 1992)
	Extreme Events	315.52	597.01	(Streiner & Loomis, 1995)
	Water Flows	8.32	8.32	(G. E. McPherson, 1992)
	Water Flows	138.22	187.58	(The Trust for Public Land, 2010)
Urban Other	Climate	420.95	420.95	(Brenner Guillermo, 2007) *
	Recreation	2,670.74	2,670.74	(Brenner Guillermo, 2007) *
	Water Flows	7.61	7.61	(Brenner Guillermo, 2007)

All values are adjusted for inflation to 2014 dollars.

\* Indicates source is from the TEEB database.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 3, Key-Log  
Economics, Economic Costs of the PennEast Pipeline,  
January 2017.**

# ECONOMIC COSTS OF THE PENNEAST PIPELINE:

EFFECTS ON  
ECOSYSTEM SERVICES, PROPERTY VALUE, AND THE  
SOCIAL COST OF CARBON IN PENNSYLVANIA AND  
NEW JERSEY

*JANUARY 2017*

Spencer Phillips, PhD

Sonia Wang

Cara Bottorff



*Research and strategy for the land community.*

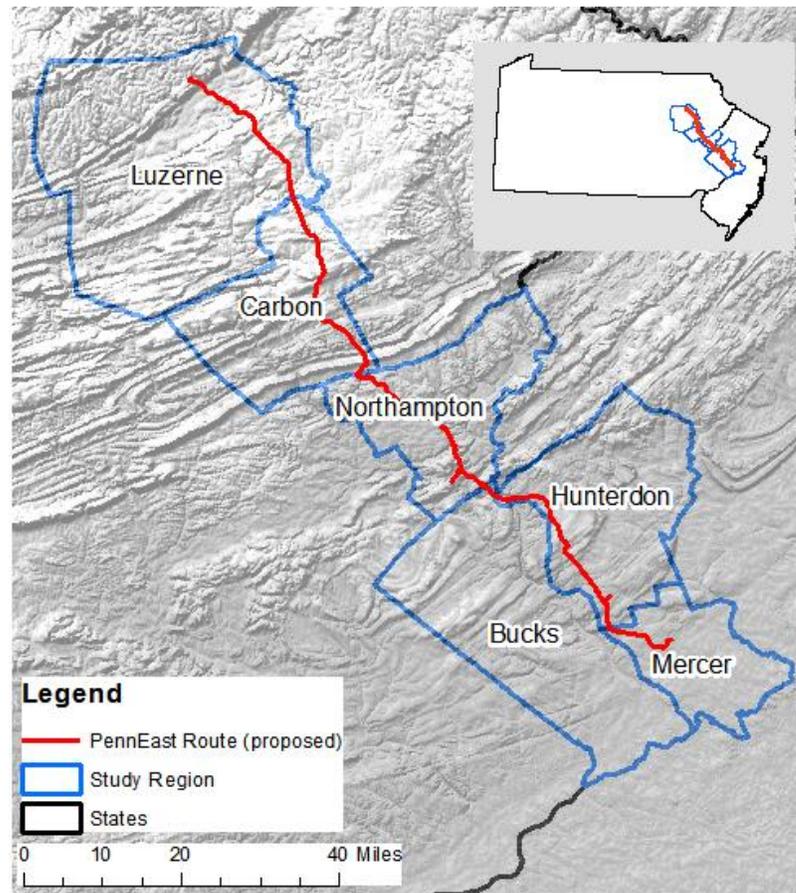
[keylogeconomics.com](http://keylogeconomics.com)

## EXECUTIVE SUMMARY

The PennEast Pipeline (PE), a proposed 36-inch diameter high-pressure natural gas pipeline, would transport 1.1 million dekatherms/Mcf, per day of natural gas from the Marcellus Shale region approximately 118 miles through four counties in Pennsylvania and two counties in New Jersey. PennEast Pipeline LLC (PE LLC), a joint venture of AGL Resources, NJR Pipeline Company, PSEG Power, SJI Midstream, Spectra Energy Partners, and UGI Energy Services, would be in charge of constructing and operating the pipeline.

The Federal Energy Regulatory Commission (FERC) is the federal agency responsible for reviewing PE LLC's proposal and either approving or rejecting the project. Under its own policy and the more comprehensive requirements of the National Environmental Policy Act (NEPA), FERC's review must look at the economic benefits, but also consider the full range of environmental effects of the proposed project. These costs include, but are not limited to, the different ways in which the environmental effects from the pipeline would result in changes in human well-being—including economic benefits and costs.

PE LLC promotes the project based on its own estimates of economic benefits, including job creation during the construction period and operation of the pipeline in the long term. FERC, however, concludes that the PennEast pipeline would have "minor" and "minor to moderate" positive effects in the form of jobs, payroll taxes, workers' expenditures, and local governments' tax revenues (Federal Energy Regulatory Commission, 2016b, p. ES-12). While even these minor benefits may be overstated,<sup>1</sup> the major problem over the public consideration of the PennEast Pipeline is that there are also important costs that, to date, PE LLC and FERC have discounted or ignored. The information provided by PE LLC and by FERC in the Draft Environmental Impact Statement falls severely short of systematically considering the potential negative economic effects, or more simply, the economic costs of the PE project.



**FIGURE 1: PennEast Pipeline (Proposed)**

Sources: PennEast route obtained from the Delaware Riverkeeper Network; Study Region (counties), federal lands, and hill shade from USGS (U.S. Department of Interior & U.S. Geological Survey, 2015).

<sup>1</sup> See Phillips, [Spencer], (2016, September 9), Comment on Draft Environmental Impact Statement, FERC Docket No. CP15-558-000; PennEast Pipeline Company, LLC, FERC/EIS-0271D, for explanation.

Delaware Riverkeeper Network commissioned this report to fill that information gap and provide research into some of the key economic and environmental costs that will certainly occur if the PE pipeline is approved. In this report, we provide quantitative estimates of several types of costs and consider other important costs FERC should evaluate before rendering its decision on the proposed pipeline.

The construction, operation, and presence of the pipeline would 1) Diminish ecosystem service value, 2) Reduce property value along the pipeline, and 3) Create economic damages associated with increases in carbon dioxide emissions (the social cost of carbon) (U.S. EPA, Climate Change Division, 2016). The construction of the pipeline corridor, as well as the establishment of a permanent easement, would alter existing land use/land cover and diminish ecosystem services, causing a loss of between \$6.3 and \$22.1 million during construction and an annual loss between \$2.4 and \$9.0 million during operation. Affected properties, those touched by the 50 foot right-of-way (ROW), the 1.2-mile-wide evacuation zone, and within half a mile of the proposed Kidder Compressor Station, could lose between a total of between \$159.7 and \$177.3 million in property value. The pipeline could also undermine scenic and quality of life amenities contributing to decreases in visitation, in-migration, tourism, and small business development. (See “At a Glance,” page iv for details.)

The estimated one-time costs for the study region range from \$166.0 to \$199.4 million. These one-time costs are comprised of diminished ecosystem services and property value lost during the construction period. Annual costs, costs that would begin following the construction period and recur each year for as long as the PE ROW exists, total between \$5.3 and \$12.8 million for lower ecosystem service productivity in the pipeline ROW, and lower property tax revenue due to the initial drop in property value. There is also an annual cost associated with the social cost of carbon, varying with the year in which the emissions would occur and the assumed rate at which future costs are discounted. Using a 5% discount rate, the social cost of carbon ranges from \$291.9 to \$608.1 million per year between 2019 and 2048. With a 2.5% discount rate, the annual social cost of carbon ranges from \$1.5 to \$2.3 billion.

Putting the streams of annual costs into present value terms<sup>2</sup> and adding the one-time costs, the total estimated economic cost of the PE pipeline in the study region is between \$13.3 and \$56.6 billion. Contrasting, and as we explain more thoroughly in this report, the costs are several times larger than the proposed benefits.

For reasons explained in the body of this report, these are conservative estimates of the external costs for the proposed PennEast Pipeline. One reason is simply that categories of impacts exist that are beyond the scope of this study. One example includes changes to sites or landscapes that possess historical or cultural significance. Like lost aesthetic quality or a decrease in the capacity of the landscape to retain soil, filter water, or sequester carbon (examples of ecosystem service values that the estimates DO include), historical and cultural impacts matter to humans and, therefore, could be expressed in monetary terms.

Further, and due to data limitations, we did not quantify public health costs to residents that may experience negative health impacts from compressor stations. We also did not estimate increased costs to communities

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<sup>2</sup> The present value of a perpetual stream of costs is the one-year cost divided by the real discount rate recommended by the Office of Management and Budget for cost-benefit and cost-effectiveness analysis of public projects and decisions (Office of Management and Budget, 2015). For our analysis, we used the recommended real discount rate for each year the project is expected to be in operation—i.e., for up to 30 years, or until 2048. These discount rates were applied to the estimated annual loss in tax revenue and ecosystem service value in each of those years. The social cost of carbon calculations have discounting built in. The total present discounted value for all costs is then the one-time costs, plus the social cost of carbon for 30 years, plus the separately discounted costs due to lost property taxes and ecosystem services.

from potential increases in demand for emergency services, more road maintenance and repair, and potential impacts on public or private water supplies, or other costs that may accompany construction.

Another important category of cost not counted here is “passive use value.” Passive use value includes the value to people of simply knowing an unspoiled natural area exists and the value of keeping those places unspoiled for the sake of some future direct or active use. In light of this, it is important to consider the estimates of economic costs provided here as a fraction of the total economic value put at risk by the proposed PennEast Pipeline.

Finally, while this report covers some of the costs that *will* occur if the PennEast Pipeline is constructed and operating, it does not include an assessment of natural resource damage and other effects that *might* occur during construction and operation. For example, there is a probability that erosion of steep slopes and resulting sedimentation of streams and rivers will occur during construction. There is also the likelihood that a leak or explosion could occur somewhere along the length of the pipeline during its lifetime. If, when, and where these events occur, there will be cleanup and remediation costs, costs of fighting fires and reconstructing homes, businesses, and infrastructure, the cost of lost timber, wildlife habitat, and other ecosystem services, and most tragically, the cost of lost human life and health.<sup>3</sup>

The magnitude of these damages, multiplied by the probability of occurrence, yields additional “expected costs” which add even more to the certain costs estimated in this study. To be clear, the costs estimated here—the effect on ecosystem services from clearing land for the pipeline corridor, the impact on land values resulting from buyers’ concerns about the pipeline, and the social cost of carbon—will occur with or without any discreet or extreme events like landslides or explosions ever happening. These impacts and their monetary equivalents are simply part of what will happen in Pennsylvania and New Jersey if the PennEast Pipeline is approved, built, and operates without incident.

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<sup>3</sup> While no one was killed in the incident, the recent explosion of Spectra Energy’s Texas Eastern gas transmission line in Pennsylvania is an example of these impacts. See, for example, “PA Pipeline Explosion: Evidence of Corrosion Found” (Phillips [Susan], 2016).

### At a Glance:

The PennEast Pipeline in Pennsylvania and New Jersey  
*Bucks, Carbon, Luzerne, and Northampton Counties in PA and  
Hunterdon and Mercer Counties in NJ*

- **Miles of pipeline:** 118
- **Impacted acres (area converted temporarily or permanently from its existing use or cover):**
  - In the permanent right-of-way (ROW): 717.3
  - In the construction zone (the construction corridor, new temporary roads, pipeyards, and temporary aboveground infrastructure): 1,852.7
  - In new permanent access roads and aboveground infrastructure: 55.8
  - The most heavily affected land cover types: forest (386.8 acres) and cropland (147.0 acres) (ROW only)
- **Parcels:**
  - In the ROW: 730
  - In the 1.2-mile-wide evacuation zone: 18,097
  - Within half a mile of the compressor station: 40
- **Residents and housing units in the evacuation zone:** 54,579 people, 23,293 homes
- **Lost ecosystem service value, such as for water and air purification, aesthetics, and recreation:**
  - Over the one-year construction period (a one-time cost): \$6.3 to \$22.1 million
  - In the ROW and in other permanent infrastructure (annual): \$2.6 to \$9.8 million
- **Property value:**
  - Baseline—that is, in a “no pipeline” scenario—property value at risk (and the expected one-time cost due to the pipeline in the following parentheses):
    - In the ROW: \$200.5 million (\$8.4 to \$26.1 million)
    - In the 1.2-mile-wide evacuation zone: \$3.9 billion (\$149.9 million)
    - Within half a mile of the compressor station: \$5.6 million (\$1.4 million)
  - Total property value lost (a one-time cost): \$159.7 to \$177.3 million
  - Resulting loss in property tax revenue (annual): \$2.7 to \$3.0 million
- **The social cost of carbon:**
  - The project would contribute to an equivalent of 21.3 million metric tons of carbon dioxide a year. Using a 5% discount rate, the social cost of carbon ranges from \$291.9 to \$608.1 million per year between 2019 and 2048. Using a 2.5% discount rate for the same time period, the social cost of carbon ranges between \$1.5 and \$2.3 billion per year.
- **Other impacts for consideration:**
  - Visual impacts:
    - The ROW for the pipeline and laterals can potentially be seen from approximately 35% of the study region. At least 1 km (0.62 miles) of pipeline ROW is visible from roughly 20% of the study region. (While these visual impacts have financial implications, we do not estimate these strictly in property value terms. Instead, the economic cost of impaired views for homeowners, as well as losses experienced by recreational visitors, and others would be captured as part of the “lost ecosystem service value”)
  - Economic activity that depends on the region’s scenic, recreational, and quality-of-life: (We consider scenarios in which visitor spending declines by 10% from current levels, and the rate of growth in retirement and proprietor’s income slows by 10%)
    - Annual loss of recreation tourism expenditures of \$448.0 million that would otherwise support 4,090 jobs and generate \$38.8 million in state and local tax receipts
    - Annual loss of personal income of \$55.6 million due to slower growth in the number of retirees
    - Annual loss of personal income of \$16.3 million due to slower growth in sole proprietorships
- **Total estimated costs:**
  - One-time costs (lost property value plus lost ecosystem service value during construction) would total between \$166.0 and \$199.4 million
  - Annual costs (costs that recur year after year) would range from \$5.3 to \$12.8 million PLUS the social cost of carbon, which varies by year, and ranges between \$291.9 million and \$2.3 billion per year
    - Present discounted value of all future annual costs (including the social cost of carbon): \$13.1 to \$56.4 billion
  - One-time costs plus the discounted value of all future annual costs: \$13.3 to \$56.6 billion

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## ABBREVIATIONS AND TERMS

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**BTM:** Benefit Transfer Method, a method for estimating the value of ecosystem services in a study region based on values estimated for similar resources in other places

**Construction Zone:** Refers to the construction corridor, new temporary roads, pipeyards, and temporary aboveground infrastructure

**EIS:** Environmental Impact Statement, a document prepared under the National Environmental Policy Act analyzing the full range of environmental effects, including on the economy, of proposed federal actions, which in this case would be the approval of the PennEast Pipeline (Related DEIS and FEIS for Draft and Final EIS, respectively)

**ESV:** Ecosystem Service Value, the effects on human well-being of the flow of benefits from an ecosystem endpoint to a human endpoint at a given extent of space and time, or more briefly, the value of nature's benefits to people

**FERC or the Commission:** Federal Energy Regulatory Commission, the agency responsible for preparing the EIS and deciding whether to grant a certificate of public convenience and necessity (i.e., whether to permit the pipeline)

**HCA:** High Consequence Area, the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure

**PE:** PennEast Pipeline, which in this report generally refers to the pipeline corridor itself

**PE LLC:** PennEast Pipeline Company, LLC, a joint venture of AGL Resources, NJR Pipeline Company, PSEG Power, SJI Midstream, Spectra Energy Partners, and UGI Energy Services

**NEPA:** National Environmental Policy Act of 1970, which requires the environmental review of proposed federal actions, preparation of an EIS, and, for actions taken, appropriate mitigation measures

**ROW:** Right-of-Way, the permanent easement in which the pipeline is buried

## AUTHORS' NOTE

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Delaware Riverkeeper Network commissioned this report to help ensure that the likely costs of the PennEast Pipeline project are not left out of the public debate. Delaware Riverkeeper Network has been working throughout the Delaware River Watershed for over 25 years. Using independent advocacy, and backed by accurate facts, science, and law, Delaware Riverkeeper Network champions the rights of communities to a Delaware River and tributary streams that are free flowing, clean, healthy, and abundant with a diversity of life. Please visit [www.delawariverkeeper.org](http://www.delawariverkeeper.org) to learn more about their work.

Key-Log Economics is an independent consultancy that brings more than 50 years of combined experience analyzing the economic features of land and resource use and related policy. We are grateful for the assistance of Delaware Riverkeeper Network in identifying local information sources and making contacts in the study region.

Key-Log Economics remains solely responsible for the content of this report, the underlying research methods, and the conclusions drawn. We used the best available data and employed appropriate and feasible estimation methods but nevertheless make no claim regarding the extent to which these estimates will match the actual magnitude of economic effects that will be realized if the PennEast Pipeline is approved.

*Cover Photo from Carla Kelly-Mackey, Hunterdon County, New Jersey.*



## BACKGROUND

According to documents filed by PennEast Pipeline LLC (PE LLC), the proposed PennEast Pipeline (PE) would be 36-inches in diameter over most of its 118-mile length. PE LLC intends on transporting up to 1.1 million dekatherms/Mcf per day of natural gas from the Marcellus Shale region in northern Pennsylvania to New Jersey, eastern and southern Pennsylvania, and via connection to existing pipelines (PennEast Pipeline Company, LLC, 2015a). The project would start in Luzerne County, Pennsylvania and travel through Carbon, Northampton, and Bucks Counties in Pennsylvania, then enter Hunterdon, New Jersey, and end in Mercer County, New Jersey. Proponents of the project tout the project as necessary to meet market demand for natural gas in Pennsylvania and New Jersey (PennEast Pipeline Company, LLC, 2015a), however, reports in response to the Draft Environmental Impact Statement (DEIS) (2016) and to the proposal conclude there is in fact no need for the pipeline (Berman, 2015; New Jersey Division of Rate Counsel, 2016). For example, the New Jersey Division of Rate Counsel (2016) found that “forecasted demands of the LDCs that PennEast is designed to supply are already being met by existing gas supply arrangements and available transportation capacity” (p. 8).

The route would cross important waterways such as the Delaware—the longest undammed river east of the Mississippi—, Lehigh, and Susquehanna rivers, pristine streams, the Appalachian Trail, wetlands, forests, and established public and private conservation lands. The D&R Greenway Land Trust estimates that the proposed route in New Jersey “will touch lands that have been preserved over time with public funding totaling over \$37 million” (D&R Greenway Land Trust, 2015). In addition, the project would potentially harm the habitat of several federally listed endangered species (Federal Energy Regulatory Commission, 2016b).

The permanent right-of-way (ROW), the temporary construction corridor of the pipeline—50 and 100 feet wide, respectively—, and the proposed 47,700 horsepower (hp) compressor station in Kidder Township would impose additional external costs on local residents and businesses, including costs that accrue due to safety concerns. Pipeline leaks and explosions are expensive, cause substantial physical damage (Table 1), and occur more frequently than in the past (Pipeline Safety Trust, 2015). According to an analysis conducted by the Pipeline Safety Trust (2015), more incidents associated with gas transmission pipelines occur for pipelines installed after 2010. Larger magnitude incidents require evacuation of wide swaths (up to 1.2 miles across for the PE), disrupting tens of thousands of homes, farms, and businesses. Still wider, but more difficult to gauge and estimate, are the zones within which the construction, operation, and presence of the pipeline would affect human well-being by changing the availability of ecosystem services such as clean air, water supply, and

**TABLE 1. Pipeline Incidents, Impacts, and Costs, 1996 to 2015. Includes gas distribution, gas gathering, gas transmission, hazardous liquid, and LNG lines.**

Source: Pipeline and Hazardous Materials Safety Administration (2016).

Place	Incidents	Fatalities	Injuries	Total Cost
U.S.	11,198	360	1,377	\$6.9 Billion
Pennsylvania	297	20	73	\$114.9 Million
New Jersey	177	5	34	\$49.7 Million

recreational opportunities. This would occur as the pipeline creates an unnatural linear feature on a landscape that otherwise remains largely natural or pastoral and dampens the attractiveness of the affected region as a place to live, visit, retire, or do business.

To date, these negative effects and estimates of their attendant economic costs have not received much attention in the otherwise vigorous public debate surrounding the proposed PE. This report is both an attempt to understand the nature and potential magnitude of the economic costs of the PE in the six-county region, as well as to provide an example for FERC as it proceeds with its process of analyzing and weighing the full effects of the proposed PE along its entire length.

## Policy Context

Before construction can begin, the PE must be approved by the Federal Energy Regulatory Commission (FERC). That approval, while historically granted to pipeline projects, depends on FERC's judgment that the pipeline would meet a public purpose and need. Because the approval would be a federal action, FERC must also comply with the procedural and analytical requirements of the National Environmental Policy Act (NEPA). These include requirements for arranging public participation, conducting environmental impact analysis, and writing an Environmental Impact Statement (EIS) that evaluates all of the relevant effects. Of particular interest here, such relevant effects include direct, indirect, and cumulative effects on or mediated through the economy. As the NEPA regulations state,

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (emphasis added, 36 CFR 1508.b).

It is important to note NEPA does not require that federal actions—which in this case would be the approval or denial of PennEast LLC's application—necessarily balance or even compare benefits and costs. NEPA is not a decision-making law, but rather a law requiring decisions be supported by an as full as possible accounting of the reasonably foreseeable effects of federal actions on the natural and human environment. It also requires that citizens have opportunities to engage in the process of analyzing and weighing those effects. NEPA therefore requires that decision-making agencies (i.e., FERC) develop or obtain and then consider information about the costs associated with the decisions they make.

Moreover, FERC's own policy regarding the certification of new interstate pipeline facilities (88 FERC, para. 61,227) requires adverse effects of new pipelines on "economic interests of landowners and communities affected by the route of the new pipeline" be weighed against "evidence of public benefits to be achieved [by the pipeline]" (88 FERC, para. 61,227; Hoecker, Breathitt, & He'bert Jr., 1999, pp. 18–19). Further, "...construction projects that would have residual adverse effects would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects" (p. 23).

In principle, this policy—what FERC calls an "economic test"—is in line with the argument, on economic efficiency grounds, that the benefits of a project or decision should be at least equal to its cost, including external costs. However, the policy's guidance regarding what adverse effects must be considered and how they are measured is deeply flawed. The policy states, for example, "if project sponsors...are able to acquire all or substantially all, of the necessary right-of-way by negotiation prior to filing the application...it would not adversely affect any of the three interests," which are pipeline customers, competing pipelines, and

“landowners and communities affected by the route of the new pipeline” (Hoecker et al., 1999, pp. 18, 26). FERC’s policy contends the only adverse effects that matter are those affecting owners of properties in the right-of-way. Even for a policy adopted in 1999, this contention is completely out of step with long-established understanding that development that alters the natural environment has negative economic effects.

A further weakness of the FERC policy is that it relies on applicants to provide information about benefits and costs. The policy’s stated objective “is for the applicant to develop whatever record is necessary, and for the Commission to impose whatever conditions are necessary, for the Commission to be able to find that the benefits to the public from the project outweigh the adverse impact on the relevant interests” (Hoecker et al., 1999, p. 26). The applicant therefore has an incentive to be generous in counting benefits<sup>4</sup> and parsimonious in counting the costs of its proposal. Under these circumstances, it seems unlikely that the Commission’s policy will prevent the construction of pipelines for which the full costs are greater than the public benefits they would actually provide. Indeed, until March 2016, FERC had never rejected a pipeline proposal (Woodall, 2016). (For the rejection, the Jordan Cove energy project (Federal Energy Regulatory Commission, 2016a) failed to demonstrate demand for the gas that would have been transported—that is, there would be no public or private benefits.)

Due to these weaknesses and as evidenced by FERC’s track record, the “economic test” does not provide a robust evaluation of the public merits of natural gas transmission projects.<sup>5</sup> It is a “test” in which difficult questions (such as ones about external costs involving all stakeholders) are not asked, and where those taking the test (the applicants) provide the answer key. In the case of the PennEast proposal, PE LLC has failed to acquire a sufficient portion of the right-of-way, so by FERC’s policy (and due to the interests of other federal agencies in how the PE would affect resources under their stewardship), FERC prepared an EIS (Federal Energy Regulatory Commission, 2016b). The process began with a series of scoping meetings where members of the public could express their general thoughts on the pipeline as well as what effects should fall under the scope of the EIS. Interested parties also had the opportunity to submit comments online and through the mail.

Much of what FERC heard from citizens echoed and expanded upon the list of potential environmental effects listed in its Notice of Intent to prepare an EIS (Federal Energy Regulatory Commission, 2015). In a review of comments collected through the DEIS, 99.4% of people who mentioned recreation and tourism businesses, 100% of commenters mentioning health (either related to the pipeline or the compressor station), and 93.3% of people mentioning the environment believed the PE would have a negative effect. In the DEIS, which came out in July 2016, FERC recognized that common topics mentioned during the scoping period include loss of property value, added responsibility for small emergency response teams, limited evacuation routes for local residents, human health and environmental impacts from compressor stations, and forest fragmentation (Federal Energy Regulatory Commission, 2016b). These effects can take the form of economic costs external to PE LLC that would be borne by individuals, businesses, and communities throughout the landscape the PE would traverse.

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<sup>4</sup> PE LLC has published estimates of economic benefits in the form of employment and income stemming from the construction and operation of the PE (PennEast Pipeline Company, LLC, 2015b). These studies suffer from errors in the choice and application of methods and in assumptions made regarding the long-run economic stimulus represented by the PE. Most significantly, the studies make no mention of likely economic costs, and their projections of long-term benefits extend far beyond the time period (of a year or so) within which economic impact analysis is either useful or appropriate. See Phillips, [Spencer], (2016, September 9), Comment on Draft Environmental Impact Statement, FERC Docket No. CP15-558-000; PennEast Pipeline Company, LLC, FERC/EIS-0271D, for explanation.

<sup>5</sup> See, for example, FERC’s Draft and/or Final Environmental Impact Statements the Constitution Pipeline (CP13-499), Mountain Valley Pipeline (CP16-10), Atlantic Coast Pipeline (CP15-554) and PennEast Pipeline (CP-15-558).

## Study Objectives

Given the policy setting and what may be profound effects of the proposed PennEast Pipeline on the people and communities of Pennsylvania and New Jersey, we have undertaken this study to provide information of two types:

1. An example of the scope and type of analyses that FERC could, and should, undertake as part of its assessment of the environmental (including economic) effects of the PE.
2. An estimate of the potential magnitude of economic effects in this region where the PE's environmental effects will be felt.

The estimates presented below, however, represent less than the total of all potential costs that would attend the construction, operation, and presence of the pipeline. The reason is that there are several categories of cost for which the scope of the project or the availability of data preclude direct quantification of those costs. These categories are:

- "Passive use value," including the value of preserving the landscape without a pipeline for future direct use.
- Probabilistic damages to natural resources, property, and human health and lives in the event of mishaps during construction and leaks/explosions during operation.
- Increases in the costs of community service like road maintenance and emergency response.<sup>6</sup> We discuss these costs under the heading of "Community Service Costs" (page 36), but we do not have sufficient data on which to base numeric estimates of these costs.

Our overall estimates, therefore, should be understood to be conservative, lower-bound estimates of the true total cost of the PE in the region.

## Current Economic Conditions in the Study Region

Our geographic focus is the six-county region the PennEast Pipeline is proposed to cross. This study region encompasses Bucks, Carbon, Luzerne, and Northampton counties in Pennsylvania, as well as Hunterdon and Mercer counties in New Jersey. This 2,961-square-mile region supports diverse land uses, including the Delaware, Lehigh, and Susquehanna Rivers, thriving cities and townships, wetlands, and parks. These natural, cultural, and economic assets are among the reasons more than 1.8 million people call this six-county region home and an even larger number visit each year for hiking, fishing, festivals, kayaking, horseback riding, weddings, and other events.

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<sup>6</sup> Similar to communities impacted by the shale gas boom, communities along the pipeline can expect spikes in crime as transient workers come and go, more damage to roads under the strain of heavy equipment, increases in physical and mental illnesses including asthma, depression, anxiety, and others triggered by exposure to airborne pollutants, to noise, and to emotional, economic, and other stress. See, for example, Ferrar et al. (2013), Healy (2013), Fuller (2007), Campoy, (2012), and Mufson (2012).

## PASSIVE USE VALUE

Passive use values include *option* value, or the value of preserving a resource unimpaired for one's potential future use; *bequest* value, which is the value to oneself of preserving the resource for the use of others, particularly future generations; and *existence* value, which is the value to individuals of simply knowing that the resource exists, absent any expectation of future use by oneself or anyone else. In the case of the PE, people who have not visited the Poconos or otherwise spent vacation time and dollars in the region, are better off knowing that the setting for their planned activities is a beautiful aesthetically pleasing landscape. What future visitors would be willing to pay to maintain that possibility would be part of the "option value" of a PE-free landscape.

Statistics from the Center for the Study of Rural America, part of the Federal Reserve Bank of Kansas City, highlight the extent to which the region possesses the right conditions for resilience and economic success in the long run (Low, 2004). These data show that the study region has a higher human amenity index (based on scenic amenities, recreational resources, and access to health care), and strong entrepreneurship relative to the average for Pennsylvania and New Jersey counties.<sup>7</sup>

More traditional measures of economic performance suggest the counties are generally strong and resilient, though there are some differences among the Pennsylvania and New Jersey counties.

From 2000 through 2014, for example:<sup>8</sup>

- Population in the study region grew by 5.2%, compared to a 4.9% increase for Pennsylvania and New Jersey overall.
  - Population in the Pennsylvania section of the study region grew by 5.3%, compared to a 4.1% increase for the state of Pennsylvania.
  - Population in the New Jersey section of the study region grew by 5.0%, compared to a 6.0% increase for the state of New Jersey.
- Employment in the study region grew by 12.6%, compared to an 8.0% increase for Pennsylvania and New Jersey overall.
  - Employment in the Pennsylvania section of the study region grew by 12.7%, compared to a 7.3% increase for the state of Pennsylvania.
  - Employment in the New Jersey section of the study region grew by 12.3%, compared to a 9.0% increase for state of New Jersey.
- Personal income in the study region grew by 16.9%, compared to a 16.1% increase in personal income for Pennsylvania and New Jersey overall.
  - Personal income in the Pennsylvania section of the study region grew by 19.7%, compared to an 18.4% increase for the state of Pennsylvania.
  - Personal income in the New Jersey section of the study region grew by 11.5%, compared to a 19.7% increase for the state of New Jersey.
- On average, earnings per job in the study region are lower, by about \$3,500/year, than the average for Pennsylvania and New Jersey overall.<sup>9</sup>
  - Earnings per job in the Pennsylvania section of the study region are lower, by about \$7,000/year, than the average for the state of Pennsylvania.
  - Earnings per job in the New Jersey section of the study are higher, by about \$5,600/year than the average for the state of New Jersey.
- Per capita income, by contrast, is higher in the study region, by \$3,600/year, than the average for Pennsylvania and New Jersey overall.<sup>10</sup>
  - Per capita income in the Pennsylvania section of the study region is higher, by about \$4,200/year, than the average for the state of Pennsylvania.
  - Per capita income in the New Jersey section of the study region is higher, by about \$6,800/year, than the average for the state of New Jersey.

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<sup>7</sup> Note that the Kansas City Fed's statistics have not been updated since 2004-2006, and conditions in and outside the study region have undoubtedly changed. Some of these relative rankings may no longer hold.

<sup>8</sup> These data are from the U.S. Department of Commerce (2015a) as reported in Headwaters Economics' Economic Profile System.

<sup>9</sup> It is not uncommon for wages to be lower in high-amenity areas, as workers can view amenities as a "second paycheck." See, for example, Roback (1988) and Niemi and Whitelaw (1999).

<sup>10</sup> Per capita income reflects non-labor income, such as from investments and social security, in addition to the wages and salaries included in earnings per job.

- The unemployment rate in the study region is 5.8%, compared to 6.2% for Pennsylvania and New Jersey overall.
  - The unemployment rate in the Pennsylvania section of the study region is 5.9%, compared to an unemployment rate of 5.8% for the state of Pennsylvania.
  - The unemployment rate in the New Jersey section of the study region is 5.5%, compared to an unemployment rate of 6.6% for the state of New Jersey.

In addition, several trends suggest entrepreneurs and retirees are moving to (or staying in) this region, bringing their income, expertise, and job-creating energy with them. Namely,

- The region’s population growth has been primarily due to in-migration,
- The proportion of the population 65 years and older has increased from 14.3% to 15.8%,
- Proprietors’ employment is up by 47.7%, and
- Non-labor income (primarily investment returns and age-related transfer payments like Social Security) is up by 26.7%.

Temporary residents—tourists and recreationists attracted to the natural amenities of the region—and the businesses that serve them are also important parts of the region’s economy. Tourists spent about \$4.5 billion in the study region in 2015. The companies that directly served those tourists employed 40,896 people, or 5.7% of total private employment in the region (Tourism Economics, 2015 & 2016).

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***“I wouldn’t have the opportunity to have my animal farm for income and it would also devastate the bucolic landscape that has driven the tourism that supports my town, bike riding and fundraisers (5k runs, cycling and others). It would also take away a safe place for my children to play and have a childhood. I would have no other choice than to leave and it would be a life without a home we own, without our farm animals and the money we made from them. Without a studio for me to earn another source of income. How could PennEast possibly mitigate this for me and my community?”***

*-Jacqueline Evans, Landowner  
Hunterdon, NJ*

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It is in this context the potential economic impacts of the PE must be weighed and the apprehension of the region’s residents understood. Many believe the construction and operation of the pipeline will kill, or at least dampen, the productivity of the proverbial goose that lays its golden eggs in the region. This could result in a slower rate of growth in the region and worse economic outcomes. More dire is the prospect that businesses will not be able to maintain their current levels of employment. Just as retirees and many businesses can choose where to locate, visitors and potential visitors have practically unlimited choices for places to spend their vacation time and expendable income. If the study region loses its amenity edge, other things being equal, people will go elsewhere, and this region could contract.

Instead of a “virtuous circle” with amenities and quality of life attracting/retaining residents and visitors, who improve the quality of life, which then attracts more residents and visitors, the PE could tip the region into a downward spiral. In that scenario, loss of amenity and risk to physical safety would translate into a diminution or

outright loss of the use and enjoyment of homes, farms, and recreational and cultural experiences. Some potential in-migrants would choose other locations and some long-time residents would move away, draining the region of some of its most productive citizens. Homeowners would lose equity as housing prices follow a stagnating economy. With fewer people to create economic opportunity, fewer jobs and less income will be generated. Communities could become hollowed out, triggering a second wave of amenity loss, out-migration, and further economic stagnation.

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*“This pipeline would directly impact our spring fed farm, our physical safety, farming yield, and overall proposes environmental harm to flora, fauna, water, and soil.”*

*-Rosemary Litschauer, Landowner  
Rieglesville, PA*

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## ENVIRONMENTAL-ECONOMIC EFFECTS AND WHERE THEY WOULD OCCUR

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In the remainder of this report, we follow this potential cycle and consider four distinct types of economic consequences.

1. **Effects on Ecosystem Service Value:** Corresponding to the direct biophysical impacts of the proposed pipeline are effects on ecosystem services—the benefits nature provides to people for free, like purified water or recreational opportunities, that will become less available and/or less valuable due to the PE’s construction and operation.
2. **Effects on Property Value:** Estimating the loss of private property value as owners and would-be owners choose properties farther from the pipeline’s right-of-way, evacuation zone, compressor station, and viewshed.
3. **The Social Cost of Carbon:** The economic cost of harm associated with the emission of carbon.
4. **Effects on Economic Development:** More general economic effects caused by a dampening of future growth prospects or even a reversal of fortune for some industries.
5. **Other Impacts Not Quantified:** We examine the impacts to public health due to the operation of the pipeline and compressor station, the potential impact of pipeline construction and operation on municipal and county community services, and provide an overview of how the pipeline’s visual impact may decrease property value.

We begin with an exploration of the geographic area over which these various effects will most likely be felt.

### Impact Zones within the Study Region

#### Right-of-Way and Construction Corridor

Construction of the pipeline corridor itself would require clearing an area at least 100 feet (30.5 m) wide. After construction, the permanent right-of-way would be 50 feet (15.2 m) wide along the entire length of the pipeline.

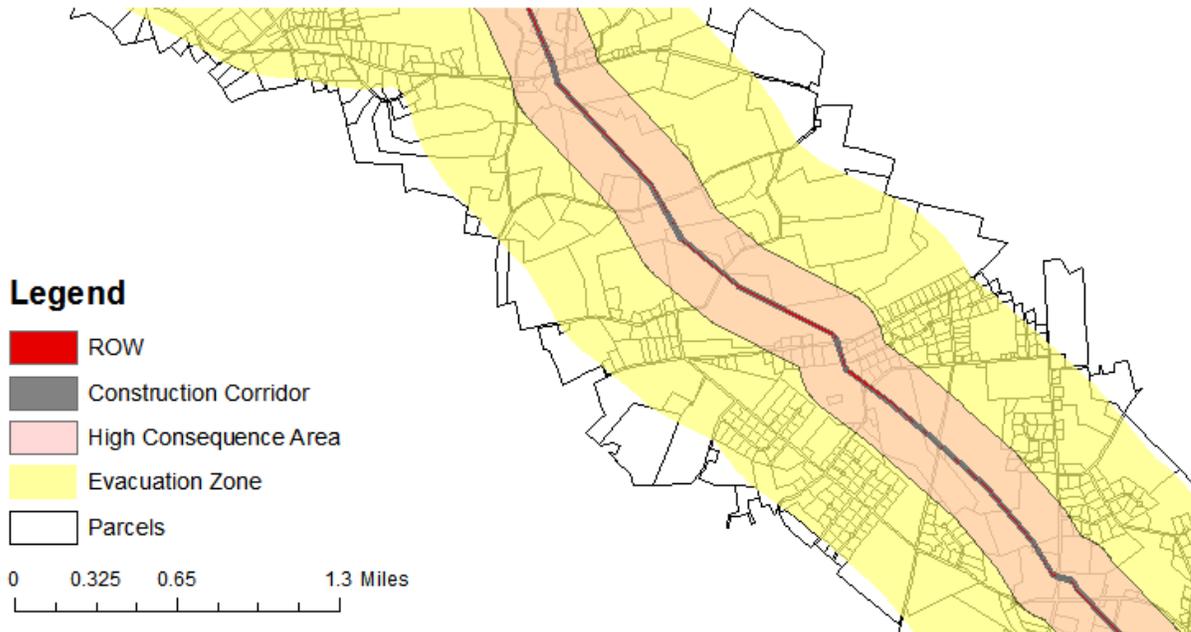
#### High Consequence Area

Operated at its intended pressure and due to the inherent risk of leaks and explosions, the pipeline would present the possibility of having significant human and ecological consequences within a large High Consequence Area (HCA). A High Consequence Area is “the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure” (Stephens, 2000, p. 3). Using Stephens’ formula, the HCA for this pipeline would have a radius of 949 feet (289.26 m).

## Evacuation Zone

The evacuation zone is defined by the distance beyond which an unprotected human could escape burn injury in the event of the ignition or explosion of leaking gas (Pipeline Association for Public Awareness, 2007, p. 29).

There would be a potential evacuation zone with a radius of at least 3,157 feet (962.48 m).<sup>11</sup> (See map, Figure 2, for a close-up of these zones in part of the study region.)



**FIGURE 2: Right-of-Way, Construction Corridor, High Consequence, and Evacuation Areas for a Section in Northampton, PA.**

Note that the overlay of the HCA (in pink) and the evacuation zone (in yellow) shows up as the salmon band in the map. The ROW covers much of the construction corridor, leaving a thin band of red/grey visible. Also, we only had data for parcels as far out as the edge of the evacuation zone for a few counties.

Sources: PE route obtained from the Delaware Riverkeeper Network; Counties from USGS (U.S. Department of Interior & U.S. Geological Survey, 2015); Parcels from Northampton obtained from the Northampton County GIS Department.

Within the construction corridor and right-of-way is where the greatest disruption of ecosystem processes will occur, so these corridors are where reductions in ecosystem service value (ESV) emanate. Because we estimate ecosystem service values at their point of origin, we focus on the ROW, the construction zone (the construction corridor, new temporary roads,<sup>12</sup> pipeyards, and temporary aboveground infrastructure), new permanent access roads,<sup>12</sup> and permanent aboveground infrastructure. An explosion would undoubtedly affect ecosystem processes within the HCA and possibly the evacuation zone, but given the probability of an explosion at a

<sup>11</sup> The maximum operating pressure proposed for the PE is 1,480 PSIG, but the source data for the evacuation distance is a table with pressure in 100 PSIG increments. The full evacuation distance would be between 3,071 feet and 3,179 feet, the distances recommended for a 36" pipeline operated at 1,400 and 1,500 PSIG. The exact evacuation distance is determined by subtracting the 1500 PSI 36" distance value from the 1400 PSI 36" value, taking 80% of that value, and adding it to the 1400 value to determine the appropriate evacuation distance for a 1480 PSI 36" pipeline. The upshot for this study is a slightly more conservative estimate of the effect of the PE on property value.

<sup>12</sup> We estimate lost ESV only for *new* temporary and permanent access roads because it is for these roads that other land uses (forest, cropland, etc.) will be converted to road surfaces. Where existing roads will be used for access, even if improved by paving, we assume there is no change in their function as sources of ecosystem service value and, therefore, there would be no decrease in that value due to their use related to the PE.

particular point along the pipeline at a given time is small, we do not include the additional effects *on ecosystem service value* due to explosion in the cost estimates.

Effects on land value are another matter, and it is reasonable to consider land value impacts within the evacuation zone. As Kielisch (2015) stresses, the value of land is determined by human perception, and property owners and would-be owners have ample reason to perceive risk to property near high-pressure natural gas transmission pipelines. Traditional and new media reports attest to the occurrence and consequences of pipeline leaks and explosions, which are even more prevalent for newer pipelines than for those installed decades ago (Smith, 2015). Information about pipeline risks translates instantly into buyers' perceptions and their willingness to pay for properties exposed to those risks. For would-be sellers, this dynamic reduces the price they could expect to receive for their homes and makes it harder to find a buyer in the first place. Property owners who do not wish to move would experience a loss of economic value due to diminished enjoyment of their homes (Freybote & Fruits, 2015).

### **Compressor Station**

The proposed compressor station is likely to have separate effects on property value and on human health. Based on the experience of homeowners near a compressor station in Hancock, New York, we consider the possibility of a property value effect within one half mile of the proposed compressor station in Kidder Township, Carbon County (Catskill Citizens for Safe Energy, 2015). This zone overlaps the ROW and the evacuation zone, and because we assume that the more acute and ever present effect of proximity to the compressor station would dominate all other effects, we ignore the ROW and evacuation zone effects for these particular properties.

Compressor stations have also been associated with various human health effects at distances up to two miles away from compressor stations (Subra, 2009, 2015). Further epidemiological research would allow estimation of the costs of those effects for the proposed station in Kidder Township, however, without such research, we do not include the potential public health costs in the present study.

### **Viewshed**

Beyond the areas where the proposed pipeline would alter land use and present the risk of physical danger, the pipeline would change the aesthetic qualities of the region. Residents and visitors will see the pipeline corridor as a break in a once completely forested hillside, and the lower aesthetic quality would translate into further loss of value for properties from which the corridor is visible. In this study, that effect is captured as lost aesthetic value under the heading of ecosystem services. Therefore, while we do map the areas from which the pipeline could be visible, we do not separately estimate impacts on properties at those locations. The cost, in other words, is estimated from the pipeline corridor where the aesthetic quality is impaired, not the points at which the diminished aesthetic quality is experienced.

### **Boroughs, Townships, Cities, and Counties**

If PE is built, there will likely be increases in the costs of community service, such as for traffic control and extra law enforcement capacity needed during construction and for emergency preparedness/emergency services during operation. As borough, township, city, and county governments, as well as volunteer fire companies meet these needs, costs for services would increase. In the DEIS, FERC states that they do not expect a change in the level of services provided by law enforcement and fire protection during pipeline construction and that PennEast will work to coordinate local community service departments in case of an emergency response situation (Federal Energy Regulatory Commission, 2016b). Neither PE LLC nor FERC have confirmed in Resource Reports or the DEIS that they interviewed officials responsible for such services. Based on comment letters

submitted to FERC from local emergency service groups raising questions and concerns over the proposed project, however, it does not seem likely PE LLC reached out. From that assumption, FERC’s statement appears to be based entirely on PennEast’s assurance and not on any real data, which should be rectified before the final decision regarding the pipeline.

### Region-Wide Effects

Beyond the loss of ecosystem services stemming from the conversion of land in the ROW, the loss of property value resulting from the chance of biophysical impacts (leaks and explosions), or the certainty of impacts on aesthetics, the proposed PE would also diminish physical ecosystem services, scenic amenity, and passive use value that are realized or enjoyed beyond the evacuation zone and out of sight of the pipeline corridor. The people affected include residents, businesses, and landowners throughout the study region, as well as past, current, and future visitors to the region. The impacts on human well-being would be reflected in economic decisions such as whether to stay in or migrate to the study region, whether to choose the region as a place to do business, and whether to spend scarce vacation time and dollars near the PE instead of in some other place.

**TABLE 2: Geographic Scope of Effects**

A check mark indicates the zones/effects for which estimates are included in this study. The “?”s indicate cost categories for future study and for which quantitative estimates are not included in this report.

Values/Effects	ROW & Construction Zone	HCA & Evacuation Zone	Near the Compressor Station	Pipeline Viewshed	Entire Study Region	Beyond the Study Region
Ecosystem Services	✓	a,b	✓	a,b	? <sup>a,b</sup>	?
Human Health and Safety	?	?	✓	?	?	?
Land/Property Value	✓ <sup>c</sup>	✓ <sup>d</sup>	✓ <sup>d</sup>	✓ <sup>e</sup>	?	?
Community Services	?	?	?	?	?	?
Economic Development	f	f	f	f	✓	?

**Notes:**

- a. Changes in ecosystem services felt beyond the ROW and construction zone may be key drivers of “Economic Development Effects,” but they are not separately estimated to avoid double counting.
- b. With the exception of the impact on visual quality, we do not estimate the spillover effects associated with altering the ecosystem within the ROW on the productivity of adjacent areas. The ROW, for example, provides a travel corridor for invasive species that could reduce the integrity and ecosystem productivity of areas that without the PE would remain core ecological areas, interior forest habitat, etc.
- c. We estimate land value effects for the ROW but not for the construction zone.
- d. Properties in the HCA are treated as though there is no additional impact on property value relative to the impact of being in the evacuation zone. Also, we exclude properties in the compressor station zone from estimates of impacts related to the ROW and the evacuation zone because while the compressor station’s effects on land value may be similar (driven by health and safety concerns and possible loss of use), they are both more acute and certain. (Noise and air emissions from the compressor stations will be routine, while the probability of a leak occurring at a given time from the pipeline is rare.) We assume that the ongoing effects of the compressor station on use and enjoyment of properties nearby would overshadow or dominate the possibility of a high-consequence event or the need to evacuate.
- e. To avoid double-counting, changes in property value due to an altered view from the property are considered to be part of lost aesthetic value under the “Effects on Ecosystem Service Value” section.
- f. Economic development effects related to these subsets of the study region are included in estimates for the study region.

To the extent the PE causes such decisions to favor other areas, less spending and slower economic growth in the study region would be the result. A secondary effect of slower growth would be further reductions in land value, but in this study we consider the primary effects in terms of slower population, employment, and income growth in key sectors. Table 2, above, summarizes the types of economic values considered in this study and the zones in which they are estimated.

## EFFECTS ON ECOSYSTEM SERVICE VALUE

The idea that people receive benefits from nature is not at all new, but “ecosystem services” as a term describing the phenomenon is more recent, emerging in the 1960s (Millennium Ecosystem Assessment, 2003). “Benefits people obtain from ecosystems” is perhaps the simplest and most commonly heard definition of ecosystem services (Reid et al., 2005).

“Ecosystem services” is sometimes lengthened to “ecosystem goods and services” to make it explicit that some are tangible, like physical quantities of food, water for drinking, and raw materials, while others are truly services, like cleaning the air and providing a place with a set of attributes that are conducive to recreational experiences or aesthetic enjoyment. We use the simpler “ecosystem services” here. Table 3, lists the provisioning, regulating, and cultural ecosystem services included in this study.

**TABLE 3: Ecosystem Services Included in Estimates**

<b>Provisioning Services<sup>a</sup></b>
<b>Food Production:</b> The harvest of agricultural produce, including crops, livestock, and livestock by-products; the food value of hunting, fishing, etc. <b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest
<b>Raw Materials:</b> Fuel, fiber, fertilizer, minerals, and energy. <b>Associated land uses<sup>b</sup>:</b> Forest, Wetland
<b>Water Supply:</b> Filtering, retention, storage, and delivery of fresh water—both quality and quantity—for drinking, watering livestock, irrigation, industrial processes, hydroelectric generation, and other uses. <b>Associated land uses<sup>b</sup>:</b> Forest, Water, Wetland
<b>Regulating Services<sup>a</sup></b>
<b>Air Quality:</b> Removing impurities from the air to provide healthy, breathable air for people. <b>Associated land uses<sup>b</sup>:</b> Shrub/Scrub, Forest, Wetland, Urban Open Space
<b>Biological Control:</b> Inter- and intra-specific interactions resulting in reduced abundance of species that are pests, vectors of disease, or invasive in a particular ecosystem. <b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest
<b>Climate Regulation:</b> Storing atmospheric carbon in biomass and soil as an aid to the mitigation of climate change, and/or keeping regional/local climate (temperature, humidity, rainfall, etc.) within comfortable ranges. <b>Associated land uses<sup>b</sup>:</b> Pasture/Forage, Grassland, Shrub/Scrub, Forest, Wetland, Urban Open Space, Urban Other
<b>Erosion Control:</b> Retaining arable land, stabilizing slopes, shorelines, riverbanks, etc. <b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest

Regulating Services Continued
<p><b>Pollination:</b> Contribution of insects, birds, bats, and other organisms to pollen transport resulting in the production of fruit and seeds. May also include seed and fruit dispersal.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest</p>
<p><b>Protection from Extreme Events:</b> Preventing and mitigating impacts on human life, health, and property by attenuating the force of winds, extreme weather events, floods, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forests, Wetland, Urban Open Space</p>
<p><b>Soil Fertility:</b> Creation of soil, inducing changes in depth, structure, and fertility, including through nutrient cycling.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest</p>
<p><b>Waste Treatment:</b> Improving soil and water quality through the breakdown and/or immobilization of pollution.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest, Water, Wetland</p>
<p><b>Water Flows:</b> Regulation by land cover of the timing of runoff and river discharge, resulting in less severe drought, flooding, and other consequences of too much or too little water available at the wrong time or place.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Forests, Wetland, Urban Open Space, Urban Other</p>
Cultural Services <sup>a</sup>
<p><b>Aesthetic Value:</b> The role that beautiful, healthy natural areas play in attracting people to live, work, and recreate in a region.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Forest, Wetland, Urban Open Space</p>
<p><b>Recreation:</b> The availability of a variety of safe and pleasant landscapes—such as clean water and healthy shorelines—that encourage ecotourism, outdoor sports, fishing, wildlife watching, hunting, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Shrub/Scrub, Forest, Water, Wetland, Urban Open Space, Urban Other</p>

Notes:

- a. Descriptions follow Balmford (2010, 2013), Costanza et al. (1997), Reid et al. (2005), and Van der Ploeg, et al. (2010).
- b. “Associated land uses” are limited to those for which per-unit-area values are available in this study.

Different ecosystems (forest, wetland, cropland, urban areas, for example) produce different arrays of ecosystem services, and/or produce similar services to greater or lesser degrees. This is true for the simple reason that some ecosystems or land uses produce a higher flow of benefits than others.

At a conceptual level, we estimate the potential effects of the PE on ecosystem service values by identifying the extent to which the pipeline’s construction would affect, and how its long-term existence would perpetuate, a change in land cover or land use, which in turn results in a change in ecosystem service productivity. Lower productivity, expressed in dollars of value per acre per year, means fewer dollars’ worth of ecosystem service value produced each year.

Construction will strip bear the 100-foot-wide construction corridor and the rest of the construction zone. Once construction is complete and after some period of recovery, much of the 50-foot-wide right-of-way will be occupied by a different set of ecosystems (land cover types) than were present before



Permanent easement of Tennessee Gas Pipeline Company’s 300 line in Pike County, Pennsylvania.  
(Photo Credit: Wendy Selepouchin)

construction. By applying per-acre ecosystem service productivity estimates (denominated in dollars) to the various arrays of ecosystem services, we can estimate ecosystem service values produced per year in the periods before, during, and after construction. The difference between annual ecosystem service value *during* construction and the value *before* construction is the annual loss in ecosystem service value *of* construction. The difference between the annual ecosystem service value during ongoing operations (i.e., the value produced in the ROW) and the before-construction baseline (no pipeline) is the annual ecosystem service cost that will be experienced indefinitely.

In addition to the ROW and construction corridor, the PE would require the construction of various temporary and permanent access roads,<sup>13</sup> pipeyards,<sup>14</sup> and aboveground infrastructure.<sup>15</sup> These additional features are treated as though they are part of the construction zone. Permanent roads and permanent aboveground infrastructure are treated separately.<sup>13,16</sup> This overall process is illustrated in Figure 3 and the details of our methods, assumptions, and calculations are described in the following two subsections.

## Ecosystem Service Estimation Methods

Economists have developed widely used methods to estimate the monetary value of ecosystem services and/or natural capital. The most commonly known example is a study by Costanza et al. (1997) that valued the natural capital of the entire world. That paper and many others employ the benefit transfer method (BTM) to establish a value for the ecosystem services produced or harbored from a particular place.<sup>17</sup> According to the Organization for Economic Cooperation and Development, BTM is “the bedrock of practical policy analysis,” particularly in cases such as this when collecting new primary data is not feasible (OECD, 2006).

BTM takes a rate of ecosystem benefit delivery calculated for one or more “source areas” and applies that rate to conditions in the “study area.” As Batker et al. (2010) state, the method is very much like a real estate appraiser using comparable properties to estimate the market value of the subject property. It is also similar to using an existing or established market or regulated price, such as the price of a gallon of water, to estimate the value of some number of gallons of water supplied in some period of time. The key is selecting “comps” (data from source areas) that match the circumstances of the study area as closely as possible.

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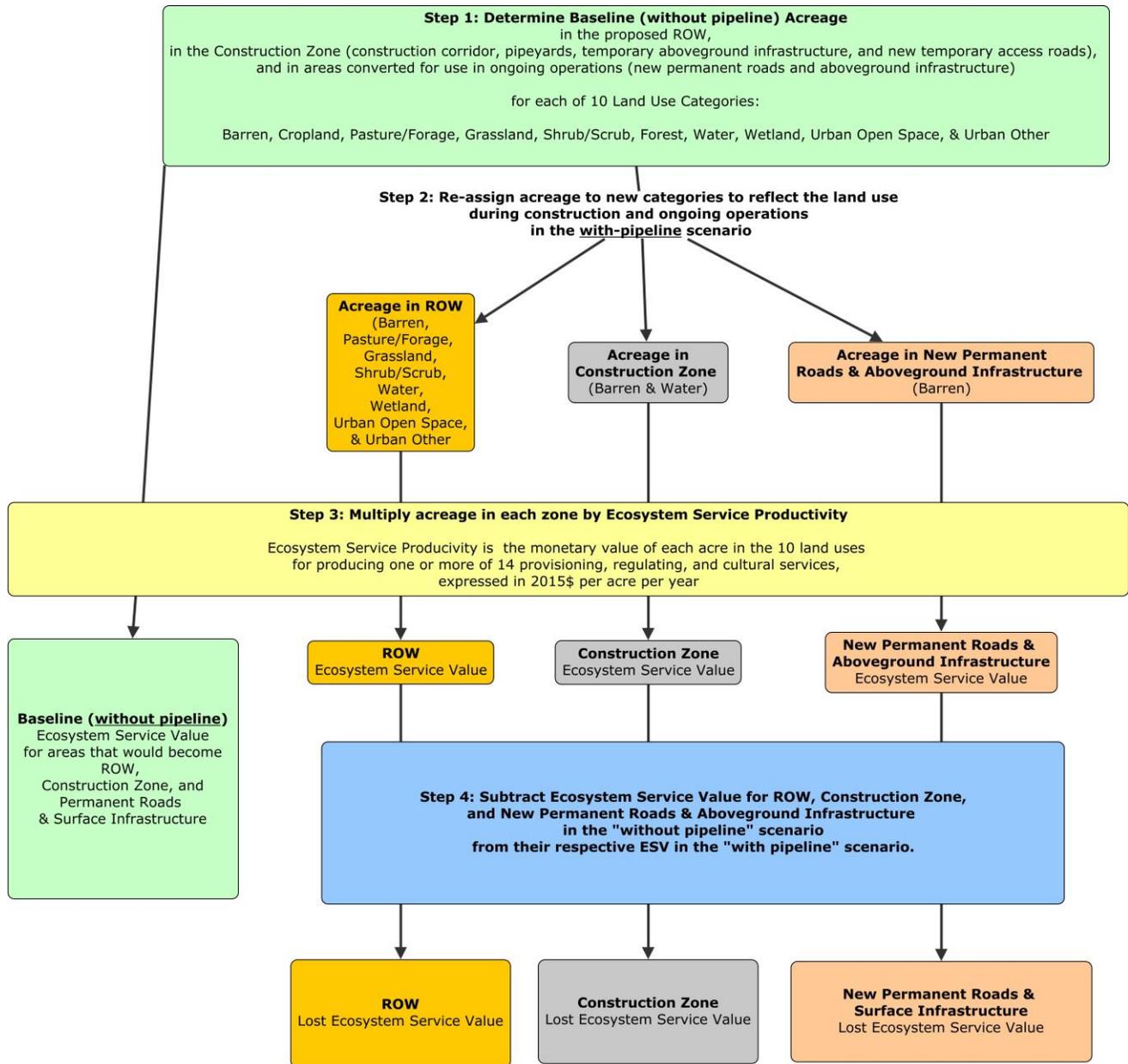
<sup>13</sup> As noted above, we only consider the ecosystem service conversion of *new* temporary and permanent access roads, not partially existing roads. Resource Report 1 (PennEast Pipeline Company, LLC, 2015a) provides the length and width of each road as well as the existing land condition, such as “grass” or “grass and trees.” We used this land condition as a proxy for the baseline land cover. For the “with PE” scenario, all of these areas would, for ecosystem services estimation purposes, be converted to the barren land category.

<sup>14</sup> Resource Report 1 (PennEast Pipeline Company, LLC, 2015a) gives the coordinates and total acreage disturbed by the construction of pipeyards, but it does not report their exact shape. To evaluate the land uses converted to barren land for pipeyards, we centered a circle of the corresponding area at the coordinate for each pipeyard and then estimated the acreage in the various land uses within that circle. To avoid double counting, we excluded any portions of these circles that overlapped with the construction corridor.

<sup>15</sup> As with pipeyards, Resource Report 1 (PennEast Pipeline Company, LLC, 2015a) gives the coordinates and amount of temporary acreage disturbed for aboveground infrastructure facilities, but it does not report their exact shape. For temporary aboveground infrastructure, we assumed a circular footprint for each facility and, after excluding any overlap with the construction corridor, we estimate the acreage in the various pre-construction land uses.

<sup>16</sup> As with pipeyards and temporary infrastructure, Resource Report 1 (PennEast Pipeline Company, LLC, 2015a) gives the coordinates and amount of permanent acreage disturbed on and off the ROW for aboveground infrastructure facilities, but not the exact footprint of the areas. For these facilities, we again assume a circular footprint of a size corresponding to each area and estimate the acreage of each land use disturbed within those circles. This estimation excludes any area of overlap with the ROW.

<sup>17</sup> See also Esposito et al. (2011), Flores et al. (2013), and Phillips and McGee (2014) for more recent examples.



**FIGURE 3: Ecosystem Service Valuation Process**

Typically, values are drawn from previous studies that estimate the value of various ecosystem services from similar land cover/biome types. Also, it is benefit (in dollars) per-unit-area-per-year in the source area that is transferred and applied to the number of hectares or acres in the same land cover/biome in the study area. For example, data for the source area may include the value of forestland for recreation. In that case, apply the per-acre value of recreation from the source area’s forestland to the number of acres of forestland in the study area. Multiply that value by the number of acres of forestland in the study area to produce the estimate of the value of the study area’s forests to recreational users. Furthermore, it is important to use source studies that are from regions with similar underlying economic, social, and other conditions to the study area.

Following these principles and techniques developed by Esposito et al. (2011), Esposito (2009), and Phillips and McGee (2014, 2016), and as illustrated in Figure 3, we employ a four-step process to evaluate the short-term and long-term effects of the PE on ecosystem service value in the study region.

The steps in summary:

1. Assign land and water in the study to one of 10 land uses based on remotely sensed (satellite) data in the National Land Cover Dataset (NLCD) (Fry et al., 2011). This provides the array of land uses for estimating baseline or “without PE” ecosystem service value.
2. Re-assign or re-classify land and water to what the land cover would most likely be during construction and during ongoing operation.
3. Multiply acreage by per-acre ecosystem service productivity (the “comps”) (in dollars per acre per year) to obtain estimates of annual aggregate ecosystem service value under the baseline/no PE scenario, for the construction zone (and period) and for the ROW during ongoing operation.  
For simplicity and given the 7-month construction period (Kornick, 2016a), we assume the construction zone will remain barren for at least 5 months after construction is completed (a one year construction period). We recognize revegetation will occur soon after the trench is closed and fill and soil are returned, but it will still be some time until something resembling a functioning ecosystem is restored.
4. Subtract baseline (no pipeline) ESV from ESV (with pipeline) for the construction period (in the construction zone) and from ESV during ongoing operations (in the ROW) to obtain estimates of the ecosystem service costs imposed annually during the construction and operations period, respectively.

## Step 1: Assign Land to Ecosystem Types or Land Uses

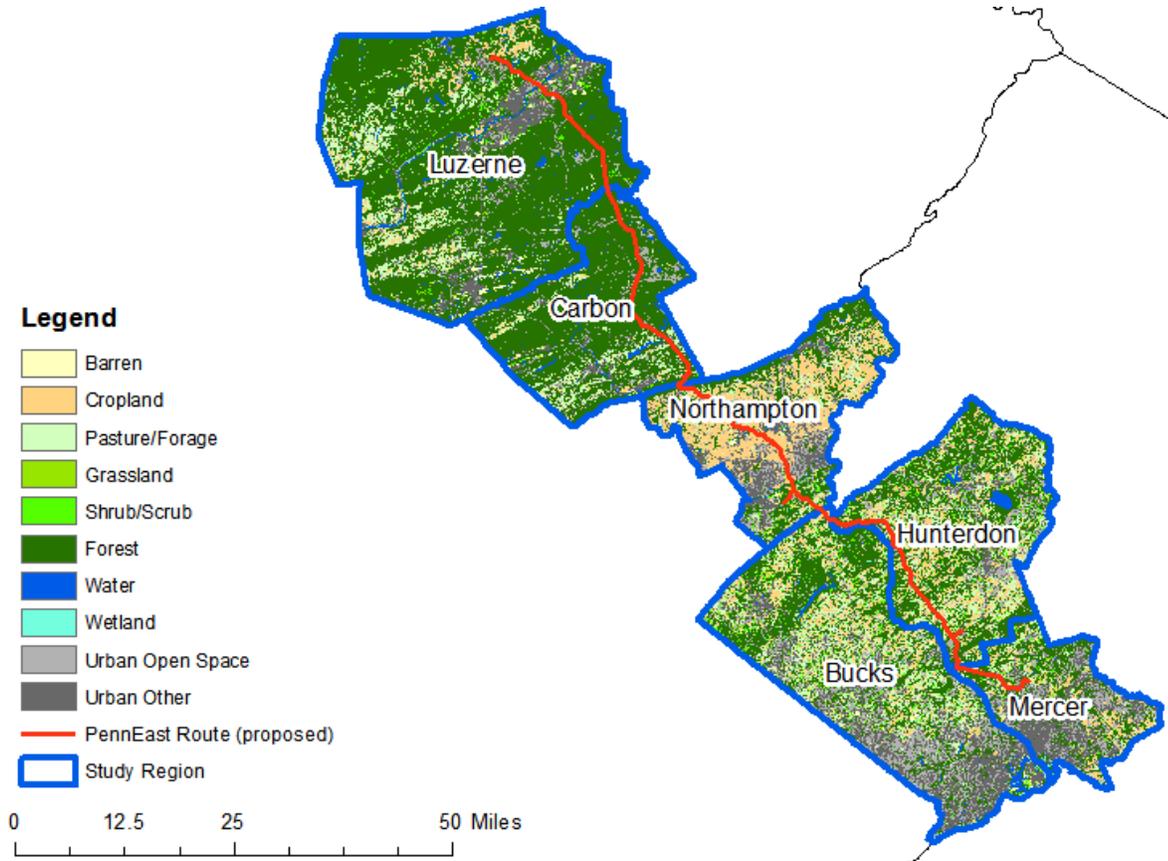
The first step in the process is to determine the area in the 10 land use groups in the study region. This determination is made using remotely sensed data from the National Land Cover Database (NLCD) (Fry et al., 2011). Satellite data provides an image of land in one of up to 21 land cover types at the 30-meter level of resolution;<sup>18</sup> 15 of these land cover types are present in the study region (Figure 4).

Looking forward to the final step, we will use land use categories to match per-acre ecosystem value estimates from source areas to the six-county study region. Unfortunately, value estimates are not available for all of the detailed land use categories present in the region. We therefore simplify the NLCD classification by combining a number of classifications into larger categories for which per-acre values are more available. Specifically, low-, medium-, and high-intensity development are grouped as “urban other,” and deciduous, evergreen, and mixed forest are grouped as “forest.” In addition, we add land in the NLCD category of “woody wetlands” to the “forest” category for two reasons. First, these wetlands would normally become forest in the study region (Johnston, 2014; Phillips & McGee, 2016). Second, wetlands possess some of the highest per-acre values for several ecosystem services. To avoid overestimating the ecosystem services contribution of “woody wetlands,” we count them as “forest” instead of “wetland.”

In the end, for baseline (no pipeline) conditions, we have land in 10 land uses (Figure 4 and Table 4). The total area that would be disturbed in the construction corridor, new temporary access roads, pipeyards, and temporary aboveground infrastructure is 1,852.7 acres, of which 715.0 acres would be occupied by the permanent right-of-way. An additional 55.8 acres would be devoted to new permanent access roads and permanent aboveground infrastructure. Figure 5 shows the distribution of acreage in the ROW, construction zone, and in land needed for permanent surface infrastructure pre-PE, or baseline land use.

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<sup>18</sup> Because 30 meters is wider than the right-of-way and not much narrower than the 100-foot construction corridor, we resample the NLCD data to 10m pixels, which breaks each 30m-by-30m pixel into 9 10m-by-10m pixels. This allows for a closer approximation of the type and area of land cover in the proposed ROW and construction corridor.



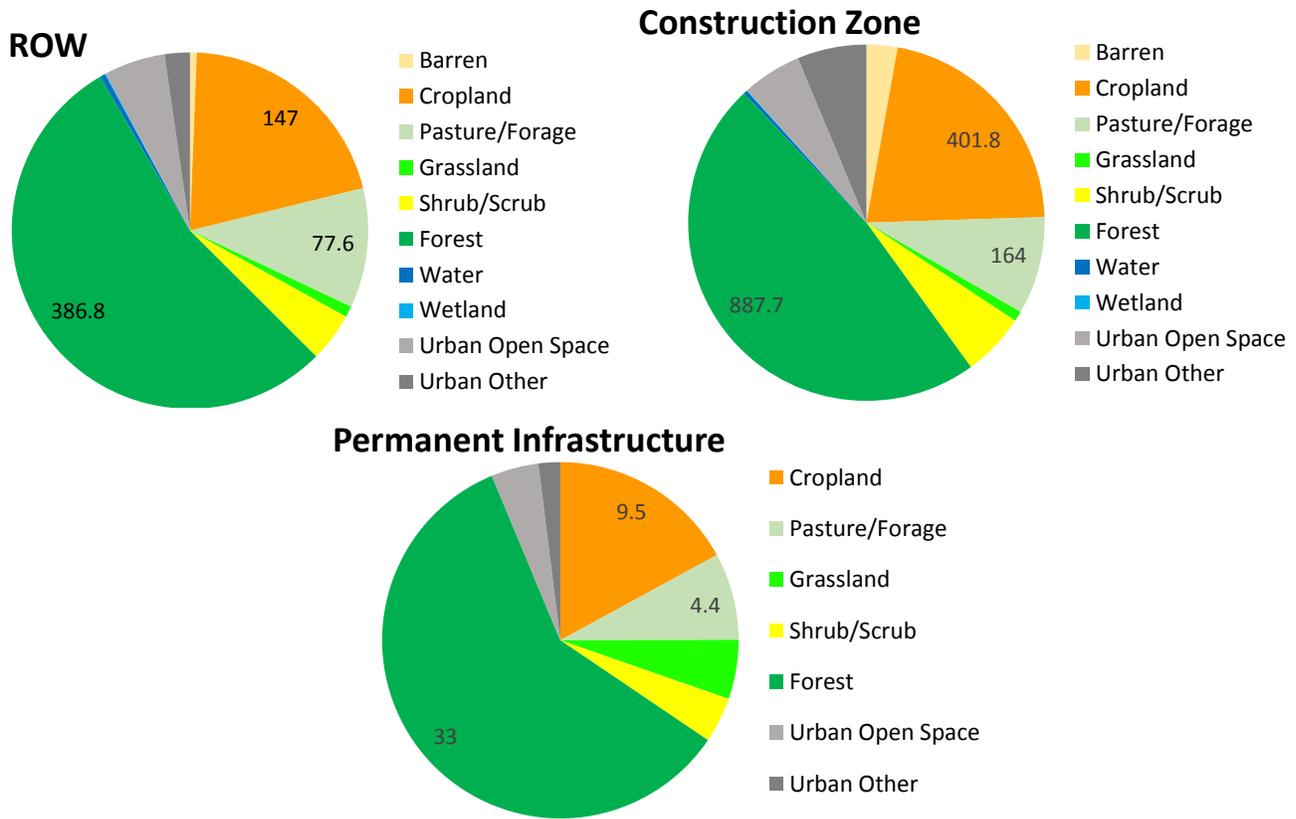
**FIGURE 4: Land Use in the Study Region, as Classified for Ecosystem Service Valuation**

Land cover for the entire study region is shown to display the overall range and pattern of land use. The ecosystem service valuation only covers portions of the study region occupied by the PE right-of-way and construction zone.

Sources: Land Cover from National Land Cover Database (Fry, et al. 2011); PE route obtained from the Delaware Riverkeeper Network; Counties from USGS (U.S. Department of Interior & U.S. Geological Survey, 2015).

**TABLE 4: Land Area Affected By PE, Study Region Total (See Also Figure 5)**

Land Use	Baseline acreage in ROW	Baseline acreage in the construction zone	Baseline acreage in permanent surface infrastructure and access roads
Barren	4.4	52.1	0
Cropland	147.0	401.8	9.5
Pasture/Forage	77.6	164.0	4.4
Grassland	7.2	17.1	3.0
Shrub/Scrub	31.8	106.6	2.3
Forest	386.8	887.7	33.0
Water	3.5	6.3	0
Wetland	0.7	1.1	0
Urban Open Space	39.6	99.9	2.4
Urban Other	16.4	116.2	1.1
<b>Total</b>	<b>715.0</b>	<b>1,852.7</b>	<b>55.8</b>



**FIGURE 5: Baseline (Pre-PE) Land Use in the ROW, Construction Zone, and Permanent Access Roads and Aboveground Infrastructure (Acres) (See also Table 4)**

## Step 2: Re-assign Acreage to New Land Cover Types for the Construction and Operation Periods

We assume all land in the construction corridor will be “barren” or at least possess the same ecosystem service productivity profile as naturally-occurring barren land for the duration of the construction period. Water will remain water during construction. Table 5 lists the reassignment assumptions in detail.

**TABLE 5: Land Cover Reclassification**

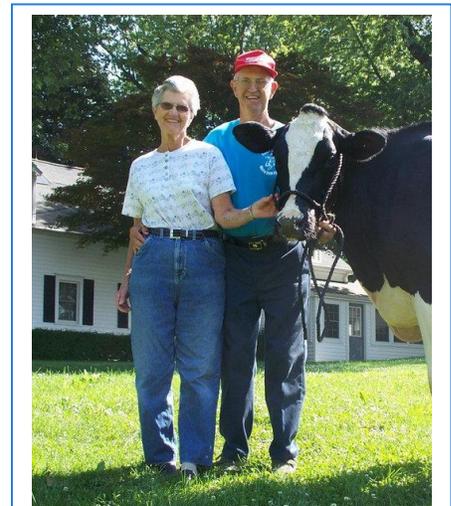
NLCD Category	Reclassification for Baseline	Reclassification for Construction	Reclassification for Ongoing Operation in the ROW	Reclassification for Ongoing Operation Roads and Aboveground Infrastructure
<b>Barren Land</b>	Barren	Barren	Barren	Barren
<b>Cultivated Crops</b>	Cropland	Barren	Pasture/Forage	Barren
<b>Pasture/Hay</b>	Pasture/Forage	Barren	Pasture/Forage	Barren
<b>Grassland/Herbaceous</b>	Grassland	Barren	Grassland	Barren
<b>Shrub/Scrub</b>	Shrub/Scrub	Barren	Shrub/Scrub	Barren
<b>Deciduous Forest</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Evergreen Forest</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Mixed Forest</b>	Forest	Barren	Shrub/Scrub	Barren

Table 5 Continued				
<b>Woody Wetlands</b>	Forest	Barren	Shrub/Scrub	Barren
<b>Open Water</b>	Water	Water	Water	Barren
<b>Emergent Herbaceous Wetlands</b>	Wetland	Barren	Wetland	Barren
<b>Developed, Open Space</b>	Urban Open Space	Barren	Urban Open Space	Barren
<b>Developed, Low Intensity</b>	Urban Other	Barren	Urban Other	Barren
<b>Developed, Medium Intensity</b>	Urban Other	Barren	Urban Other	Barren
<b>Developed, High Intensity</b>	Urban Other	Barren	Urban Other	Barren

Within the ROW, and for the indefinite period following construction—during ongoing operations—we assume pre-PE forestland converts to shrub/scrub, and cropland converts to pasture/forage. We recognize that cropland in the ROW could potentially revert back to cropland, but if there are restrictions on the weight of vehicles that can be operated on top of the buried pipeline easement, it may turn out to be the case that cropland reverts, at best, to pastureland. These include limits on the weight of equipment that could cross the corridor at any given point and difficulty using best soil conservation practices, such as tilling along a contour, which may be perpendicular to the pipeline corridor. (This would require extra time and fuel use that could render some fields too expensive to till, plant, or harvest.) Reclassifying cropland as pasture/forage (which is a generally less productive ecosystem service) recognizes these effects while also recognizing some sort of future agricultural production in the ROW (grazing and possibly haying) could be possible.

An additional effect not captured in our methods is long-standing harm to agricultural productivity due to soil compaction, soil temperature changes, and alteration of drainage patterns due to pipeline construction. Rob Fulper, a farmer in West Amwell, Hunterdon County, New Jersey, noticed that corn planted over two existing pipelines buried on his 100-year-old family farm during World War II that now transport natural gas produce lower yields (Colaneri, 2015). Separately, agronomist Richard Fitzgerald (2015) concludes, “it is my professional opinion that the productivity for row crops and alfalfa will never be regenerated to its existing present ‘healthy’ and productive condition [after installation of a pipeline].” Thus, the true loss in food and other ecosystem service value from pasture/forage acreage would be larger than our estimates reflect.

Permanent access roads and sites for mainline valves are assumed, post construction, to remain in the “barren” land use and produce the corresponding level of ecosystem services.



Bob and Sally Fulper at the Fulper Family Farmstead.  
(Photo Credit: Breanna ‘Fulper’ Lundy)

### Step 3: Multiply Acreage by Per-Acre Value to Obtain ESV

After obtaining acreage by land use in the construction zone and the ROW, we are ready to multiply those acres times per-acre-per-year ecosystem service productivity (in dollar terms) to obtain total ecosystem service value in each area and for with- and without-pipeline scenarios. Per-acre ecosystem service values are obtained primarily from a database of more than 1,300 estimates compiled as part of a global study known as “The Economics of Ecosystems and Biodiversity” or “the TEEB” (Van der Ploeg et al., 2010).<sup>19</sup> The TEEB database allows the user to select the most relevant per-unit-area values, based on the land use/land cover profile of the study region, comparison of general economic conditions in the source and study areas, and the general “fit” or appropriateness of the source study for use in the study area at hand. After eliminating estimates from lower-income countries and estimates from the U.S. that came from circumstances vastly different from Pennsylvania and New Jersey, we identified 91 per-acre estimates in the TEEB that adequately provide approximations of ecosystem service value in our study region.<sup>20</sup>

After selecting the best candidate studies and estimates in the TEEB database, we still had some key land use/ecosystem services values (such as food from cropland) without value estimates. To fill some of the most critical gaps, we turned to other studies that examined ecosystem service value in this general region (Phillips, 2015; Phillips & McGee, 2016) and to specific data on cropland and pasture/hayland value from the National Agricultural Statistics Service (USDA National Agricultural Statistics Service, 2016).

For several land cover-ecosystem service combinations, either multiple source studies were available or the authors of those studies reported a range of dollar-per-acre ecosystem service values. We are therefore able to report both a low and a high estimate based on the bottom and top end of the range of available estimates.

In the end, we have 165 separate estimates from 61 unique source studies covering 67 combinations of land uses and ecosystem services. (See Appendix A to this report for a full list of the values and sources that yielded these estimates.) This is still a fairly sparse coverage given there are 140 possible combinations of the 10 land uses and 14 services. Therefore, we know our aggregate estimates will be lower than they would be if dollar-per-acre values for all 14 services were available to transfer to each of the 10 land use categories in the study region. It is possible to live with that known underestimation, or it is possible to assign per-acre values from a study of one land-use-and-service combination to other combinations. Doing so would introduce unknown over- or perhaps under-estimation of aggregate values. We prefer to take the first course, knowing our estimates are low/conservative and urge readers to bear this in mind when interpreting this information for use in weighing the costs of the proposed PE.

After calculating acreage and per-acre ecosystem service values, we now calculate ecosystem service value-per-year for each of the four area/scenario combinations. To repeat, these annual values are:

- Baseline (no pipeline) ecosystem service value in the proposed construction zone
- Ecosystem service value in the construction zone during construction

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<sup>19</sup> Led by former Deutsche Bank economist, Pavan Sukhdev, the TEEB is designed to “[make] nature’s values visible” in order to “mainstream the values of biodiversity and ecosystem services into decision-making at all levels” (“TEEB - The Initiative,” n.d.). It is also an excellent example of the application of the benefit transfer method.

<sup>20</sup> Among those U.S. studies included in the TEEB database that we deemed inappropriate for use here were a study from Cambridge Massachusetts that reported extraordinarily high values for aesthetic and recreational value and the lead author’s own research on the Tongass and Chugach National Forests in Alaska. The latter was excluded due to the vast differences in land use, land tenure, climate, and other factors between the source area and the current study region.

- Baseline (no pipeline) ecosystem service value in the proposed right-of-way
- Ecosystem service value in the right-of-way during the (indefinite) period of ongoing operations<sup>21</sup>

Value calculations are accomplished according to the formula:

$$ESV = \sum_i, [(Acres_j) \times (\$/acre/year)_{i,j}]$$

Where:

$Acres_j$  is the number of acres in land use (j)

$(\$/acre/year)_{i,j}$  is the dollar value of each ecosystem service (i) provided from each land use (j) each year. These values are drawn from the TEEB database and other sources listed in Appendix A.

#### Step 4: Subtract Baseline “without PE” ESV from ESV in “with PE” Scenario

With steps 1-3 complete, we now estimate the cost in ecosystem service value of moving from the baseline (no pipeline) or status quo to a scenario in which the PE is built and operating. The cost of construction is the ESV from the construction zone during construction, minus the baseline ESV for the construction zone. PennEast, LLC estimates an approximate 7-month construction period (Kornick, 2016a). Our estimate of a one-year construction period assumes that the land disturbed during construction will remain barren for at least the next 5 months after construction. The ecosystem service cost of ongoing operations is ESV from the ROW in the “with PE” scenario minus the baseline ESV for the ROW. This will be an annual cost borne every year in perpetuity.

### Ecosystem Service Value Estimates

Ecosystem service value in the construction zone will be lost for one year and total between \$6.3 and \$22.1 million. Those one-time losses will be followed by annual losses in the ROW of between \$2.4 and \$9.0 million and annual losses from other permanent surface infrastructure of between \$218,186 and \$789,362. Most of this annual loss is due to the long-term conversion of more productive to less productive land uses in the ROW. The remainder is due to the displacement of natural land cover and functioning ecosystems by surface infrastructure and new permanent roads. By discounting the perpetual stream of annual losses we compute the present discounted value of all future losses to be between \$72.6 and \$272.4 million. Combined with the one-time loss during construction this puts the total loss of ecosystem service value due to the proposed PennEast Pipeline at \$78.9 to \$294.6 million.

In the baseline or “no pipeline” scenario, the land in the construction zone (including the construction corridor, new temporary roads, pipeyards, and temporary aboveground infrastructure) produces between \$6.3 and \$22.1 million per year in ecosystem service value. The largest contributors to this total (at the high end) are aesthetics, water, and pollination. Under a “with PE” scenario, and not surprisingly given the temporary conversion to bare/barren land, these figures drop to near zero, or between a total of \$640 and \$5,044 during the one year long construction period. Taking the difference as described in step 4, estimated per-year ecosystem service cost of the PE’s construction would be between \$6.3 and \$22.1 million (Table 6).

<sup>21</sup> Note that while the ROW and construction corridors overlap in space, they do not overlap in time, at least not from an ecosystem services production standpoint. During construction, the land cover that would eventually characterize the ROW will not exist in the construction corridor. Thus, there is no double counting of ecosystem service values or of costs from their diminution as a result of either construction or ongoing operations.

**TABLE 6: Ecosystem Service Value Lost to the Construction Corridor, New Temporary Roads, Pipeyards, and Temporary Aboveground Infrastructure, Relative to Baseline, by Ecosystem Service**

Ecosystem Service	Study Region			
	Baseline (low) (2015\$)	Loss (low) (2015\$)	Baseline (high) (2015\$)	Loss (high) (2015\$)
Aesthetic Value	4,074,427	(4,074,427)	16,294,264	(16,294,264)
Air Quality	338,034	(338,034)	354,037	(354,037)
Biological Control	10,782	(10,782)	93,016	(93,016)
Climate Regulation	214,188	(214,188)	223,733	(223,733)
Erosion Control	19,310	(19,310)	98,867	(98,867)
Protection from Extreme Events	739,748	(739,748)	775,744	(775,744)
Food Production	30,692	(30,692)	30,692	(30,692)
Pollination	187,254	(187,254)	982,539	(982,539)
Raw Materials	21,827	(21,827)	148,140	(148,140)
Recreation	313,753	(312,823)	775,837	(770,123)
Soil Formation	8,970	(8,970)	64,670	(64,670)
Waste Treatment	62,009	(61,942)	347,929	(347,862)
Water Supply	42,231	(42,087)	1,152,907	(1,149,702)
Water Flows	210,333	(210,333)	732,789	(732,789)
<b>Total</b>	<b>\$6,273,559</b>	<b>(\$6,272,418)</b>	<b>\$22,075,164</b>	<b>(\$22,066,177)</b>

The ecosystem service costs for the ROW are predictably smaller on a per-year basis, but because they will persist indefinitely, the cumulative effect is much higher. In the baseline or “no pipeline” scenario, the land in the ROW produces between \$2.6 and \$9.4 million per year in ecosystem service value. Under the “with PE” scenario, using minimum values, the annual ecosystem service value from the ROW falls from \$2.6 million to about \$227,900 for an annual loss of over \$2.4 million. At the high end of the range, the ecosystem service value of the ROW falls from \$9.4 million to about \$454,400 for an annual loss of \$9.0 million in the study region (Table 7).

**TABLE 7: Ecosystem Service Value Lost Each Year Post Construction in Right-Of-Way, Relative to Baseline, by Ecosystem Service**

Ecosystem Service	Study Region			
	Baseline (low) (2015\$)	Loss (low) (2015\$)	Baseline (high) (2015\$)	Loss (high) (2015\$)
Aesthetic Value	1,770,919	(1,707,351)	7,092,570	(7,013,190)
Air Quality	146,631	(129,697)	152,973	(129,697)
Biological Control	4,386	(858)	34,868	(31,340)
Climate Regulation	74,333	(18,670)	78,531	(22,756)
Erosion Control	7,419	6,159	41,118	(15,759)

<b>Table 7 Continued</b>				
Protection from Extreme Events	321,090	(308,529)	337,532	(308,529)
Food Production	11,780	(6,330)	11,780	(6,330)
Pollination	81,381	(77,026)	372,309	(365,572)
Raw Materials	9,523	(9,487)	64,559	(64,523)
Recreation	45,399	709	247,900	(196,163)
Soil Formation	3,725	(2,902)	24,965	(24,142)
Waste Treatment	23,357	(21,891)	146,293	12,247
Water Supply	18,423	(18,329)	503,337	(499,826)
Water Flows	92,316	(88,592)	319,393	(308,156)
<b>Total</b>	<b>\$2,610,683</b>	<b>(\$2,382,794)</b>	<b>\$9,428,127</b>	<b>(\$8,973,736)</b>

Most of this loss is due to the conversion of forestland to shrub/scrub. Shrub/scrub naturally increases its share of overall ecosystem service value in the “with pipeline” scenario. Those ecosystem service value gains are dwarfed, however, by the loss of much more productive forests. Similarly, the ecosystem service value of cropland falls due to its assumed transition to pasture/forage. While there is some gain in the pasture/forage category, there is a net loss of ecosystem service value from the two agricultural land uses of between \$15,300 and \$348,900 per year.<sup>22</sup>

*“With this pipeline construction through my property, the disruption of my spring is only one of my concerns. We do not have air conditioning and rely on the mature trees to provide shade to keep the house cool in the summer months. Many of these trees will be taken down if this project is approved.”*

*-Jeremy Hayes, Landowner  
Bath, PA*

Finally, the establishment of new permanent access roads and other aboveground infrastructure will entail the conversion of land from various uses to what, from an ecosystem services perspective, will function as barren land. These areas amount to a total of 55.8 acres across the study region, so the effect on ecosystem service values are correspondingly small, at least when compared to the impact of the construction zone and ROW. As with the ROW, however, these effects would occur year after year for as long as the PE exists. The annual loss of ecosystem service value from these areas under a “with PE” scenario would range from \$218,186 to \$789,362.

<sup>22</sup> Note that due to differences in the range of dollars-per-acre estimates available for the various combinations of land use and ecosystem service, there are some instances where an apparent gain at the low end turns into a loss at the high end. For example, and based on the estimates available from the literature, the minimum value for erosion control from shrub/scrub acres is higher than the minimum for forests. Because we assume that forests return to shrub/scrub after the pipeline is in operation, this translates into a net increase in erosion regulation. At the high end, however, available estimates show a higher erosion control value for forests than for shrub/scrub. Thus, the high estimate shows a net loss of erosion control benefits. It is important, therefore, to keep in mind that these estimates are sensitive to the availability of underlying per-acre estimates.

**TABLE 8: Ecosystem Service Value Lost Each Year Post Construction in Permanent Infrastructure, Relative to Baseline, by Ecosystem Service**

Ecosystem Service	Study Region			
	Baseline (low) (2015\$)	Loss (low) (2015\$)	Baseline (high) (2015\$)	Loss (high) (2015\$)
Aesthetic Value	150,016	(150,016)	603,428	(603,428)
Air Quality	12,456	(12,456)	12,847	(12,847)
Biological Control	333	(333)	2,347	(2,347)
Climate Regulation	5,173	(5,173)	5,522	(5,522)
Erosion Control	543	(543)	3,290	(3,290)
Protection from Extreme Events	27,085	(27,085)	27,774	(27,774)
Food Production	672	(672)	672	(672)
Pollination	6,913	(6,913)	25,644	(25,644)
Raw Materials	809	(809)	5,503	(5,503)
Recreation	3,108	(3,108)	19,848	(19,848)
Soil Formation	296	(296)	1,776	(1,776)
Waste Treatment	1,582	(1,582)	11,282	(11,282)
Water Supply	1,563	(1,563)	42,629	(42,629)
Water Flows	7,636	(7,636)	26,800	(26,800)
<b>Total</b>	<b>\$218,186</b>	<b>(\$218,186)</b>	<b>\$789,362</b>	<b>(\$789,362)</b>

It bears repeating that the BTM as applied here is useful for producing first-approximation estimates of ecosystem services. For several reasons, we believe this approximation of the effect of the PE’s construction and operation on ecosystem service values is too low rather than too high. These reasons include:

- The estimates only include the loss of value that would otherwise emanate from the ROW, construction zone, and aboveground infrastructure. The estimates do not account for the extent to which the construction and long-term presence of the PE could damage the ecosystem service productivity of *adjacent* land. During construction, the construction zone could be a source of air and water pollution potentially compromising the ability of surrounding or downstream areas from delivering their own ecosystem services. For example, if construction contributes to sedimentation of surface waters, those streams and rivers may lose some ability to provide clean water, food (fish), recreation, and other valuable services. This reduced productivity may persist after construction is complete.
- Over the long term, the ROW could serve as a pathway for invasive species or wildfire to more quickly penetrate areas of interior forest habitat, thereby reducing the natural productivity of those areas and imposing direct costs on communities and landowners in the form of fire suppression costs, lost property, and the costs of controlling invasive species.
- Finally, these estimates only reflect changes in natural benefits occurring due to changes in conditions on the lands surface. Activities during construction could alter existing underground waterways and disrupt water supply. There is also a risk that sediment and other contaminants could reach surface water or groundwater supplies if sinkholes form near the pipeline during construction or afterwards.

## EFFECTS ON PROPERTY VALUE

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### Land Price Effects

To say the impacts and potential impacts of the PennEast Pipeline on private property value are important to people along its proposed route would be an extreme understatement. Key-Log Economics and Delaware Riverkeeper Network are conducting an analysis of all comments submitted through the closing of the DEIS comment period on September 12, 2016. Of 1977 total comments reviewed thus far (a sample), 99.8% of comments mentioning property value believed the PE would have a negative impact.

Landowners and Realtors along the proposed route of the Mountain Valley Pipeline, a 42" high-pressure natural gas pipeline designated to transport gas from fracked wells in the Marcellus through West Virginia and Virginia, report abandoned building plans, lower than expected appraisals, and buyers walking away from properties potentially affected by the construction (Adams, 2016). At least one ROW landowner was told by insurance agencies that their rates would likely increase if coverage remains available at all (Roston, 2015).

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***“Real estate brokers have indicated that the value of our farm with the pipeline running across it would see an 80%-100% drop in value relative to its value absent the pipeline—if the property is sellable at all.”***

*-Richard Kohler, Owner of Cedar Lane Farm, Inc.  
Hunterdon, NJ*

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While it is impossible to know precisely how large an effect the specter of the PE has already had on land prices, there is strong evidence from other regions that the effect would be negative. In a systematic review, Kielisch (2015) presents evidence from surveys of Realtors, home buyers, and appraisers demonstrating natural gas pipelines negatively affect property values for a number of reasons. Among his key findings relevant to the PE:

- 68% of Realtors believe the presence of a pipeline would decrease residential property value.
- Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%.)
- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.
- More than three quarters of the Realtors view pipelines as a safety risk.
- In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36-inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (2015, p. 7). The survey participants had, in other words, realistic information about the probability of pipeline accidents and were not responding out of overblown fears.

Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%.<sup>23</sup> This loss in value provides the mid-level impact in our estimates. A much greater loss (and higher estimates) would occur if one were to consider the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.<sup>24</sup> In our estimates, however, we have used the smaller effect (-10.5%) based on the assumption that sellers will eventually find one of the buyers still willing to buy the pipeline-easement-encumbered property.

- Based on five “impact studies” in which appraisals of smaller properties with and without pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%” (Kielisch, 2015, p. 11). The average rises to a range of -12% to -14% if larger parcels are considered, possibly due to the loss of subdivision capability.

These findings are consistent with economic theory about the behavior of generally risk-averse people. While would-be landowners who are informed about pipeline risks and nevertheless decide to buy property near the proposed PE corridor could be said to be “coming to the nuisance,” one would expect them to offer less for the pipeline-impacted property than they would offer for a property with no known risks.

Kielisch’s findings demonstrate that properties on natural gas pipeline rights-of-way suffer a loss in property value. Boxall, Chan, and McMillan (2005), meanwhile, show that pipelines also decrease the value of properties lying at greater distances. In their study of property values near oil and gas wells, pipelines, and related infrastructure, the authors found that properties within the “emergency plan response zone” (EPZs) of sour gas<sup>25</sup> wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.

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***“I am entering retirement and am also deeply concerned about my future and what the property value of my only nest egg will be when it comes time for me to sell it. Local realtors tell me that properties along the proposed route are already not selling and sitting on the market. Realtors also tell me that I will have to sell my house for much less than I would without the pipeline.”***

*-Janice Hofreiter, Landowner  
Mercer, NJ*

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The risks posed by the PE would be different—it would not be carrying sour gas, for example—but there are similarities between the PE scenario and the situation in the study that makes their finding particularly relevant. The emergency plan response zones, for example, are defined by the health and safety risks posed by the gas operations and infrastructure. Also, in contrast to PE-cited studies showing no price effects (see “Claims that pipelines have no effect on property value may be invalid,” below), the Boxall study examines prices of properties for which landowners must inform prospective buyers when one or more EPZs intersect the property.

The PE has both a high consequence area and an evacuation zone radiating from both sides of the pipeline defined by health and safety risks. Whether disclosed or not by sellers, prospective buyers are likely to become informed regarding location of the property relative to the PE’s HCA and evacuation zones or, at a minimum, regarding the presence of the PE in the study region.

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<sup>23</sup> Half of the buyers would offer 21% less, and the other half would offer 0% less; therefore the expected loss is  $0.5(-21\%) + 0.5(0\%) = -10.5\%$ .

<sup>24</sup> This is the expected value calculated as  $0.622*(-100\%) + 0.189*(-21\%) + 0.189*(0\%)$ .

<sup>25</sup> “Sour” gas contains high concentrations of hydrogen sulfide and poses an acute risk to human health.

The compressor station proposed for Kidder Township in Carbon County would likely cause its own more severe reduction in the value of nearby properties. We apply the percentage reduction awarded in the Hancock, New York case (25%) to properties that are (as the properties were in that case) within half a mile of the proposed compressor station (“Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015). The stations can also be noisy, with low-frequency noise cited as a constant nuisance (“Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015). These issues led some homeowners to pull-up stakes and move away and to reduced property value assessments for others (Cohen, 2015; “Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015).

Existing studies suggest negative impacts on land value from various types of nuisances that impose noise, light, air, and water pollution, life safety risks, and lesser human health risks on nearby residents (Sun, 2013; Bolton & Sick, 1999; Boxall et al., 2005). In addition to the emerging body of evidence demonstrating a negative relationship between natural gas infrastructure and property value, well established analyses strongly reveal the opposite analog. Namely, amenities such as scenic vistas, access to recreational resources, proximity to protected areas, cleaner water, and others convey positive value to property.<sup>26</sup> The bottom line is that people derive greater value from, and are willing to pay more for, properties that are closer to positive amenities and farther from negative influences, including health and safety risks.

## Claims That Pipelines Have No Effect on Property Value Are Invalid

The DEIS (Federal Energy Regulatory Commission, 2016b) and PE LLC cite studies purporting to show that natural gas pipelines (and in one case a liquid petroleum pipeline) have at most an ambiguous and non-permanent effect on property values (Allen, Williford & Seale Inc., 2001; Fruits, 2008; Palmer, 2008; Diskin et al. 2011). While the studies differ in methods, they are similar in that they fail to take into account two factors potentially voiding their conclusions entirely.

First, the studies fail consider that the property price data employed in the studies do not reflect buyers’ true willingness to pay for properties closer to or farther from natural gas pipelines. For prices to reflect willingness to pay (and therefore true economic value), buyers would need to have full information about the subject properties, including whether the properties are near a pipeline. Second, the studies that find no difference in prices for properties closer to or farther away from pipelines are not actually comparing prices for properties that are “nearer” or “farther” by any meaningful measure.<sup>27</sup> The studies compare similar properties and, not surprisingly, find that they have similar prices. Their conclusions are neither interesting nor relevant to the important question of how large an economic effect the proposed pipeline would have.

*When the pre-conditions for a functioning market are not met, observed property prices do not (and cannot) indicate the true economic value of the property*

Economic theory holds that for an observed market price to be considered an accurate gauge of the economic value of a good, all parties to the transaction must have full information about the good. If, on the other hand, buyers lack important information about a good, in this case whether a property is near a potential hazard, they cannot bring their health and safety concerns to bear on their decision about how much to offer for the

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<sup>26</sup> Phillips (2004) is an example of a study that includes an extensive review of the literature on the topic.

<sup>27</sup> This is based on a best estimate of the location of the pipelines derived from descriptions of the pipelines location provided in the study (only sometimes shown on the neighborhood maps) and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

property. As a result, buyers' offering prices will be higher than both what they would offer if they had full information and, most importantly, the true economic value of the property to the buyer.

As Albright (2011) notes in response to the article by Disken, Friedman, Peppas, & Peppas (2011):

“The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchaser had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on, near or across their property... I believe that the authors' failure to confirm that the purchasers in any of the paired sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undercut the authors' work product and the conclusions set forth in the article” (p. 5).

Of the remaining studies, only Palmer (2008) gives any indication that any buyers were aware of the presence of a pipeline on or near the subject properties. For Palmer's conclusion that the pipeline has no effect on property value to be valid, however, it must be true that **all** buyers have full information, and this was not the case.

In some cases, however, the location and hazards of petroleum pipelines become starkly and tragically known. For example, a 1999 liquid petroleum pipeline exploded in Bellingham, Washington, killing three, injuring eight, and causing damage to property and the environment. In that case and as Hansen, Benson, and Hagen (2006) found, property values fell after the explosion, which is to say, once would-be buyers became aware of the pipeline in the neighborhood. The authors also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

Today's market is quite different. In contrast to Bellingham homebuyers in the months and years after the 1999 explosion, today's homebuyers can query Zillow to see the history of land prices near the pipeline and explore online maps to see what locally undesirable land uses exist near homes they might consider buying. They also have YouTube and repeated opportunities to find and view news reports, landowners' videos, and other media describing and depicting such explosions and their aftermath. Whether the pre-explosion prices reflected the presence of the pipeline or not, it is hard to imagine that a more recent event and the evident dangers of living near a fossil fuel pipeline would be forgotten so quickly by today's would-be homebuyers.

In Resource Report 5 (2015b), PE LLC claims that “it has never been commonplace for consumers to identify the presence of natural gas pipelines as part of their real estate transaction diligence and therefore, it can be argued the presence of natural gas pipelines is not a significant determinant to the value for real estate transactions” (p. 5-23). This is grossly misleading and plainly illogical. It is wrong to conclude a lack of a negative effect from the fact that home sellers do not typically—and against their own self-interest—disclose information that could induce a drop in the sale price. There are many attributes of homes offered for sale that are not typically included in the information displayed on real estate marketing sites. Drafty windows or unpleasant neighbors are but two examples of things home sellers do not typically include in their description of a home on the market. They are nevertheless two attributes of a home that would diminish the value to prospective buyers and, once known by those buyers, would also diminish the price offered.

PE LLC would instead have FERC believe that all persons selling real estate always disclose any and all features of their property that could possibly reduce the offers they may receive. If that were true, there would be no need for the laws that require homeowners to disclose, for example, whether the basement is damp or if the property is included in a homeowners association. Either PE LLC does not understand rational buyer/seller behavior, or they expect that FERC and the public do not.

What Zillow.com or other sites do accomplish is lowering the effort required for homebuyers to visualize the location of properties relative to other land uses, including pipeline rights-of-way. Combined with other information, such as maps of pipeline routes and other searchable online information, real estate marketing tools make it more likely that prospective buyers will gain information about the hazard they could be buying into.

With more vocal/visible opposition to large, high-pressure natural gas pipelines, it also seems likely that prospective home buyers will not have to wait for an incident involving the PennEast Pipeline to learn of it and, therefore, for the pipeline to affect their willingness to pay (and actual offer prices) for properties nearby. A drive down the street and a quick online search for information about a community one is considering a move to would likely reveal “no pipeline” signs, municipal ordinances opposing the pipeline, and Facebook groups created by local community members formed to raise awareness about the pipeline. Anyone with an eye toward buying property near the proposed PennEast corridor could quickly learn that the property is in fact near the corridor, that there is a danger the property could be adversely affected by the still-pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health, safety, and environmental effects.

When people possess more complete information about a property, they are able to express their willingness to pay when it comes time to make an offer. Accordingly, the prices buyers offer for homes near the PennEast Pipeline will be lower than the prices offered for other homes farther away or in another community or region.

*Due to fundamental flaws, studies concluding that proximity to pipelines do not result in different property values are not actually comparing prices for properties that are different*

While the studies cited in Resource Report 5 and the DEIS purport to compare the price of properties near a pipeline to properties not near a pipeline, many or in some cases all, of the properties counted as “not near” the pipelines are, in fact, near enough to have health and safety concerns that could influence prices. In both studies written by the Interstate Natural Gas Association of America (INGAA) the authors compare prices for properties directly on a pipeline right-of-way to prices of properties off the right-of-way (Allen, Williford & Seale Inc., 2001; Integra Realty Resources, 2016). However, in almost all of the case studies the geographic scope of the analysis was small enough where most or all of the properties not on the right-of-way were still within the pipelines’ respective evacuation zones (Allen, Williford & Seale Inc., 2001; Integra Realty Resources, 2016).<sup>28</sup>

INGAA analyzed six case studies in the 2016 study. In four of the case studies where an exact distance between the property and the pipeline was given, an average of 72.5% of the “off” properties were actually within the evacuation zone and, like the “on” properties, are likely to suffer a loss in property value relative to properties farther away.<sup>29</sup>

For the other two case studies analyzed in the 2016 INGAA study, the study reported a simple “yes” or “no” to indicate whether the property abutted the pipeline in question. For these two case studies, we assume the

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<sup>28</sup> Proximity of properties to pipelines is based on best estimate of the location of the pipelines derived from descriptions of the pipelines’ locations provided in the studies and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

<sup>29</sup> We estimated the evacuation zone based on available information about the pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

***“PennEast can trumpet the study and try to convince landowners how beneficial their pipeline would be for everyone concerned, but the truth of the matter, based on my own personal experience, is that nobody wants a property with a pipeline.”***

*-Joyce Sherman, Resident  
Stockton, NJ*

author’s methods, while flawed, are at least consistent from one case study to the next meaning it is likely at least 50% or more of the comparison properties (the “off” properties) are in fact within the evacuation zone.

To adequately compare the price of properties with and without a particular feature, there needs to be certainty that properties either have or do not have said feature. The feature of interest in this case is the presence of a nearby risk to health and safety. INGAA instead relied upon case studies with little to no variation in the feature of interest (i.e., the majority of properties are within the evacuation zone), and found, unsurprisingly, that there was no systematic variation in the subsequent price of properties.

This is a situation where comparing apples and oranges is not only reasonable, but also essential. The INGAA case studies are only looking at and comparing all “apples.” By comparing apples to apples rather than comparing apples to oranges, the INGAA studies reach the obvious and not very interesting conclusion that properties that are similar in size, condition, and other features including their location within the evacuation zone of a natural gas pipeline have similar prices.

To varying degrees, the other studies cited by FERC and PE LLC suffer from the same problem. Fruits (2008), who analyzes properties within one mile of a pipeline with a 0.8-mile-wide-evacuation zone (0.4 miles on either side), offers the best chance that a sizable portion of subject properties are in fact “not near” the pipeline from a health and safety standpoint. He finds that the distance from the pipeline does not exert a statistically significant influence on the property values, but he does not examine the question of whether properties within the evacuation zone differ in price from comparable properties outside that zone. A slightly different version of Fruits’ model, in other words, could possibly have detected such a threshold effect. (Such an effect would show up only if the buyers of the properties included in the study had been aware of their new property’s proximity to the pipeline.)

In short, the conclusion that pipelines do not negatively affect property values cannot be drawn from these flawed studies. To evaluate the effects of the proposed PennEast Pipeline on property value, FERC and others must look to studies (including those summarized in this report) in which buyers’ willingness to pay is fully informed about the presence of nearby pipelines and in which the properties examined are truly different in terms of their exposure to pipeline-related risks.

## Land Value Effects of Compressor Stations

Compressor stations like the three-unit, 47,700 hp station proposed for Kidder Township can cause decreases in home values and have even forced some homeowners to move away from the noise, smells, and illnesses associated with living near stations. In one case from Minisink, New York, a family of six moved to escape the effects of a much smaller (12,600 hp) compressor station operated by Millennium Pipeline, L.L.C. After two years of headaches, eye irritation, and lethargy among the children and even lost vigor in their fruit trees, the couple, unable to find a buyer for their home, moved away, leaving their \$250,000 investment in the property on the table with their bank holding the balance of the mortgage (Cohen, 2015).

In Hancock, another New York town with a relatively small (15,000 hp) compressor station, three homeowners have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station (“Proximity of Compressor Station Devalues Homes by as Much as 50%”, 2015). The larger of these reductions was for a home very close to the station and reflected physical damage that led to an increase in radon concentrations above safe levels. The two properties devalued by 25% were approximately one half mile away (Ferguson, 2015).

As of this writing, there are no statistical studies demonstrating the relationship between a property’s value and its proximity to a compressor station. The mounting anecdotal information, however, suggests there is a negative relationship and depending on the particular circumstances, the effect can be large—up to the 100% loss sustained by the family in Minisink (minus whatever the bank might be able to recover at auction). FERC must therefore count the potential loss of property value associated with the compressor station proposed for location in Kidder Township.

For our estimates, we follow the example of the Hancock, New York case and assume that properties within one half mile of the Kidder Township compressor station would lose 25% of their value if the station is built.<sup>30</sup> We believe this assumption provides a conservative estimate in part because the Kidder compressor station would be more than three times the horsepower of the Hancock station. It is therefore likely that its noise, odor events, and other physical effects would be experienced at a greater distance and/or with greater intensity than in the New York case.

## Parcel Values

We obtained parcel data in electronic form from the Geographic Information System (GIS) departments from each of the six counties impacted by the proposed route. These included GIS layers for, at minimum, those parcels touched by the evacuation zone, as well as valuation/assessment data for those parcels. Because publicly owned conservation lands (parks, etc.<sup>31</sup>) are unlikely to be sold, they do not have any market value. To avoid overestimating property value effects, we set the value of any publicly owned parcels equal to zero.

Using the GIS data, we identified the five different types of parcels for which the pipeline would have an effect. In order of increasing distance from the pipeline itself, these are:<sup>32</sup>

1. Parcels crossed by the right-of-way  
(730 parcels, with total baseline value (without PE) of \$200.5 million)
2. Parcels crossed by the construction corridor  
(842 parcels, with total baseline value (without PE) of \$228.0 million)
3. Parcels at least partially within the high consequence area (HCA)  
(4,619 parcels, with total baseline value (without PE) of \$1.0 billion)
4. Parcels at least partially within the evacuation zone  
(18,097 parcels, with total baseline value (without PE) of \$3.9 billion)

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<sup>30</sup> For land value analysis of the compressor station, we buffered a half mile radius around the parcel containing the station.

<sup>31</sup> We used the “Protected Areas Database” from the National Gap Analysis Program to identify fee-owned conservation properties (Conservation Biology Institute, 2012).

<sup>32</sup> Ideally, one would also want to identify the parcels from which views would be impaired by the presence of the pipeline ROW. Such an analysis would require parcel maps for the entire study region. Our maps (GIS layers) for some counties, however, cover only the evacuation zone, making a parcel-by-parcel analysis of viewshed impacts impossible. See the section titled “Visual Effects” for a general analysis of the PE’s potential impact on viewsheds across the study region.

5. Parcels with their geographic center (centroid) within one-half mile of the parcel containing the compressor station  
(40 parcels, with total baseline value (without PE) of \$5.6 million)

Note there is overlap among the zones. All ROW parcels are within the construction corridor, the HCA, and the evacuation zone. All construction corridor parcels are within the HCA and the evacuation zone. And HCA parcels are within the evacuation zone. To avoid double counting parcel values, only one land value effect is applied to a given parcel.

For estimates of the ROW, we assume that the health and safety concerns associated with the compressor station dominate the effects within the ROW and the evacuation zone. Estimates of the impact of the ROW and evacuation zone exclude the compressor zone parcels, and we estimate a separate effect of the compressor station. ROW parcels are also assumed to suffer no further reduction in value due to their location within the evacuation zone.

We do not consider the construction corridor separately for the land value analysis. Even though the additional 112 parcels and \$27.5 million in value (relative to parcels in the ROW) are not trivial, we do not have a basis for estimating a change in value that is separate from, or in addition to, the change due to these parcels' proximity to the ROW or their location within the evacuation zone.

Furthermore, we treat parcels in the HCA and in the evacuation zone the same by applying a single land value change to all parcels in the evacuation zone. Arguably, there should be a larger effect on parcels in the HCA than those only in the evacuation zone. Living with the possibility of having to evacuate at any time day or night should have a smaller effect on property value than living with the possibility of not surviving a "high consequence" event and, therefore, not having the chance to evacuate at all. We do not have data or other study results that allow us to draw this distinction. We therefore apply the lower evacuation zone effect to all HCA and evacuation zone parcels (beyond the ROW).

To summarize, Table 9 repeats a portion of Table 2, but with the property value effects in place of check marks.

**TABLE 9: Summary of Marginal Property Value Effects**

Values/ Effects	Right-of-Way (Low, Medium, & High Effects)	High Consequence Area	Evacuation Zone	Compressor Station Zone	Pipeline Viewshed
Land/ Property Value	-4.2% <sup>a</sup> -10.5% <sup>b</sup> -13.0% <sup>c</sup>		-3.8% <sup>d</sup>	-25% <sup>e</sup>	Impact included with Ecosystem Services

Notes:

- a. Kielisch, Realtor survey in which 56% of respondents expected an effect of between -5% and -10% ( $0.56 \times -7.5\% = -4.2\%$ ).
- b. Kielisch, buyer survey in which half of buyers still in the market would reduce their offer on a property with a pipeline by 21% ( $0.50 \times -0.21 = -10.5\%$ ).
- c. Kielisch, appraisal/impact studies showing an average loss of between -12% and -14% (-13% is the midpoint).
- d. Boxall, study in which overlap with an emergency planning zone drives, on average, a 3.8% reduction in price. We apply this reduction ONLY to those parcels in the evacuation zone that are not also in the ROW or within one half mile of the compressor station.
- e. Based on examples from the town of Hancock, New York.

## Estimated Land Value Effects

Following the procedures outlined in the previous section, our conservative estimate for costs of the proposed PE would include between \$159.7 million and \$177.3 million in diminished property value. Some of the most intense effects will be felt by the owners of 730 parcels in the path of the right-of-way, who collectively would lose between \$8.4 million and \$26.0 million in property value. Some 18,097 additional parcels lie outside the ROW but are within or touching the evacuation zone. These parcels' owners would lose an estimated \$149.9 million (Table 10). Finally, the compressor station proposed for Kidder Township in Carbon County, Pennsylvania would reduce the value of 40 properties by a total of \$1.4 million.

**Table 10: Summary of Land Value Effects, by Zone and County**

Area	Effects in Right-of-Way (2015\$)			Effects in Evacuation Zone (2015\$)
	Realtor Survey (4.2%)	Buyer Survey (10.5%) <sup>a</sup>	Impact Studies (13.0%)	Boxall Study (3.8%)
<b>Study Region</b>	<b>-8,420,100</b>	<b>-21,050,250</b>	<b>-26,062,214</b>	<b>-149,890,650</b>
<i>Pennsylvania Portion</i>	-4,400,237	-11,000,593	-13,619,782	-77,656,828
Bucks	-24,305	-60,761	75,228	-334,798
Carbon	-411,78	-1,029,459	-1,274,568	-3,690,122
Luzerne	-2,709,525	-6,773,812	-8,386,625	-36,044,026
Northampton	-1,254,624	-3,136,560	-3,883,360	-37,587,882
<i>New Jersey Portion</i>	-4,019,863	-10,049,657	-12,442,433	-72,233,822
Hunterdon	-2,326,511	-5,816,278	-7,201,106	-30,734,752
Mercer	-1,693,352	-4,233,380	-5,241,327	-41,499,070

**Table 10: Continued**

Area	Effects Near Compressor (2015\$)	Total of ROW, Compressor Station, and Evacuation Zone Effects (2015\$)		
	Hancock, NY Finding (25%)	Low	Medium	High
<b>Study Region</b>		<b>-159,698,484</b>	<b>-172,328,634</b>	<b>-177,340,598</b>
<i>Pennsylvania Portion</i>	-1,387,734	-83,444,799	-90,045,155	-92,664,344
Bucks	n/a	-359,103	-395,560	-410,027
Carbon	-1,387,734	-5,489,639	-6,107,315	-6,352,424
Luzerne	n/a	-38,753,551	-42,817,838	-44,430,651
Northampton	n/a	-38,842,506	-40,724,442	-41,471,242
<i>New Jersey Portion</i>	n/a	-76,253,685	-82,283,479	-84,676,255
Hunterdon	n/a	-33,061,263	-36,551,029	-37,935,857
Mercer	n/a	-43,192,422	-45,732,450	-46,740,397

Based on median property tax rates in each county, these one-time reductions in property value would result in reductions in property tax revenue of between \$2.7 and \$3.0 million per year (Table 11). The present value of this stream of lost revenue over the 2018-2048 operating period would be \$75.9 and \$84.2 million. To keep their budgets balanced in the face of this decline in revenue, counties would need to increase tax rates, cut back on services, or both. The loss in revenue would be compounded by the likelihood that the need for local public

services, such as road maintenance, water quality monitoring, law enforcement, and emergency preparedness/emergency response could increase. Thus, the PE could drive up expenses while driving down the counties’ most reliable revenue stream. (See also “Community Service Costs”, below.)

**Table 11: Effects on Local Property Tax Revenue**

Source: Property Taxes by State (propertytax101.org, 2016).

Area	Median Tax Rate (% of Home Value) <sup>a</sup>	Lost Property Tax Revenue (2015\$)		
		Low	Medium	High
<b>Study Region</b>		<b>-2,719,343</b>	<b>-2,932,534</b>	<b>-3,017,134</b>
<i>Pennsylvania Portion</i>		-1,215,386	-1,310,614	-1,348,403
Bucks	1.27%	-4,561	-5,024	-5,207
Carbon	1.56%	-85,638	-95,274	-99,098
Luzerne	1.40%	-542,550	-599,450	-622,029
Northampton	1.50%	-582,638	-610,867	-622,069
<i>New Jersey Portion</i>		-1,503,95	-1,621,920	-1,668,731
Hunterdon	1.91%	-631,470	-698,125	-724,575
Mercer	2.02%	-872,487	-923,795	-944,156

## THE SOCIAL COST OF CARBON: AN ADDITIONAL COST OF METHANE TRANSPORT

The social cost of carbon (SCC) is a comprehensive estimate of the economic cost of harm associated with the emission of carbon. The SCC is important for regulation because it helps agencies more accurately weigh the costs and benefits of a new rule or regulation. In April 2016, a federal court upheld the legitimacy of using the social cost of carbon as a viable statistic in climate change regulations (Brooks, 2016). In August 2016, The Council on Environmental Quality (CEQ) issued its final guidance for federal agencies to consider climate change when evaluating proposed Federal actions (Council on Environmental Quality, 2016). The CEQ states “agencies should consider applying this guidance to projects in the EIS preparation stage if this would inform the consideration of differences between alternatives or address comments raised through the public comment process with sufficient scientific basis that suggest the environmental analysis would be incomplete without application of the guidance, and the additional time and resources needed would be proportionate to the value of the information included” (Council on Environmental Quality, 2016).

EPA has also challenged FERC’s failure to consider climate change implications in a similar application process (Westlake, 2016). Citing the CEQ guidance, EPA notes that the Final EIS for the Leach Xpress, Columbia Gulf Transmission LLC-Rayne Xpress Expansion project “perpetuates the significant omission...with respect to a proper climate change analysis to inform the decision making process” and recommends that GHG emissions from end product combustion be counted among the environmental effects of each alternative” (p. 2).

PennEast, LLC estimates the pipeline would transport 401,500,000 dekatherms annually, contributing to an equivalent of 21.3 million metric tons of CO<sub>2</sub> emitted per year (U.S. EPA, 2016a). Because the SCC assumes a ton of carbon emitted in the future will have more dire impacts than a ton emitted in the present, we estimate the cost of carbon annually until 2048.<sup>33</sup> Using U.S. EPA estimates based on the average of impacts from three

<sup>33</sup> We assumed that if the PE were to be approved, construction would occur in 2018 and the first year of operation, or the first year the project would produce associated emissions, would be 2019. Based off of an email correspondence with a PennEast representative, “PennEast fully anticipates the PennEast Pipeline safely will transport enough natural gas for

assessment models and discount rates of 5% and 2.5% (U.S. EPA, Climate Change Division, 2016), the cost to society of the carbon transmitted through the PennEast Pipeline would total between \$12.9 and \$56.0 billion over 30 years. FERC must count this significant cost among the effects of the proposed pipeline.

## OTHER IMPACTS FOR CONSIDERATION

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### Public Health Effects

Natural gas transmission releases toxins, smog forming pollutants, and greenhouse gases that have a negative impact on public health (Fleischman, McCabe, & Graham, 2016). Emissions from the natural gas industry have been tied to a myriad of health concerns, however, more concrete epidemiological studies are needed to determine the extent to which natural gas transmission causes public health concerns.

More recent emerging literature is beginning to quantify just how large of an effect the industry can have on public health. For example, a study by the Clean Air Task Force (2016) estimated that in 2025, increases in ozone levels due to pollution from the oil and gas industry will cause 750,000 additional asthma attacks in children under the age of 18, add an additional 2,000 asthma-related emergency room visits and 600 respiratory related hospital admissions, cause children to miss 500,000 days of school annually, and cause adults to deal with 1.5 million days of forced rest or reduced activity due to ozone smog.

### Air Pollution from the Proposed Compressor Station

The PennEast Pipeline impacts air quality by converting forests, which remove normal levels of impurities from the air, to other land uses. There is also concern for impacts that would occur due to the dumping of excess impurities into the air in the first place. While there is a chance leaks could occur at any place along the proposed route, leaks and major releases of gas and other substances (lubricants, etc.) would certainly occur at the 47,700 hp compressor station proposed for Kidder Township, Carbon County, Pennsylvania. Leaks in seals on the moving parts of natural gas compressors produce a significant amount of VOC emissions (Fleischman, McCabe, & Graham, 2016).

The negative effects of the compressor station include noise and air pollution from everyday operations plus periodic “blowdowns,” or venting of gas in the system to reduce pressure. As a recent study by the New York Department of Environmental Conservation indicates, pollution around compressor stations is common and severe (Lucas, 2015). The five-state study found that “more than 40% of the air samples from compressor stations exceeded federal regulations for certain chemicals like methane, benzene, and hydrogen sulfide” (Lucas, 2015). The study also found high rates of illnesses such as nosebleeds and respiratory difficulties among people living near the stations.

While more definitive epidemiological studies are needed to determine the extent to which natural gas compressor stations add to background rates of various illnesses, these stations are implicated as contributing to a long list of maladies. According to Subra (2015), individuals living within 2 miles of compressor stations and metering stations experience respiratory impacts (71% of residents), sinus problems (58%), throat irritation (55%), eye irritation (52%), nasal irritation (48%), breathing difficulties (42%), vision impairment (42%), sleep disturbances (39%), and severe headaches (39%). In addition, some 90% of individuals living within 2 miles of these facilities also reported experiencing odor events (Southwest Pennsylvania Environmental Health Project,

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several decades” (Kornick, 2016b). For our analysis, we interpreted “several decades” as thirty years after the first year of construction.

2015). Odors associated with compressor stations include sulfur smell, odorized natural gas, ozone, and burnt butter (Subra, 2009). Furthermore, compressors emit constant low-frequency noise, which can cause negative physical and mental health effects (Lockett, Buppert, & Margolis, 2015).

In Carbon County, 560 people live within 2 miles of the proposed compressor station (U.S. Census Bureau, 2015). Translating the findings from Subra (2015), 504 people would experience odor events, 398 people would experience respiratory impacts, 325 people would experience sinus problems, and 218 people would experience sleep disturbances and/or severe headaches. In addition to the health impacts discussed above, this pollution can cause damage to agriculture and infrastructure. One study found that shale gas air pollution damages in Pennsylvania already amount to between \$7.2 and \$30 million, with compressor stations responsible for 60-75% of this total (Walker & Koplinka-Loehr, 2014). Using the low estimate of 60%, that is between \$4.32 and \$18 million in damages associated with compressor stations.

## Visual Effects

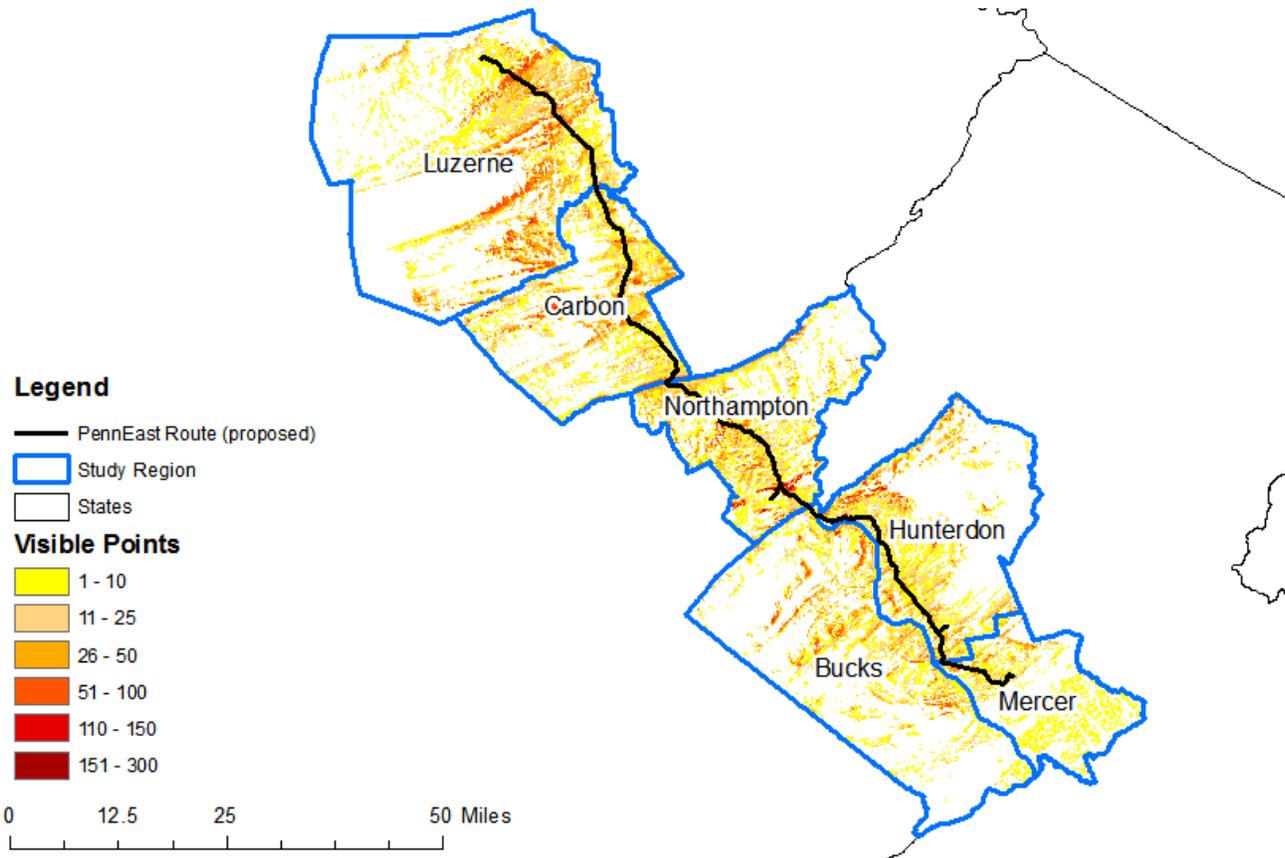
Information about how the visual effects of natural gas transmission pipelines are reflected in property values is scarcer than information related to health and safety effects. On one hand, we know better views increase property value. Conversely, utility corridors from which power lines are visible decrease property values (by 6.3% in one study) (Bolton & Sick, 1999). This suggests that a pipeline corridor reduces property value either by impairing a good view or, like power lines, by simply being unattractive. It is reasonable to conclude that the proposed PE would have effects on property value due to the visual effects, but the literature to date does not offer clear guidance on how large or strong the effects may be. We therefore did not include separate estimates of the impact of the PE on property value in the viewshed. Moreover, we do not wish to double-count a portion of the impact of the PE on “Aesthetics,” which is already included among the ecosystem service value effects.

However, it is important to know the places where the pipeline would be visible in the study region that might suffer a portion of lost aesthetic value. To determine the potential visibility, a GIS-based analysis provides an estimate of how many points along the pipeline could potentially be seen from each 30m-by-30m spot in the study region (Figure 6). To keep the computing needs manageable, we analyzed a sample of points placed at 100m intervals along the proposed PE route.

Because weather, smog, and other conditions may limit the distance of extended unobstructed views in Pennsylvania and New Jersey, we restricted the scope of analysis for any given point on the pipeline to spots in the study region that lie within a 25-mile radius or within the counties’ boundaries.

By tallying the number of points on the pipeline corridor that can be seen from each spot in the study region, we obtain an estimate for the amount of pipeline visible. In Figure 6, yellow spots on the map are points where between 1 and 10 points on the pipeline are visible, whereas red spots have a view of up to 300 points. Since each point represents 100 meters of pipeline, this analysis shows that there are places in the study region where 30 km, or 18.6 miles, of the pipeline corridor could be visible. One limitation is that this is a *potential* view of the pipeline because other visual obstructions, such as trees or buildings, are not taken into account.

Based on this GIS analysis, it would be possible to see at least one point (representing 100m) along the ROW from 36% of the six-county study region. For this 36% of the region, an average of 1.8 km (1.1 miles) of the PE ROW would be visible. For 20% of the study region, seeing 10 or more points, or 1 km (0.62 miles) of the ROW is possible. Note that what would be visible is not the pipeline itself, but rather the gap or break in otherwise intact forests, farm fields, or other more natural features through which the ROW passes.



**FIGURE 6: Visibility of the Proposed PennEast Pipeline**

The color of each point on the map indicates the number of waypoints, spaced 100m apart, along the PE route and within 25 miles that could be seen from each point. Note that the analysis is based on elevation only and does not take into account the extent to which buildings or trees may mask views of the pipeline corridor.

Sources: PE route obtained from the Delaware Riverkeeper Network; Counties from USGS (U.S. Department of Interior & U.S. Geological Survey,

## Community Service Costs

The construction and operation of the PennEast Pipeline is likely to impose various costs on local governments and, by extension, local taxpayers. The main categories of community services that the PE could affect are 1) Provision of Public and Private Water, 2) Roads and Traffic, 3) Emergency Services (Fire, Rescue, and EMS), and 4) Law Enforcement. For this report, we do not have a complete basis for providing estimates of the costs of community service for the counties and municipalities affected by the pipeline. However, we explain them below to provide a more complete picture of public services at stake and an example of indirect costs FERC should be further investigating and considering.

### Provision of Public and Private Water

Landowners all over the Marcellus region are increasingly worried about the potential degradation of water quality associated with the construction and operation of pipelines (Wheeler, 2014; Adams, 2015a). The construction of natural gas infrastructure causes erosion, sedimentation, and contamination of local waterways from runoff (Union of Concerned Scientists, n.d.). In an example from just earlier this year, the state of New York rejected the Constitution Pipeline because the project failed to address significant water resource impacts (New York State Department of Environmental Conservation, 2016).

The PennEast Pipeline would cross, at least, four principal bedrock aquifer systems, multiple surficial unconsolidated aquifers, two EPA-designated sole source aquifers, and three wellhead protection areas (Federal Energy Regulatory Commission, 2016b). The PennEast Pipeline would also cross the Delaware River, a major drinking water source for communities in NJ and PA.

To mitigate potential impacts to water quality, PennEast prepared a Well Monitoring Plan stating that the company will conduct pre- and post-construction water quality monitoring within 150 feet of the construction corridor. If PennEast deems the water supply quantity or quality is affected, they are prepared to provide alternate water supply sources or reparations to the landowner for a new, analogous well (Federal Energy Regulatory Commission, 2016b). The 150 feet buffer, however, does not protect all potentially impacted landowners. In response to the buffer identified by PE LLC and listed in the DEIS, the New Jersey Department of Environmental Protection commented that a monitoring distance of 150 feet of the pipeline is inadequate, suggesting a 1,000 feet monitoring radius instead (New Jersey Department of Environmental Protection, 2015).

The Environmental Protection Agency also submitted a comment letter outlining drinking water concerns and inadequacies in information noting that the DEIS fails to identify Source Water Protection Areas which are determined by contaminant time-of-travel and include areas more than 3 miles upstream of potable source water intakes (U.S. EPA, 2016b). Only three Wellhead Protection Areas (WHPAs) are identified in the DEIS, however, the EPA's comment letter notes 122 WHPAs within 5 miles of the pipeline's proposed path. To more thoroughly account for potential drinking water contamination, the EPA (2016b) suggests PE LLC work directly with state water agencies to locate the intersections between source water protection areas and WHPAs.

In New Jersey, two public supply wells in Alexandria Township in Hunterdon County are within 150 feet of the construction corridor (Federal Energy Regulatory Commission, 2016b). PE LLC has not currently identified the number or location of private wells in New Jersey but states that it will identify affected private wells using public records and interviews with landowners. Dozens of communities along the proposed route are already passing official resolutions against the pipeline. Many of them, for example Kingwood Township, a rural municipality located in Hunterdon County, New Jersey, strongly oppose the PE because of the potential impacts on landowners that predominantly rely on private water supplies (Township Committee of the Township of Kingwood, 2014).



Proposed PE crossing along the Alexauken Creek in New Jersey, a C1 stream.  
(Photo Credit: Faith Zerbe)

According to the DEIS, “based on review of the Pennsylvania Department of Conservation and Natural Resource (PA DCNR) Pennsylvania Groundwater Information System, no public and/or private water supply wells or springs are located within 150 feet of the pipeline construction workspace in Pennsylvania” (Federal Energy Regulatory Commission, 2016b). However, Delaware Riverkeeper Network found that community members and volunteer monitors have identified additional potential freshwater wells and springs within 150 feet of the route (Zerbe, 2016). In Pennsylvania, more than a million people rely on private wells, with 20,000 new wells drilled each year (PennState Extension, 2016), however, because the

state of Pennsylvania does not regulate private well use, testing for contamination falls on the homeowner. These well testing costs would be yet another external cost of the PE that would fall on landowners.

***“If your well is dry or poisoned, your family's well-being is at risk, and your property has become worthless, it won't matter how much PennEast is paying in taxes.”***

*-Mayor Susan Lockwood of Delaware Township, Mayor Kevin Kuchinski of Hopewell Township,  
Mayor Zach Rich of West Amwell Township, Mayor Richard Dodds of Kingwood Township,  
and Mayor Ray Krov of Holland Township*

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## Roads and Traffic

Although no current literature exists that provides estimates of the extent to which natural gas pipeline construction and operation would increase wear and tear on local roads, snarl traffic, or increase the rate of motor vehicle accidents, it is reasonable to assume some of these effects will occur based on documented instances in areas where unconventional natural gas drilling. The increase in traffic volume from fracking produces a strain on existing transportation infrastructure because damage to roads and bridges increases exponentially with vehicle weight (Abramzon et. al, 2014). Heavy vehicle traffic associated with fracking in the Barnett shale in Texas has already run up a repair bill of \$40 million, and New York State estimates potential fracking would require road and bridge upgrades of upwards of hundreds of millions to prepare for the punishment associated with increased vehicle volume and traffic (Efstathiou, 2012).

Damaged or worn-out roads, an increase in traffic volume involving those heavy vehicles, and an influx of out-of-area workers unfamiliar with local roads are also associated with increases in motor vehicle accidents (Muehlenbachs & Krupnick, 2014). Motor vehicle accidents impose a range of costs, from emergency response, medical care, time off of work, premature death, property damage, and the cost of time lost to traffic jams at accident scenes (National Highway Traffic Safety Administration, 2015).

Another reason to expect that PE's external costs would include transportation impacts is that PennEast LLC has stated that it will pay to restore local roads damaged during construction to their original or better condition (Federal Energy Regulatory Commission, 2016b). To help ensure that this does in fact happen, at least one Pennsylvania Township is taking steps and spending public funds to document current road conditions so that officials know how much PennEast-related damage would need to be repaired. According to Upper Nazareth Township zoning Officer John Soloe, “Our road system could be dramatically impacted” (Best, 2016). Since PennEast has pledged only to pay for the damage to roads, the costs of such surveys would be borne by municipalities. Similarly, PennEast would not be paying for the costs of time lost to traffic congestion, traffic accidents, or excess wear and tear on vehicles traversing damaged roads before they are repaired. By paying just a portion of the external transportation-related costs of the PE, the project would leave many costs unmitigated.

## Emergency Services (Fire, Rescue, and Emergency Medical Services)

With pipeline incidents becoming more and more frequent (Kelso, 2013), fire and rescue teams must devote additional time and resources for planning, training, and response. In Allentown, Pennsylvania, roughly 15 miles west of the proposed PennEast Pipeline, the process for responding to a natural gas incident is intensive and burdens the community (Kutz, 2012). When the fire station receives a pipeline related call it must dispatch a battalion chief, one truck company, and three engines with 13-15 firefighters in all. When the first units arrive on the scene, they close roads to all traffic for one square block, take samples, and wait for the utility company to arrive (Kutz, 2012). Fire departments that do not already have the requisite level of staffing, training, and equipment will need to invest to increase their capacity to serve their communities in the face of new risks.

Although incidents with larger transmission lines, such as PennEast, occur with lower frequency, potential accidents still require preparatory training and warrant concern. According to Tim Butters, former deputy administrator of the Pipeline and Hazardous Materials Safety Administration, emergency responders are often overwhelmed with the amount of information on various hazards and priorities in their jurisdiction, which may impact their ability to properly respond to an incident involving a larger transmission pipeline (Armstrong, Hall, & Butters, 2011). An investigation into a pipeline rupture in California that killed eight people, injured over 60, destroyed 38 homes, and damaged 70 others, for example, revealed that local responders were not prepared to handle the emergency (Armstrong, Hall, & Butters, 2011).

PennEast states that it does not expect construction to have an adverse impact on local and regional medical services (Federal Energy Regulatory Commission, 2016b). However, PennEast fails to answer critical questions in their filings relevant for emergency medical services (EMS). The chief of the Kingwood Rescue Squad raises concerns on whether or not rescue vehicles may drive or park over the pipeline, whether a helicopter would be able to land on site, how PennEast would address downed power lines near the PE, and what protective gear would be necessary for first responders to possess and be trained to use (Ponter, 2015).

## Law Enforcement

The increased cost to law enforcement stems from additional time and potential personnel needed to handle increased motor vehicle accidents and crime associated with temporary workers as demonstrated by the experience of communities where temporary workers are a regular presence due to shale gas operations. Pennsylvania localities have experienced a 46% increase in 911 call activity, even with their population declining (Detrow, 2011). The majority of 911 calls stem from heavy trucks jamming traffic on local roads and accidents involving heavy rigs, trucks, tractor-trailers, dump trucks, and trailers hauling hazardous materials, all of which will be present during pipeline construction.

Furthermore, a multi-state analysis found that counties with high drilling had statistically significant increases in violent crime and property crime (Multi-State Shale Research Collaborative, 2014). Temporary out-of-state workers have been associated with increased arrests, traffic violations, protection-from-abuse orders, and warrants for people failing to appear in court (Associated Press, 2011). In Bradford County, Pennsylvania, for example, DUI arrests rose 60%; the number of sentences handed for criminal offenses rose 35%; warrants for criminal activity such as protection-from-abuse rose 25% as well (Associated Press, 2011).

PennEast expects 60% of their 2,400 person workforce to consist of non-local, temporary hires (Federal Energy Regulatory Commission, 2016b). While pipeline construction jobs will come and go more quickly than gas field jobs, it is reasonable to assume, prepare for, and expect higher costs for additional law enforcement needs.

## Effects on Economic Development

Impacts to public health, scenery, and community services could affect the economic development of the counties crossed by the pipeline's route. Across the study region, county-level economic development plans recognize the importance of a high quality of life, a clean environment, and scenic and recreational amenities to the economic future of people and communities. According to the Comprehensive Economic Development Strategy Five-Year Plan for Northeastern Pennsylvania, which encompasses Carbon and Luzerne Counties, "the Northeastern Pennsylvania region will continue to be an attractive place to live because of its excellent quality of life, which is supported by a strong and diversified economic base that brings prosperity to its residents...the



Pasture in Hunterdon County that would be impacted by the PennEast Pipeline.

(Photo Credit: Carla Kelly-Mackev)

region will maintain a balance between the preservation of its rural environment with open space and an expanded economic base with industrial, commercial and retail centers for its residents” (Northeastern Pennsylvania Alliance, 2013, p. 23).

In New Jersey, Hunterdon County’s Comprehensive Economic Development Strategy notes the County’s melding of old and new economy businesses (farming and nationally recognized healthcare, for example) and recognizes that the “beautiful rural landscape comprised of rolling hills, working farms, and attractive historical hamlets...provides an attractive location for a young, highly-skilled workforce that is heavily vested in an active outdoor lifestyle” (Hunterdon County Board of Chosen

Freeholders, CEDS Governing Committee, Hunterdon County Planning Board Staff, & North Jersey Transportation Planning Authority, 2014, p. 102).

These intentions mirror common trends in other amenity-rich locales around the country. For example, Niemi and Whitelaw state “as in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth.... This influence occurs through the so-called people-first-then-jobs mechanism, in which households move to (or stay in) an area because they want to live there, thereby triggering the development of businesses seeking to take advantage of the households’ labor supply and consumptive demand” (1999, p. 54). They note that decisions affecting the supply of amenities “have ripple effects throughout local and regional economies” (p. 54). Similarly, Johnson and Rasker (1995) found that quality of life is important to business owners deciding where to locate a new facility or enterprise and whether to stay in a location already chosen. This is not surprising. Business owners value safety, scenery, recreational opportunities, and quality of life factors as much as residents, vacationers, and retirees.

Part of what makes tourism an important part of the region’s economy is the high aesthetic quality and environmental amenities available in the study region. In 2012, a visitor report about the Pocono Mountains (partially located in Carbon County) reported \$1.3 billion in total spending resulting from overnight visits, with an estimated 25 million total person-trips consisting of 9.1 million in overnight trips and 15.9 million day trips during 2012 (Northeastern Pennsylvania Alliance, 2013).

Wildlife-related recreational activities related to tourism are also important. In 2011, hunters, anglers, and wildlife watchers spent \$2.7 billion in Pennsylvania and another \$2.2 billion in New Jersey (U.S. Fish & Wildlife Service, 2011b, 2011a).

The PE could dampen these economic activities and undermine the progress toward economic development goals. A loss of scenic and recreational amenities, the perception and the reality of physical danger, and environmental and property damage resulting from the PE could discourage people from visiting, relocating to, or staying in the region. Workers, businesses, and retirees who might otherwise choose to locate along the PE’s proposed route will instead pick locations that have retained their character, their productive and healthy landscapes, and their promise for a higher quality of life.

This is already occurring in the region. With the possibility of the PE looming, business plans are stalling and the real estate market is slowing. For example, Movant, Kay Trio, LLC, a land development company, had plans to

develop 105 total acres for single family homes in Nazareth, Pennsylvania. The proposed pipeline, however, would cross the “Trio Fields” development and “aside from destroying numerous lots and any profits associated therewith, will likely affect sales, interest, operation and the overall success of the development as a whole” (Avrigian, Jr. & Martosella, III, 2015). Natasha Jiovino, an owner of property in Holland Township, New Jersey, has been pursuing a development project since 1999 that has incurred development costs of over \$2.8 million to date.

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***“Our customers will not tolerate less than pristine environmental conditions for their prized champion mares and their foals. Construction of the pipeline will result in the immediate loss of our customers and the closure of our business, resulting in the loss of the primary source of income for my wife and me.”***

*-Richard Kohler, Owner of Cedar Lane Farm Inc.  
Hunterdon, NJ*

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Among other impacts, the PE would jeopardize the construction of 132 townhouses and other units that would help the township reach its affordable housing requirements (Jiovino, 2015).

Many of the region’s residents believe the PE will harm the travel and tourism industry. For example, officials from the City of Lambertville in Hunterdon County, New Jersey believe the pipeline and associated construction will disrupt local tourism and recreation businesses (City of Lambertville & PennEast Pipeline Committee of the City of Lambertville, 2016).

It is difficult to predict just how large an effect the PE would have on decisions about visiting, locating to, or staying in the study region. Even so, based on information provided by business owners to FERC and as part of this research, we can consider scenarios for how the PE might affect key portions of the region’s overall economy, such as tourism and recreation, retirement, and entrepreneurship.

If, for example, the PE were to cause a 10% drop in recreation and tourism spending from 2015 baselines, the PE could mean \$448.0 million less in travel expenditures each year (Tourism Economics, 2015, 2016).<sup>34</sup> Those missing revenues would otherwise support roughly \$38.8 million in state and local tax revenue and 4,090 jobs in the six-county region.<sup>35</sup> In the short run, these changes multiply through the broader economy as recreation and tourism businesses buy less from local suppliers and fewer employees spend their paychecks in the local economy. As with the reduction in local property taxes, lost tax revenue from a reduction in visitation and visitor spending would squeeze local governments trying to meet existing public service needs as well as additional demands created by the PE.

Along similar lines, retirement income is an important economic engine that could be adversely affected by the PE. In county-level statistics from the U.S. Department of Commerce, retirement income shows up in investment income and as age-related transfer payments, including Social Security and Medicare payments. In the study region, investment income grew by 0.6% per year from 2000 through 2014, and age-related transfer payments grew by 4.1% per year. During roughly the same time period (through 2013), the number of residents age 65 and older grew by 15.8% (1.2% per year), and this age cohort now represents 15.8% of the total population (U.S. Department of Commerce, 2015a; U.S. Department of Commerce, 2015b).

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<sup>34</sup> Baseline tourism data for Pennsylvania was given for 2014 and adjusted for inflation to 2015\$.

<sup>35</sup> This reduction in economic activity would be in addition to the lost recreation benefits (the value to the visitors themselves over and above their expenditures on recreational activity) that are included under the heading of lost ecosystem services.

It is difficult to precisely quantify the effect of the PE on retirement income, but given the expression of concern from residents about changes in quality of life, safety, and other factors influencing retirees' location decisions, it is important to consider that some change is likely. Here, we consider what a *10% reduction of the growth rate* might entail. A 10% growth reduction scenario would mean an annual decrease in investment income and age-related transfer payments of approximately \$55.6 million. That loss would ripple through the economy as the missing income is not spent on groceries, health care, and other services such as restaurant meals, home and auto repairs, etc.

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***“As a business owner, I provide employment for ten heads of households in a rural area where few job opportunities exist. I also provide critical youth employment on a part time basis for many of our local teenagers. Part of the draw of my restaurant, Milford Oyster House, is the pristine natural environment in which it exists. Travelers come from all over to visit our beautiful area.”***

*-Amy Coss, Owner of Milford Oyster House  
Milford, NJ*

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The same phenomenon also applies to people starting new businesses or moving existing businesses to communities in the study region. This may be particularly true of sole proprietorships and other small businesses who are most able to choose where to locate. As noted, sole proprietors account for a large and growing share of jobs in the region. If proprietors' enthusiasm for starting businesses in the study region were dampened to the same degree as retirees' enthusiasm for moving there, the 10% reduction in the rate of growth would mean 791 fewer jobs and \$16.3 million less in personal income.

For “bottom line” reasons (e.g., cost of insurance) or due to owners' own personal concerns, businesses in addition to sole proprietorships might choose locations where the pipeline is not an issue. If so, further opportunities for local job and income growth will be missed.

These are simple scenarios and the actual magnitude of these impacts of the PE will not be known unless the pipeline is built. Even so, and especially because the pipeline is promoted by its supporters for its jobs and potential other economic benefits to the region, it is important to consider the potential for loss.

## CONCLUSIONS

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The full costs of the proposed PennEast Pipeline to people and communities in the six-county study region and beyond are wide-ranging. The costs include one-time costs like reductions in property value and lost ecosystem services during pipeline construction. These one-time costs, according to our conservative estimates, would be between \$166.0 and \$199.4 million. There are also ongoing costs like diminished ecosystem service value, lost property tax revenue, and the cost of increased carbon emissions that recur year after year for the life of the pipeline (assumed to be 30 years). Lost ecosystem service value and diminished property tax revenues would total between \$5.3 and \$12.8 million per year. The majority of these costs would be borne by the residents, businesses, and institutions in Bucks, Carbon, Luzerne, Northampton, Hunterdon, and Mercer counties.

Beyond the immediate region, the PennEast Pipeline would also impose a cost on people worldwide, due to the addition to the combustion of natural gas transported through the pipeline. The social cost of carbon is an annual cost that varies by year and with the rate at which future costs are discounted. It would total between \$291.9 million and \$2.3 billion, raising the total annual external costs to between \$297.2 million and \$2.3 billion.

Adding up all one-time recurring costs, and discounting those future costs to 2017, we estimate the total external costs of PennEast Pipeline to be between \$13.3 and \$56.6 billion.

By contrast, the pipeline would in the words of FERC's DEIS provide only "minor" benefits in the form of economic impact during construction and operation of the pipeline. Using PennEast LLC's own estimates (Econsult Solutions & Drexel University School of Economics, 2015) and applying the same methods to calculate the present value of all future benefits, the pipeline promises a total of \$2.3 billion in economic impact over 30 years of operation. This means for every dollar of benefit promised, the PennEast Pipeline would impose between \$5.85 and \$24.97 in costs.

While the decision to approve or not approve the PE does not hinge on a simple comparison of estimated benefits versus estimated costs, the huge difference between the external economic costs presented in this report and the potential payments to local and state governments as well as citizens suggests that, from an economic perspective, the proposed PE is grossly inefficient. The scope and magnitude of the costs outlined here reflect an important component of the full extent of the PE's likely environmental effects that must be considered when making the certification decision. Impacts on human well-being, including but not limited to those that can be expressed in dollars-and-cents, must be taken into account by the Federal Energy Regulatory Commission and others weighing the societal value of the PennEast Pipeline.

If these considerations and FERC's overall review result in selection of the "no-action" alternative and the PennEast Pipeline is never built, most of the costs outlined in this report will be avoided. It is *most*, not *all*, costs because the cost of delayed business plans, houses languishing on the market, and the cost to individuals of the stress, time, and energy diverted to concern about the pipeline rather than what would normally (and more productively) fill their lives has already occurred.

Another possible scenario is that FERC, considering the impacts of the PE *as currently proposed* on ecosystem services, property values, and economic development, conducts a thorough analysis of all possible alternatives. Those alternatives may include using alternative energy technologies for meeting the energy needs of the region, using existing gas transmission infrastructure (with or without capacity upgrades), routing new gas transmission lines along existing utility and transportation rights-of-way, and/or scaling down permitted new pipeline capacity to match regional gas transmission needs. In this case, estimates of these impacts should inform the choice of a preferred alternative that minimizes environmental damage and, thereby, minimizes the economic costs to individuals, businesses, and the public at large.

Note that consideration regional energy and natural gas transmission needs would most appropriately be made in the course of preparing a Programmatic Environmental Impact Statement, or PEIS, that considers the multiple pipeline proposals now on FERC's docket as well as others that FERC could reasonably foresee as likely to be proposed to transport gas from the Marcellus Shale to regional, national and international markets. FERC has unfortunately, and possibly in direct violation of NEPA, so far refused to do PEISs (Adams, 2015b). FERC's reason is in part that it has not done PEIS's before. FERC also maintains that it can adequately address such concerns as part of its analysis of the cumulative effects of any individual pipeline.

In the case of the Mountain Valley Pipeline, for example, FERC stated in a 2015 letter that its DEIS "will analyze both the project-specific impacts of the Mountain Valley Pipeline and the cumulative impacts of other actions affecting the environment in the region, including other proposed natural gas pipelines (FERC Chairman Norman Bay, quoted in Adams, 2015b)." That DEIS was released in the fall of 2016 and, as it turns out, FERC failed to adequately assess cumulative impacts of the proposed project. The U.S. Environmental Protection Agency (which has responsibility to review the quality of other agencies' compliance with NEPA) critiqued FERC's DEIS,

saying FERC "uses a narrow geographic and temporal scope," EPA said the Commission defined the scope of analysis of cumulative effects is too narrow. EPA recommended "that FERC describe the inter-related network of existing and proposed pipelines and associated impacts...to provide a more comprehensive consideration of impacts from natural gas production, transmission and use" (U.S. EPA Office of Environmental Programs, 2016, p.4).<sup>36</sup>

Unfortunately, and as demonstrated in the case of the Mountain Valley Pipeline and several other pipeline proposals in the Marcellus Shale region, the outlook for an adequate environmental review by FERC and, subsequently, an economically efficient outcome is not good. FERC routinely discounts or ignores important economic costs and turns a blind eye to energy supply and transmission options that could reduce the waste of land, natural resources, and financial wealth.

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## APPENDIX A: CANDIDATE PER-ACRE VALUES FOR LAND-USE AND ECOSYSTEM SERVICE COMBINATIONS

As explained under “Effects on Ecosystem Service Value,” the benefit transfer method applies estimates of ecosystem service value from existing studies of “source areas” to the “study area,” which in this case is the proposed PE corridor. This application is done on a land-use-by-land-use basis. So, for example, values of various ecosystem services associated with forests in the source area are applied to forests in the study area. The table below lists all of the values from source area studies considered for our calculations.

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/acre/year	Source Study
Cropland	Aesthetic	35.01	89.23	(Bergstrom, Dillman, & Stoll, 1985)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Biological Control	14.38	204.95	(Cleveland et al., 2006)
	Erosion	27.31	72.55	(Pimentel et al., 2003) *
	Food	33.25	33.25	(Lex & Groover, 2015)
	Pollination	10.14	10.14	(Brenner Guillermo, 2007) *
	Pollination	13.89	13.89	(Robinson, Nowogrodzki, & Morse, 1989)
	Pollination	47.43	1,987.97	(Winfree, Gross, & Kremen, 2011)
	Recreation	18.77	18.77	(Brenner Guillermo, 2007) *
	Recreation	2.16	5.02	(Knoche & Lupi, 2007)
	Soil Fertility	7.28	7.28	(Pimentel, 1998) *
	Soil Fertility	115.23	115.23	(Pimentel et al., 2003)
Waste	132.26	132.26	(Perrot-Maître & Davis, 2001) *	
Grasslands	Aesthetic	102.38	116.61	(Ready, Berger, & Blomquist, 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015) *
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Pasture	Aesthetic	102.38	116.61	(Ready et al., 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015)
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/acre/year	Source Study
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Shrub/Scrub	Air Quality	37.26	37.26	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Climate	7.27	7.27	(Croitoru, 2007) *
	Erosion	22.75	22.75	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Pollination	1.41	7.10	(Robert Costanza, Wilson, et al., 2006)
	Recreation	3.95	3.95	(Haener & Adamowicz, 2000)
	Waste	46.35	46.35	(Croitoru, 2007) *
	Waste	0.10	324.35	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Forest	Aesthetic	4,439.71	18,141.99
Air Quality		372.57	372.57	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
Biological Control		8.91	8.91	(Wilson, 2005) *
Biological Control		2.54	2.54	(Brenner Guillermo, 2007) *
Climate		67.45	67.45	(Brenner Guillermo, 2007) *
Climate		56.89	56.89	(Robert Costanza, d'Arge, et al., 2006)
Erosion		61.87	61.87	(Brenner Guillermo, 2007) *
Erosion		3.09	36.09	(Zhou, Al-Kaisi, & Helmers, 2009)
Extreme Events		797.66	797.66	(Weber, 2007)
Food		0.13	0.13	(Wilson, 2005) *
Pollination		202.87	202.87	(Brenner Guillermo, 2007) *
Raw Materials		24.53	24.53	(Wilson, 2005) *
Raw Materials		166.82	166.82	(Weber, 2007)
Recreation		152.66	152.66	(Brenner Guillermo, 2007) *
Recreation		1.29	4.55	(Cruz & Benedicto, 2009) *
Recreation		1.56	1.56	(Kniivila, Ovaskainen, & Saastamoinen, 2002) *
Recreation		37.13	45.50	(Prince & Ahmed, 1989)
Recreation		2.79	503.97	(Shafer, Carline, Guldin, & Cordell, 1993)
Soil Fertility		6.09	6.09	(Brenner Guillermo, 2007) *
Soil Fertility		19.97	19.97	(Weber, 2007)
Waste		55.28	55.28	(Brenner Guillermo, 2007) *
Waste		8.66	8.66	(Cruz & Benedicto, 2009) *
Waste		265.79	266.89	(Lui, 2006)
Water		204.39	204.39	(Brenner Guillermo, 2007) *
Water		47.39	47.39	(Cruz & Benedicto, 2009) *
Water		1,292.23	1,292.23	(Weber, 2007)
Water Flows		230.01	230.01	(Mates, 2007)
Water Flows		797.66	797.66	(Weber, 2007)
Water	Recreation	446.31	446.31	(Brenner Guillermo, 2007) *

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/acre/year	Source Study
	Recreation	155.36	914.10	(Cordell & Bergstrom, 1993)
	Recreation	304.18	437.19	(Mullen & Menz, 1985)
	Recreation	148.68	148.68	(Postel & Carpenter, 1977)
	Waste	10.72	10.72	(Gibbons, 1986) *
	Water	512.74	512.74	(Brenner Guillermo, 2007) *
	Water	22.98	22.98	(Gibbons, 1986) *
Wetland	Aesthetic	38.46	38.46	(Amacher & Brazee, 1989) *
	Air Quality	75.50	98.02	(Jenkins, Murray, Kramer, & Faulkner, 2010)
	Climate	1.84	1.84	(Wilson, 2005) *
	Climate	157.73	157.73	(Brenner Guillermo, 2007) *
	Extreme Events	228.06	369.85	(Wilson, 2005) *
	Extreme Events	110.06	4,583.26	(Brenner Guillermo, 2007) *
	Extreme Events	304.18	304.18	(Robert Costanza, Farber, & Maxwell, 1989)
	Extreme Events	278.77	278.77	(Robert Costanza & Farley, 2007)
	Extreme Events	1,645.59	7,513.98	(Leschine, Wellman, & Green, 1997)
	Raw Materials	50.16	50.16	(Everard, Great Britain, & Environment Agency, 2009)
	Recreation	80.71	80.71	(Bergstrom, Stoll, Titre, & Wright, 1990)
	Recreation	1,716.76	1,761.89	(Brenner Guillermo, 2007) *
	Recreation	109.30	429.97	(Robert Costanza et al., 1989)
	Recreation	1,041.04	1,041.04	(Creel & Loomis, 1992)
	Recreation	88.06	994.50	(Gren & Söderqvist, 1994) *
	Recreation	71.11	71.11	(Gren, Groth, & Sylven, 1995) *
	Recreation	208.01	208.01	(Kreutzwiser, 1981)
	Recreation	209.51	209.51	(Lant & Roberts, 1990) *
	Recreation	648.57	4,203.82	(Whitehead, 1990)
	Waste	141.56	141.56	(Wilson, 2005) *
	Waste	67.02	67.02	(Breux, Farber, & Day, 1995)
	Waste	1,050.34	1,050.34	(Brenner Guillermo, 2007) *
	Waste	170.05	170.05	(Gren & Söderqvist, 1994) *
	Waste	35.20	35.20	(Gren et al., 1995) *
	Waste	551.02	551.02	(Jenkins et al., 2010)
	Waste	209.51	209.51	(Lant & Roberts, 1990) *
	Waste	5,027.28	5,027.28	(Meyerhoff & Dehnhardt, 2004) *
	Waste	10,881.15	10,881.15	(Lui, 2006)
	Water	1,934.84	2,407.52	(Brenner Guillermo, 2007) *
	Water	622.77	622.77	(Creel & Loomis, 1992)
	Water	18.19	18.19	(Folke & Kaberger, 1991) *
	Water Flows	3,741.87	3,741.87	(Brenner Guillermo, 2007) *
Water Flows	3,920.69	3,920.69	(Leschine et al., 1997)	
Water Flows	4,329.70	4,329.70	(UK Environment Agency, 1999)	
Urban Open Space	Aesthetic	1,006.06	1,322.31	(Qiu, Prato, & Boehrn, 2006)
	Air Quality	32.46	32.46	(G. McPherson, Scott, & Simpson, 1998)
	Air Quality	192.35	192.35	(G. E. McPherson, 1992)

Land Use	Ecosystem Service	Minimum \$/acre/year	Maximum \$/acre/year	Source Study
	Climate	1,134.38	1,134.38	(G. E. McPherson, 1992)
	Extreme Events	315.52	597.01	(Streiner & Loomis, 1995)
	Water Flows	8.32	8.32	(G. E. McPherson, 1992)
	Water Flows	138.22	187.58	(The Trust for Public Land, 2010)
Urban Other	Climate	420.95	420.95	(Brenner Guillermo, 2007) *
	Recreation	2,670.74	2,670.74	(Brenner Guillermo, 2007) *
	Water Flows	7.61	7.61	(Brenner Guillermo, 2007)

All values are adjusted for inflation to 2015 dollars.

\* Indicates source is from the TEEB database.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 4**, Catskill Citizens for Safe Energy, press release, “Proximity of Compressor Station Devalues Homes by as Much as 50%”, July 7, 2015.



*For Immediate Release: July 7, 2015*

### **PROXIMITY OF COMPRESSOR STATION DEVALUES HOMES BY AS MUCH AS 50%**

Fremont Center, NY - Homeowners living near the Millennium Pipeline Company's 15,000 horsepower compressor station on Hungry Hill Road in Hancock, New York have seen the value of their homes decline by as much as 50 percent since the industrial facility was constructed in the midst of what used to be a quiet, rural community.

In May 2014 several Hungry Hill residents sought real estate tax relief citing the adverse impact of the compressor station on their property values. The Town of Hancock, denied the tax grievances, but Catskill Citizens for Safe Energy subsequently offered to fund homeowner appeals. On August 25, 2014, small claims hearings were held in the Hancock Town Hall. Two homeowners, a certified Real Estate Appraiser, and a representative of Catskill Citizens testified that the compressor station was responsible for heavy truck traffic, noxious odors, persistent low-level vibrations, and air contamination. The witnesses also asserted that the facility presented a safety threat and recounted how a Millennium employee suddenly knocked on the door of a house late one evening and urged the family to quickly evacuate their home. Finally, it was alleged that blasting during the construction of the compressor station had cracked the foundation of one house, which in turn led to an unsafe spike of radon levels. (Pre and post-construction radon tests conducted by Professional Home Inspection Service of Binghamton, New York showed that radon levels in the home jumped from 3 pCi/L to 6.1 pCi/L, which is above the EPA recommended action guideline of 4.0 pCiL.)

In light of the evidence proffered, the Town of Hancock tax assessors agreed to decrease the assessed valuation and real estate taxes on two homes by 25 percent. The assessed valuation and taxes on a third home, the one that had been physically damaged, were cut by 50 percent. Hearing Officer John Creech, who presided over the settlement, was familiar with the compressor station and remarked, "I wouldn't want to live next to it." After the tax assessors agreed to the 50 percent tax cut he told the owners, "You have a good lawsuit here."

*For further information contact: [info@catskillcitizens.org](mailto:info@catskillcitizens.org) or call (845) 468-7063.*

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 5**, Letter from Key-  
Log Economics to Secretary Kimberly Bose & Deputy  
Secretary Nathaniel J. Davis, September 9, 2016.



*Research and strategy for the land community.*

September 9, 2016

Kimberly Bose, Secretary  
Nathaniel J. Davis, Sr., Deputy Secretary  
Federal Energy Regulatory Commission  
888 First Street NE, Room 1A  
Washington, DC 20426

REFERENCE: OEP/DG2E/Gas 2  
PennEast Pipeline Company, LLC  
FERC Docket No. CP15-558-000  
FERC/EIS-0271D

Dear Ms. Bose and Mr. Davis:

Thank you for this opportunity to comment on the Draft Environmental Impact Statement (DEIS) regarding the PennEast pipeline project as proposed by PennEast Pipeline Company, LLC. I am an economist specializing in research on the relationships between natural resource stewardship and environmental quality on human well-being. Key-Log Economics has been retained by Delaware Riverkeeper Network to conduct an independent analysis of key effects of the proposed pipeline, including changes in property value, lost natural benefits (also known as ecosystem services), health care costs and others. Based on what we have found in the course of that ongoing research, and on behalf of Delaware Riverkeeper Network, we offer the comments below regarding FERC's own as reflected in the DEIS.

I also teach microeconomics, natural resource economics, and natural resource policy at the undergraduate and graduate level. In that vein, I am including the following brief discussion of economic effects, prices, and value to frame my specific comments regarding the PennEast pipeline and FERC's analysis of its environmental effects.

As it pertains to the proposed PennEast pipeline and FERC's subsequent analysis as reported in the DEIS and supporting documents, these relationships result in two distinct, but overlapping types of effects on human well-being. They are:

- Effects on human welfare that are at least partially reflected in observed prices of goods and services and/or expenditures on those goods and services. These would include both positive and negative economic impacts, such as income earned in jobs allocated to operating a pipeline, or expenditures to repair roads and replace water supplies damaged or disrupted by pipeline construction.
- Effects on human well-being that are not reflected in observable market prices that we can observe. These are commonly known as non-market benefits (of environmental quality or improvements, for example) and non-market costs (such as those from environmental degradation). Non-market benefits include the value to people (willingness to pay) over and above what they actually have to pay for an environmental good (such as clean water to drink) or

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over and above what they actually have to pay to remediate environmental damage. Non-market benefits and costs also include changes in human welfare from environmental effects for which there is no out-of-pocket payment at all. Enjoying the aesthetic quality of a view may cost nothing to experience, but it still is valued by the observer.

Closely related to these effects are “external costs.” External costs are effects on human welfare that are not considered as part of a given market transaction because they are borne by or imposed on people other than the parties to the transaction. They are outside -- that is, external to -- the transaction, but they are every bit as much of an economic effect as private (internal) costs are. When external costs are present, market prices can be said to be too low. Consequently, the level of provision of the market good in question--for example natural gas or the pipelines to transport it--will be too high, resulting in an inefficient allocation of resources and what economists call a “deadweight loss” to society.

Because “the market” fails to count external costs on its own, additional analyses and decision making processes are required. FERC’s policy on the Certification of New Interstate Natural Gas Pipeline Facilities (88 FERC, para. 61,227, or Hoecker et al., 1999) is one example of an attempt to ensure consideration of at least some external costs. The policy requires that adverse effects of new pipelines on “economic interests of landowners and communities affected by the route of the new pipeline” be weighed against “evidence of public benefits to be achieved [by the pipeline]” (Hoecker et al., 1999, pp. 18–19). Further, “...construction projects that would have residual adverse effects would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects” (p. 23).

In principle, this policy is in line with the argument, on economic efficiency grounds, that the benefits of a project or decision should be at least equal to its cost, including external costs. However, the policy’s guidance regarding what adverse effects must be considered and how they are measured is deeply flawed. The policy states, for example, “if project sponsors...are able to acquire all or substantially all, of the necessary right-of-way by negotiation prior to filing the application...it would not adversely affect any of the three interests,” with the three interests being pipeline customers, competing pipelines, and “landowners and communities affected by the route of the new pipeline” (Hoecker et al., 1999, pp. 18, 26). The Commission’s policy therefore contends that the only adverse effects that matter are those affecting owners of properties in the right-of-way. Even for a policy adopted in 1999, this contention is completely out of step with long-established understanding that development that alters the natural environment has negative economic effects.

The policy’s confusion over what counts as an environmental effect (again, most of which will have economic effects) is further expressed by the following statement:

Traditionally, the interests of the landowners and the surrounding community have been considered synonymous with the environmental impacts of a project; however, these interests can be distinct. Landowner property rights issues are different in character from other environmental issues considered under the National Environmental Policy Act of 1969 (NEPA) (Hoecker et al., 1999, p. 24)

By the Commission’s reasoning, environmental effects are a matter of the Commission’s “traditions”, not science, and environmental effects are deemed to be both synonymous with, and distinct from, interests of landowners and the surrounding community. This statement seems to contradict the statement one page earlier (p. 23) that “There are other interests [besides those of customers,

competitors, and landowners and surrounding communities] that may need to be separately considered in a certificate proceeding, such as environmental interests.” While we agree that separate/additional consideration of environmental “interests” must indeed be part of the Commission’s review<sup>1</sup>, the policy embodies such a muddle of contradictions on the question of what impacts to examine and why (tradition versus science), that it seems unlikely that any pipeline certification granted under the policy would be scientifically or economically sound. In the case of the proposed PennEast pipeline we find the DEIS to be greatly lacking both in the scope of economically relevant environmental effects considered and in the quality of the analysis of those few effects considered.

A further weakness of the FERC policy is that it relies on applicants to provide information about benefits and costs. The policy’s stated objective “is for the applicant to develop whatever record is necessary, and for the Commission to impose whatever conditions are necessary, for the Commission to be able to find that the benefits to the public from the project outweigh the adverse impact on the relevant interests” (Hoecker et al., 1999, p. 26). The applicant therefore has an incentive to be generous in counting benefits and parsimonious in counting the costs of its proposal. And as reflected in the DEIS at hand, FERC has made no effort itself to ensure a full accounting of economic costs to landowners or the broader community despite the wealth of comments placed on the docket that could support such an assessment. Under these circumstances, it seems unlikely that the Commission’s policy will prevent the construction of pipelines for which the full costs are greater than the public benefits they would actually provide.

Compliance with the the National Environmental Policy Act (NEPA) adds, or should add, breadth to the assessment of economics costs of proposed pipelines. NEPA requires an evaluation of all relevant effects. Of particular interest here, such relevant effects include direct, indirect, and cumulative economics effects--changes in human welfare that might or might not be reflected in the market economy. As the NEPA regulations state,

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (emphasis added, 36 CFR 1508.b).

It is important to note that NEPA does not require that federal actions—which in this case would be approving or denying the PennEast certification—necessarily balance or even compare benefits and costs. NEPA is not a decision-making law, but rather a law requiring decisions be supported by as full as possible accounting of the reasonably foreseeable effects of federal actions on the natural and human environment. It also requires that citizens have opportunities to engage in the process of analyzing and weighing those effects.

Relative to these requirements of NEPA, the PennEast DEIS falls short. The DEIS ignores several important external costs and discounts others. It also relies too heavily on inadequate and misleading information provided by the applicant and the natural gas industry. While predictable, given the

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<sup>1</sup> Note that environmental effects overlap, but are not limited to, the interests of landowners and surrounding communities. The effects of air emissions, loss of productive or aesthetically pleasing land uses, lost recreational opportunities, impacts on climate, and others will affect many people, some much farther from the pipeline itself than “surrounding communities” would connote.

inherent bias and weakness in FERC's certification policy noted above, the outcome leaves FERC and the public without a full picture of the relevant economic effects of the proposed PennEast pipeline.

Details on economics-related shortcomings of the DEIS are provided in the remainder of this comment, beginning with the overarching issue of the DEIS missing several opportunities for meeting energy service needs in a least-cost / lowest impact manner.

## **The DEIS fails to define and analyze a reasonable range of alternatives.**

As required by CEQ regulations mentioned in the above section, FERC considered in the DEIS a No Action alternative, system alternatives, pipeline route alternatives, pipeline route variations, and aboveground facilities alternatives. The selection criteria for alternatives include whether they 1) Are technically and economically feasible, reasonable, and practical 2) Offer a significant environmental advantage over the proposed action 3) Have the ability to meet the objectives of the project (Federal Energy Regulatory Commission, 2016).

FERC's failure to consider alternatives aimed at the bigger picture question of energy efficiency and renewables has important implications for the economics of the proposed pipeline. Namely, unless further alternatives for meeting actual regional needs for energy services (which is not the same as the applicant's stated "need" to transport natural gas) are considered, it will remain impossible to know whether one of the alternatives considered is actually best. If energy services could be delivered to people and industry at a lower cost (including all external costs) by focusing on energy efficiency or power generation from renewable fuels, then considering ONLY gas transmission options will guarantee an inefficient, wasteful outcome.

FERC states that renewable energy generation or gains realized from increased energy efficiency are not considered because they are not transportation alternatives. But NEPA requires a broader view. Under NEPA, federal actions must consider the cumulative impact, defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Changes in energy markets due to energy efficiency gains and/or further market penetration by renewable alternatives to fossil fuels are reasonably foreseeable. For example, renewable energy accounted for 40% of new domestic power capacity installed (American Council On Renewable Energy, 2014), and the relative cost of producing power from renewable sources, which is already competitive, is falling (Randall, 2016; U.S. Energy Information Administration, 2016). Moreover, and as shown in Lander (2016), "there are 49.9% more resources available to meet peak day demand from local gas distribution companies in the region than is needed (p. 9)." In light of these facts and related factors, FERC must consider alternatives that reflect the likely future reality in which the gas the PennEast pipeline would transport is not needed and/or is not a cost-effective choice for consumers or electric power generators. To do otherwise--that is, to focus narrowly on only transportation options--could lead to a federal action that imposes significant environmental effects and associated economic costs for no reason.

## **DEIS Overestimates Positive Economic Effects**

Based on a study of potential economic impacts sponsored by the applicant (Econsult Solutions & Drexel University School of Economics, 2015), the Commission concludes that construction and

operation of the PennEast pipeline would have “minor” and “minor to moderate” positive effects<sup>2</sup> in the form of jobs, payroll taxes, workers’ expenditures, and local governments’ tax revenues (DEIS, ES-12). Unfortunately, and due to flaws in the methods and execution of the Econsult study, even these minor benefits are overblown<sup>3</sup>. In short, the study

- Overestimates short term impacts due to inherent issues with the models used and the choice of the size of the study region.
- Overestimates long-term job “creation” and other impacts due to use of a model empirically proven to have no value as a predictor of economic activity occurring more than a year into the future.

### ***Overestimation of short-term impacts due to pipeline construction.***

The Econsult study’s estimates of economic impacts resulting from spending on the construction of the pipeline suffer from inherent problems with input-output analysis, for which Econsult used the IMPLAN data and modeling software. Input-output models are so-named because they purport to translate an exogenous change in the economy—that is, the “input,” which in this case is spending required to construct the proposed PennEast pipeline—into “outputs,” which are spending by firms that PennEast LLC would hire to build the pipeline, spending by firms that those firms would hire, and so on, plus spending by the households whose labor the various firms would hire. The spending by PennEast LLC in this case would be a “direct” effect. Spending by the other firms would be the “indirect effects.” Spending by those households would be the “induced effects.” The ratio of the sum of all three effects to the direct effect is called the “multiplier.”

While intuitively satisfying, empirical input-output models like IMPLAN are built on a very restrictive set of assumptions about how those spending/hiring decisions are made. Namely, the models assume that decisions are made the way they have always been made. Even though firms and people in the real world will adjust and innovate when faced with a new situation, firms and people in the input-output model will simply do what they have always done. And since innovation tends toward cost minimization, using input-output models as a proxy for real-world decision-making tends to overestimate a firms’ spending and results in overestimates of “multiplier effects” (Hoffmann and Fortmann, 1996). What that means in this case is that construction of the PennEast will not involve as much indirect and induced spending, or create as many indirect and induced jobs, in the real world as the output from Econsult’s run of the IMPLAN model suggests.

Another caution—and another reason the estimates of construction impacts are likely inflated—is that Econsult chose to use the entire states of Pennsylvania and New Jersey as regions for analysis in addition to analyzing impacts for the six-county region where the pipeline would be built. Regional economic impact depends on the degree to which direct, indirect and induced spending can occur

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<sup>2</sup> Note that the authors of the Econsult study characterize these effects as “significant.” While “minor” and “significant” are subjective and relative terms, it cannot be the case that the estimated positive economic impacts of the pipeline are both minor and significant.

<sup>3</sup> Econsult also asserts, without reference to any data or analysis, a primary long-term benefit due to lower natural gas and electricity prices for consumers. The authors fail to consider the possibility that end users could experience higher costs due to the burden of supporting more transmission infrastructure than is needed (Lander, 2016), the effect of natural gas price increases and/or volatility as Marcellus Shale supplies wane in the long run, or the potential availability of lower-cost energy alternatives.

within the study region. The bigger the region one selects for analysis, the more likely it is that one can find a firm in that selected region from which to buy materials or services, and the more likely it becomes that one could hire labor from someone living inside the region. In other words, the larger the selected region, the larger the multiplier effect. The Econsult studies do not present a rationale for the choice of entire states as the study regions.

***Overestimate long-term impacts due to pipeline operation and maintenance.***

Econsult (2015) also uses input-output modeling and IMPLAN to project long-term or ongoing impacts from the operation and maintenance (O&M) of the pipeline. Input-output modeling, however, is not suited for long-term economic impact assessment, and it has been empirically shown to be unreliable for that purpose. As Haynes et al. (1997) note:

Where the economic base approach gets into trouble is when it is used inappropriately as a tool for planning or predicting impacts of greater than one year in duration; a snapshot of current conditions tells little about the form a region's future economy may take.

The reason for this caution is that economic base theory and empirical input-output models grounded in that theory (e.g., the IMPLAN model used in the Econsult report) assume a static economy. In such an economy, there are no changes in relative prices, no input substitution or technological change in the production processes, no labor mobility, no change in products or consumers' tastes and preferences, no regional migration, and no changes in state and local tax laws—to name a few. The constant technology assumption, for example, prevents firms from using cost-savings innovations, forcing them to be inefficient, and the result is higher multiplier effects than are actually experienced (Hoffmann and Fortmann, 1996).

Due to these restrictive assumptions, economic base models have a dismal track record when it comes to predicting economic growth in the real world and in the long run. (The “long run” is more than a year into the future, when a firm can change technology, prices can adjust, and people can change what they want to buy.) In a review of 23 studies, Krikelas (1991) compared predictions of the economic base model against the actual experience of the subject regions and found only 4 studies where the models correctly predicted longer run economic growth. Similarly, Robertson (2003) tested predictions from input-output models against actual experience in 15 communities in Southeast Alaska (a region in which many of the restrictive assumptions of economic base theory might actually apply). He found that initial economic stimulus does not “cause changes in economic activity serving local demand for the average community.... The implications of these results [are that] secondary economic impacts [i.e., “multiplier effects”] cannot be taken as a foregone conclusion in policy analysis” (p. iii).

While Econsult does reference some of the shortcomings of its modeling approach in an appendix to its report, the report shrugs off the limitations, stating “Regardless, I-O models still serve as the standard in the estimation of local and regional impacts.” Despite the shortcomings, and under the cloak of its “everyone else does it” defense, Econsult plugs the 24 direct jobs required to operate and maintain the pipeline (PennEast Pipeline Company, LLC, 2015) into the IMPLAN model and projects that there would be 74 additional jobs supported by PennEast. Those 74 jobs are due to the multiplier effect and include “indirect” employment, or jobs in companies providing materials and services needed for operation and maintenance of the PennEast pipeline, and “induced” jobs, which are jobs supported when the people with the direct and indirect jobs spend their pay at grocery stores, at the doctor, or for other local goods and services. (For comparison, employment in the six-county study region stood at

1.06 million in 2014, making even the the inflated total employment impact less than one one-hundredth of one percent (0.009%) (Headwaters Economics, 2015.)

Regardless of the size of the estimate, to ascribe these indirect and induced jobs to the PennEast pipeline as the cause of that employment in the long-term is to assume that the workers in those indirect and induced jobs would otherwise be idle. Such an assumption is not realistic: idle workers in the real world typically re-train or relocate to take already open jobs, or they create new employment opportunities for themselves where they live. Those 74 jobs, in other words, will most likely exist **somewhere** (in another sector in the study region or in another region) with or without the direct PennEast jobs. Operation of the pipeline, in other words, does not create those indirect and induced jobs any more than the pipeline can create methane to pump through it.

In short, we do not doubt that the construction and operation of the PennEast pipeline will spur economic activity in the form of jobs and income associated with construction and operation of the proposed pipeline. And we agree with FERC that the level of that activity is minimal. Because the estimated level of activity presented by the applicant through the Econsult study is grossly overstated, we would amplify FERC's assessment and conclude that the employment and income effects are not minimal, but practically nonexistent.

## **DEIS Misses or Discounts Important Economic Effects**

### ***Public Health***

Compressor stations have been implicated in a variety of illnesses among nearby residents. (Subra, 2009, 2015). The stations can also be noisy, with low-frequency noise cited as a constant nuisance. ("Proximity of Compressor Station Devalues Homes by as much as 50%," 2015). These issues have led some homeowners to pull-up stakes and move away and to reduced property value assessments for others (Cohen, 2015; "Proximity of Compressor Station Devalues Homes by as much as 50%," 2015).

One way the PennEast pipeline impacts air quality is by converting forests, which remove normal levels of impurities from the air, to other land uses. There is also concern for impacts that would occur due to the dumping of excess impurities into the air in the first place. The 47,700 horsepower (hp) compressor station proposed for Kidder Township, Carbon County, Pennsylvania, for example, will emit noise as well as gas and other substances (lubricants, etc.) as a normal part of operations. The negative effects of the compressor station would include noise and air pollution from everyday operations plus periodic "blowdowns," or venting of gas in the system to reduce pressure. As a recent study by the New York Department of Environmental Conservation indicates, pollution around compressor stations is common and severe. The five-state study found that "more than 40% of the air samples from compressor stations exceeded federal regulations for certain chemicals like methane, benzene, and hydrogen sulfide" (Lucas, 2015). The study also found high rates of illnesses such as nosebleeds and respiratory difficulties among people living near the stations.

While more definitive epidemiological studies are needed to determine the extent to which natural gas compressor stations add to background rates of various illnesses, these stations are implicated as contributing to a long list of maladies. According to Subra (2015), individuals living within 2 miles of compressor stations and metering stations experience respiratory impacts (71% of residents), sinus problems (58%), throat irritation (55%), eye irritation (52%), nasal irritation (48%), breathing difficulties (42%), vision impairment (42%), sleep disturbances (39%), and severe headaches (39%). In

addition, some 90% of individuals living within 2 miles of these facilities also reported experiencing odor events (Southwest Pennsylvania Environmental Health Project, 2015). Odors associated with compressor stations include sulfur smell, odorized natural gas, ozone, and burnt butter. (Subra, 2009). Finally, compressors emit constant low-frequency noise, which can cause negative physical and mental health effects (Lockett, Buppert, & Margolis, 2015).

In Carbon County, 560 people live within 2 miles of the proposed compressor station (US Census Bureau, 2015). This would mean 504 people experiencing odor events, 398 people experiencing respiratory impacts, 325 people experiencing sinus problems, and 218 people experiencing sleep disturbances and/or severe headaches. In addition to the health impacts discussed above, this pollution can cause damage to agriculture and infrastructure. One study found that shale gas air pollution damages in Pennsylvania already amount to between \$7.2 and \$30 million, with compressor stations responsible for 60-75% of this total (Walker & Koplinka-Loehr, 2014). Using the low estimate of 60%, that is between \$4.32 and \$18 million in damages associated with compressor stations.

***Social Cost of Carbon: PennEast pipeline would abet the emission of 20.1 metric tons of CO<sub>2</sub> equivalent a year, adding \$252.4 million annually to the cost of the pipeline.***

The social cost of carbon (SCC) is a comprehensive estimate of the economic cost of harm associated with the emission of carbon. The SCC is important for regulation because it helps agencies more accurately weigh the costs and benefits of a new rule or regulation. In April 2016, a federal court upheld the legitimacy of using the social cost of carbon as a viable statistic in climate change regulations (Brooks, 2016). In August 2016, The Council on Environmental Quality (CEQ) issued its final guidance for federal agencies to consider climate change when evaluating proposed Federal actions (Council on Environmental Quality, 2016). The CEQ states “agencies should consider applying this guidance to projects in the EIS or EA preparation stage if this would inform the consideration of differences between alternatives or address comments raised through the public comment process with sufficient scientific basis that suggest the environmental analysis would be incomplete without application of the guidance, and the additional time and resources needed would be proportionate to the value of the information included” (Council on Environmental Quality, 2016).

PennEast, LLC estimates the pipeline would transport 401,500,000 dekatherms annually, contributing to an equivalent of 20.1 metric tons of CO<sub>2</sub> emitted per year (U.S. EPA, 2016). Using the most conservative estimate of the cost per metric ton of carbon (U.S. EPA, 2016), the additional emission of CO<sub>2</sub> would cost \$252.4 million annually. FERC must count this significant cost among the effects of the proposed pipeline.

***Ecosystem Services: FERC ignores the potential loss of human benefit due to pipeline-induced land conversion.***

The idea that people receive benefits from nature is not at all new, but “ecosystem services” as a term describing the phenomenon is more recent, emerging in the 1960s (Millennium Ecosystem Assessment, 2005). According to a White Memorandum titled “Incorporating Ecosystem Services into Federal Decision Making” (Donovan, Goldfuss, & Holdren, 2015), ecosystem services are “benefits that flow from nature to people.” They include tangible physical quantities, such as food, timber, and clean drinking water, life support functions like assimilating waste that ends up in air and water or on the

land, as well as aesthetics, recreational opportunities, and other benefits of a more cultural, social, or spiritual nature.

If ecosystem services are the products of nature, then ecosystems themselves--the land--are the factories where those products and values are produced. Just as with different man made factories, different types of ecosystems (forest, wetland, cropland, urban areas) produce different arrays of ecosystem services, and/or produce similar services to greater or lesser degrees. This is true for the simple reason that some ecosystems or land uses produce a higher flow of benefits than others.

By similar reasoning, a changes in ecosystems or more fundamentally, changes in land use, will change the type, amount, and value of the ecosystem services produced in the affected area. In the case of natural gas transmission pipelines, there is the conversion in the short run of all land in the construction zone from forests, cropland, urban open space, and other productive uses to barren land with very little, if any ecosystem service value.

In the longer run, a portion of the construction zone will revert to its pre-disturbance land cover, though the effects of soil compaction, introduction of invasive species, etc. may make even reverted land formerly in the construction zone less productive. In the right-of-way however, land that had been forested before construction, will revert to the (less productive) land cover of grassland, or perhaps shrub scrub, depending on the frequency of mowing to keep the right-of-way free of trees.

Cropland in the ROW could revert to cropland, but if there are restrictions on the weight of vehicles that can be operated on top of the buried pipeline, it may turn out to be the case that cropland reverts, at best, to pastureland. Moreover, there could be long-standing harm to agricultural productivity due to soil compaction, soil temperature changes, and alteration of drainage patterns due to pipeline construction. As agronomist Richard Fitzgerald (2015) concludes in the context of another proposed pipeline, "it is my professional opinion that the productivity for row crops and alfalfa will never be regenerated to its existing present 'healthy' and productive condition [after installation of the pipeline]." In the path of the PennEast pipeline, grower Ron Fulper of West Amwell, New Jersey has seen "very low [corn] yields" in the portion of his fields crossed by an existing natural gas pipeline (Colaneri, 2015).

By applying per-acre ecosystem service productivity estimates (denominated in dollars per acre per year) to the various arrays of ecosystem service types, one can estimate ecosystem service value produced per year in the periods before, during, and after construction. The difference between annual ecosystem service value during construction and before construction is the annual loss in ecosystem service value of construction. The difference between the annual ecosystem service value during ongoing operations (i.e., the value produced in the ROW) and the before-construction baseline (no pipeline) is the annual ecosystem service cost that will be experienced indefinitely.

Using methods established in Phillips and McGee (2016) and applied to pipelines in Phillips, Wang and Bottorff (2016), we estimate that the PennEast pipeline would cause an initial loss of \$7.3 million in ecosystem services during a one-year construction period. For each year the pipeline is in operation, the pipeline would induce an additional loss of \$2.4 in ecosystem services due to conversion of land in the ROW. Land converted for use as permanent pipeline-related infrastructure would mean an additional loss of \$218,200 each year.

These are preliminary estimates, and we recommend that FERC undertake its own assessment of the ecosystem services impacts of the proposed action. Such a review would be consistent with current

executive branch direction and coming implementation guidance (Donovan, Goldfuss, & Holdren, 2015). FERC should follow the lead of other agencies and use existing resources, such as Federal Resource Management and Ecosystem Services (National Ecosystem Services Partnership, n.d.) and Best Practices for Integrating Ecosystem Services into Federal Decision Making (Olander et al., 2015) in its review. Such a review would help ensure that these important environmental effects (and their economic consequences) are no longer ignored in FERC's decision making.

The failure to include in the DEIS an analysis of ecosystem services lost due to the construction and operation is a glaring example of inadequacy of FERC's "traditional" conflation of the interests of landowners and surrounding communities with environmental impacts described above. The exclusion of ecosystem service losses means that many of the economic consequences of environmental effects, not to mention many environmental effects, have not been considered at all. This renders the DEIS inadequate for informing decision making about the PennEast pipeline.

### **Property Value: Claims that pipelines do not harm property value are invalid.**

The DEIS (Federal Energy Regulatory Commission, 2016) and PennEast, LLC cite studies purporting to show that natural gas pipelines (and in one case a liquid petroleum pipeline) have at most an ambiguous and non-permanent effect on property values (Allen, Williford & Seale Inc., 2001; Fruits, 2008; Palmer, 2008; Diskin et al. 2011). While the studies differ in methods, they are similar in that each fails to take into account two factors potentially voiding their conclusions entirely. First, the studies do not consider that the property price data employed in the studies do not reflect buyers' true willingness to pay for properties closer to or farther from natural gas pipelines. For prices to reflect willingness to pay (and therefore true economic value), buyers would have to have full information about the subject properties, including whether the properties are near a pipeline.

Second, and for the most part, the studies that find no difference in prices for properties closer to or farther away from pipelines are not actually comparing prices for properties that are "nearer" or "farther" by any meaningful measure. The studies compare similar properties and, not surprisingly, find that they have similar prices. Their conclusions are neither interesting nor relevant to the important question of how large an economic effect the proposed pipeline would have.

### ***When the pre-conditions for a functioning market are not met, observed property prices do not (and cannot) indicate property value.***

Economic theory holds that for an observed market price to be considered an accurate gauge of the economic value of a good, all parties to the transaction must have full information about the good. If, on the other hand, buyers lack important information about a good, in this case whether a property is near a potential hazard, they cannot bring their health and safety concerns to bear on their decision about how much to offer for the property. As a result, buyers' offering prices will be higher than both what they would offer if they had full information and, most importantly, the true economic value of the property to the buyer.

As Albright (2011) notes in response to the article by Disken, Friedman, Peppas, & Peppas (2011):

"The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchaser had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on,

near or across their property. ... I believe that the authors' failure to confirm that the purchasers in any of the paired sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undercut the authors' work product and the conclusions set forth in the article. (p.5)"

Of the remaining studies, only Palmer (2008) gives any indication that any buyers were aware of the presence of a pipeline on or near the subject properties. For Palmer's conclusion that the pipeline has no effect on property value to be valid, however, it must be true that **all** buyers had full information, which was not the case in the study.

In some cases, however, the location and hazards of petroleum pipelines become starkly and tragically known. For example, a 1999 liquid petroleum pipeline exploded in Bellingham, Washington, killing three, injuring eight and causing damage to property and the environment. In that case and as Hansen, Benson, and Hagen (2006) found, property values fell after the explosion, which is to say, once would-be buyers became aware of the pipeline in the neighborhood. The authors also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

Today's market is quite different. In contrast to Bellingham homebuyers in the months and years after the 1999 explosion, today's homebuyers can query Zillow to see the history of land prices near the pipeline and explore online maps to see what locally undesirable land uses exist near homes they might consider buying. They also have YouTube and repeated opportunities to find and view news reports, citizens' videos, and other media describing and depicting such explosions and their aftermath. Whether the pre-explosion prices reflected the presence of the pipeline or not, it is hard to imagine that a more recent event and the evident dangers of living near a fossil fuel pipeline would be forgotten so quickly by today's would-be homebuyers.

In Resource Report 5, PennEast, LLC claims that "it has never been commonplace for consumers to identify the presence of natural gas pipelines as part of their real estate transaction diligence and therefore, it can be argued the presence of natural gas pipelines is not a significant determinant to the value for real estate transactions" (2015). This is grossly misleading and plainly illogical. One cannot conclude a lack of a negative effect from the fact that home sellers do not typically, and counter to their own self-interest, disclose information that could induce a drop in the sale price. There are many attributes of homes offered for sale that are not typically included in the information displayed on real estate marketing sites. Drafty windows or unpleasant neighbors are but two examples of things home sellers do not typically include in their description of a home one is trying to sell. They are nevertheless two attributes of a home that would diminish the value to prospective buyers and, once known by those buyers, would also diminish the price offered.

PennEast LLC would instead have FERC believe that all persons selling real estate always disclose any and all features of their property that could possibly reduce the offers they may receive. If that were true, there would be no need for the laws that require homeowners to disclose, for example, whether the basement is damp or if the property is included in a homeowners association. Either PennEast LLC does not understand rational buyer/seller behaviour, or they expect that FERC and the public do not.

What Zillow.com or other sites do accomplish is lowering the effort required for homebuyers to visualize the location of properties relative to other land uses, including pipeline rights of way.

Combined with other information, such as maps of pipeline routes and other searchable online information, real estate marketing tools do make it more likely that prospective buyers will gain information about the hazard they could be buying into.

With more vocal/visible opposition to large, high-pressure natural gas pipelines, it also seems likely that prospective home buyers will not have to wait for an incident involving the PennEast pipeline to learn of it and, therefore, for the PennEast pipeline to affect their willingness to pay (and actual offer prices) for properties nearby. A drive down the street and a quick online search for information about a community one is considering a move to is likely to reveal “no pipeline” signs, municipal ordinances opposing the pipeline, and facebook groups created by local community members formed to raise awareness about the pipeline. Anyone with an eye toward buying property near the proposed PennEast corridor could quickly learn that the property is in fact near the corridor, that there is a danger the property could be adversely affected by the still-pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health, safety, and environmental effects.

When people have more complete information about a property, they are able to express their willingness to pay when it comes time to make an offer. Accordingly, the prices buyers offer for homes near the PennEast pipeline will be lower than the prices offered for other homes farther away or in another community or region.

***Studies concluding that proximity to pipelines does not result in different property values do not actually compare prices for properties that are different.***

While the studies cited in Resource Report 5 and the DEIS purport to compare the price of properties near a pipeline to properties not near a pipeline, many or in some cases all, of the properties counted as “not near” the pipelines are, in fact, near enough to have health and safety concerns that could influence prices. In both studies written by the Interstate Natural Gas Association of America (INGAA) the authors compare prices for properties directly on a pipeline right-of-way to prices of properties off the right-of-way. However, in almost all cases the geographic scope of the analysis was small enough where most or all of the properties not on the right-of-way were still within the pipelines’ respective evacuation zones (Allen, Williford & Seale Inc., 2001; Integra Realty Resources, 2016).<sup>4</sup>

In the 2016 INGAA study, the specific distance from pipeline was reported for eight case studies. In those cases, an average of 72.5% of the “off” properties were actually within the evacuation zone and, like the “on” properties, are therefore likely to suffer a loss in property value relative to properties farther away. (We estimated the evacuation zone based on available information about the pipeline diameter and operating pressure.) For the other two cases, the study reported a simple “yes” or “no” to indicate whether the property abutted the pipeline in question. For these cases, we assume the author’s methods, while flawed, are at least consistent from one case study to the next meaning it is likely at least 50% or more of the comparison properties (the “off” properties) are in fact within the evacuation zone.

To adequately compare the price of properties with and without a particular feature, there needs to be certainty that properties either have or do not have the feature. It is a case where comparing apples and oranges is not only reasonable, but also essential. In the case of these studies, there is little to no

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<sup>4</sup> Proximity of properties to pipelines is based on best estimate of the location of the pipelines derived from descriptions of the pipelines’ locations provided in the studies and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

variation in the feature of interest (i.e., the majority of properties are within the evacuation zone). The studies are looking at and comparing the “apples.” In this case, the feature of interest is the presence of a nearby risk to health and safety. With no variation in that feature, a systematic variation in the price of the properties is not expected. By comparing apples to apples when it should be comparing apples to oranges, the INGAA studies reach the obvious and not very interesting conclusion that properties that are similar in size, condition, and other features including their location within the evacuation zone of a natural gas pipeline, have similar prices.

To varying degrees, the other studies cited by FERC PennEast LLC suffer from the same problem. Fruits (2008), who analyzes properties within one mile of a pipeline that has a 0.8-mile-wide-evacuation zone (0.4 miles on either side), offers the best chance that a sizable portion of subject properties are in fact “not near” the pipeline from a health and safety standpoint. He finds that distance from the pipeline does not exert a statistically significant influence on the property values, but he does not examine the question of whether properties within the evacuation zone differ in price from comparable properties outside that zone. A slightly different version of Fruits’ model, in other words, could possibly have detected such a threshold effect. (It should go without saying that such an effect would show up only if the buyers of the properties included in the study had been aware of their new property’s proximity to the pipeline.)

In short, the conclusion that pipelines do not negatively affect property values cannot be drawn from these flawed studies. To evaluate the effects of the proposed PennEast pipeline on property value, FERC and others must look to studies (including those summarized in the next section) in which buyers’ willingness to pay is fully informed about the presence of nearby pipelines and in which the properties examined are truly different in terms of their exposure to pipeline-related risks.

***Better information about the effect of pipelines on property values is available.***

To say the impacts and potential impacts of the PennEast pipeline on private property value are important to people along its proposed route would be an extreme understatement. Along with Delaware Riverkeeper Network, we are reviewing all comments regarding the PennEast proposal. While that review is still underway, we can report that of the random sample of comments reviewed so far 35% mention concerns about the effect on property value. Of this group, 99.6% believe the effect on property value will be negative.

While it is impossible to know precisely how large an effect the specter of the PennEast pipeline has already had on land prices, there is strong evidence from other regions that the effect would be negative. In a systematic review, Kielisch (2015) presents evidence from surveys of Realtors, home buyers, and appraisers demonstrating natural gas pipelines negatively affect property values for a number of reasons. Among his key findings relevant to PennEast:

- 68% of Realtors believe the presence of a pipeline would decrease residential property value.<sup>5</sup>
- Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%.)

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<sup>5</sup> This result demonstrates that Realtors’ knowledge of their own market is not defined by or limited to what is advertised on realtor.com.

- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.
- More than three quarters of the Realtors view pipelines as a safety risk.
- In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36-inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (Kielisch, 2015, p. 7). Considering only those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%.<sup>6</sup> This loss in value provides the mid-level impact in our estimates. A much greater loss (and higher estimates) would occur if one were to consider the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.<sup>7</sup> In our estimates (see below), however, we have used the smaller effect (-10.5%) based on the assumption that sellers will eventually find one of the buyers still willing to buy the pipeline-easement-encumbered property.

- Based on five “impact studies” in which appraisals of smaller properties with and without pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%” (Kielisch, 2015, p. 11). The average rises to a range of -12% to -14% if larger parcels are considered, possibly due to the loss of subdivision capability.

Kielisch’s findings demonstrate that properties on natural gas pipeline rights-of-way suffer a loss in property value. Boxall, Chan, and McMillan (2005), show that pipelines also decrease the value of properties lying at greater distances. In their study of property values near oil and gas wells, pipelines, and related infrastructure, the authors found that properties within the “emergency plan response zone” of sour gas<sup>8</sup> wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.

The risks posed by PennEast would be different—it would not be carrying sour gas, for example—but there are similarities with the PennEast scenario that make Boxall et al.’s finding particularly relevant. Namely, the emergency plan response zones (EPZs) are defined by the health and safety risks posed by the gas operations and infrastructure. Also, and in contrast to the FERC- and PennEast-cited studies showing no price effects (see “Property Value: Claims that pipelines do not harm property value are invalid,” above), the Boxall study examines prices of properties for which landowners must inform prospective buyers when one or more EPZs intersect the property.

In addition to the emerging body of evidence that there is a negative relationship between natural gas infrastructure and property value, there have been many analyses demonstrating the opposite analog.

<sup>6</sup> Half of the buyers would offer 21% less, and the other half would offer 0% less; therefore the expected loss is  $0.5(-21\%) + 0.5(0\%) = -10.5\%$ .

<sup>7</sup> This is the expected value calculated as  $0.622*(-100\%)+0.189*(-21\%)+0.189*(0\%)$ .

<sup>8</sup> “Sour” gas contains high concentrations of hydrogen sulfide and poses an acute risk to human health.

Namely, it is well-established that amenities such as scenic vistas, access to recreational resources, proximity to protected areas, cleaner water, and others convey positive value to real property.<sup>9</sup> There are also studies demonstrating a negative impact on land value of various other types of nuisance that impose noise, light, air, and water pollution, life safety risks, and lesser human health risks on nearby residents (Bixuan Sun, 2013; Bolton & Sick, 1999; Boxall et al., 2005). The bottom line is that people derive greater value from, and are willing to pay more for, properties that are closer to positive amenities and farther from negative influences, including health and safety risks.

Using the results established by Kielisch (2015) and Boxall, Chan, McMillan (2005), and applied to pipelines in Phillips, Wang and Bottorff (2016), we estimate that construction of the the PennEast pipeline would result in a loss of \$158.3 to \$176.0 million in property value in the right-of-way and evacuation zone.

### ***Further property value impacts near the Kidder compressor station.***

In addition to the direct effects on nearby residents' health and quality-of-life noted above, compressor stations have caused some homes to lose value and some homeowners to move away rather than endure the noise, smells, and illnesses they have experienced. In one case from Minisink, New York, a family of six moved to escape the effects of a 12,600 hp compressor station operated by Millennium Pipeline LLC. After two years of headaches, eye irritation, and lethargy among the children and even lost vigor in their fruit trees, the couple, unable to find a buyer for their home, moved away, leaving their \$250,000 investment in the property on the table with their bank holding the balance of the mortgage (Cohen, 2015).

In Hancock, another New York town with a much smaller (15,000 hp) compressor station, three homeowners have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station ("Proximity of Compressor Station Devalues Homes by as Much as 50%", 2015). The larger of these reductions was for a home very close to the station and reflected physical damage that led to an increase in radon concentrations above safe levels. The two properties devalued by 25% were approximately one half mile away (Ferguson, 2015).

As of this writing, there have not been statistical studies of the relationship between a property's value and its proximity to a compressor station. The mounting anecdotal information does suggest that there is a negative relationship, however, and depending on the particular circumstances, the effect can be large—up to the 100% loss sustained by the family in Minisink (less whatever the bank can recover at auction). FERC must therefore count the potential loss of property value associated with the compressor station proposed for location in Kidder Township.

For our estimates, we follow the example of the Hancock, New York case and assume that properties within one half mile of the Kidder Township compressor station would lose 25% of their value if the station is built. We believe this assumption provides a conservative estimate in part because the Kidder compressor station would be more than three times the horsepower of the Hancock station. It is therefore likely that its noise, odor events, and other physical effects would be experienced at a greater distance and/or with greater intensity than in the New York case. The resulting loss of value would affect Carbon County landowners over a wider area and, possibly, the percentage reduction would be

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<sup>9</sup> Phillips (2004) is one such study that includes an extensive review of the literature on the topic.

greater at any given distance. Under these conservative assumptions, the Kidder compressor station would reduce the value of 40 properties by a total of \$1.4 million dollars.

Beyond health and safety concerns, compressor stations might also affect property values due to a “stigma of industrialization” similar to that found for high-voltage lines, according to real estate expert Kurt Kielisch of the Forensic Appraisal Group (Personal Communication 1/6/2016).

## Conclusion

Based on our own and others’ research regarding the potential economic effects of natural gas transmission pipelines, we find the following critical weaknesses in FERC’s Draft Environmental Impact Statement regarding the proposed PennEast pipeline.

1. The DEIS reflects FERC’s policy on pipeline certification, which embodies confused and economically incorrect guidance regarding the scope or extent of the area within which economic costs the pipeline would be experienced. Namely, the policy looks only at impacts on owners of pipeline rights of way and an undefined “surrounding community,” rather than the full geographic area over which impacts could be felt. In addition, the policy ignores even the surrounding community if a significant proportion of landowners have agreed to sell easements to their property.
2. The range of alternatives is inadequate, resulting in the potential that the DEIS has missed opportunities to meet the same energy services need at a lower environmental and economic cost.
3. The DEIS, while noting that economic benefits would be slight, still relies on over-estimates of those benefits.
4. The DEIS ignores important economic costs, including public health and the value of ecosystem services lost due to land conversion in the pipeline construction corridor and right-of-way.
5. The DEIS accepts and repeats the conclusions of studies purporting to show that pipelines have no affect on property value and ignores research showing that pipelines do harm property value.

Taken together, these flaws render the DEIS unsuitable as a guide to evaluating the economic effects of the proposed PennEast pipeline. We look forward to submitting to the record our own evaluation of economic costs that FERC has ignored in the DEIS. We strongly recommend that FERC undertake its own rigorous examination of the full economic effects.

Sincerely,



Spencer Phillips, Ph.D.  
Principal

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People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 6**, Jessica Cohen,  
*House Abandoned Because of Minisink Compressor  
Station -- Family Walks Away from \$250,000*, The River  
Reporter November 24, 2015.

# House abandoned because of compressor station; Family walks away from \$250,000

## The River Reporter

By JESSICA COHEN  
November 24, 2015 —

MINISINK, NY — In June, Leanne and Rob Baum and their four children abandoned their house in Minisink, leaving it to the bank holding the mortgage and oversight by a friend. Ominous symptoms from emissions of a 12,600 horsepower gas compressor built in their rural neighborhood two years before by Millennium Pipeline, LLC, prompted their decision, said Leanne. After it had been six months on the market they had no offers on their house, and selling to another family felt morally questionable.

“Once you know, you can’t un-know about the hazards,” she said. “I hoped no one would be interested.”

No one was, and others in the neighborhood negotiated with “lowball offers” to sell their houses in the once-quiet rural community after they had been a year on the market, Baum said.

The Baums had bought their four-bedroom house for \$374,000, and invested about \$250,000 in payments and improvements during their nine years there. In addition to putting in hardwood floors, lighting upgrades, a family room, wood stove and patio, they had landscaped two acres. Their apple, cherry and peach trees, gardens and greenhouse yielded produce they ate, preserved and gave away to friends. They sold raspberry jam at a farmers’ market and drank wine made from grapes they grew.

But in those last two years, they lost interest in gardening. Rob had begun waking up with headaches that went away when he arrived at work, though his office was dusty, low-ceilinged and lit by fluorescent lights, said Leanne. Her eyes became too irritated to tolerate contact lenses, and she noticed her children had become “lethargic.” Although they were accustomed to playing imaginary games outside, where they had a tree house and trampoline, the Baums began to wonder if that was a good idea, with the toxic emissions from the compressor.

“OSHA [Occupational Safety and Health Administration] regulations for the workplace are more stringent than for compressors,” said Leanne. “And that’s for a six-foot male, not for kids, whose metabolisms are faster.”

Even some of the Baum’s fruit trees looked sickly, as environmental health consultant David Brown noticed when he visited, while doing a health survey of 35 residents living within 1.5 kilometers of the compressor. Brown, former Chief of Environmental Epidemiology and Occupational Health in Connecticut, and his cohorts at Southwest Pennsylvania Environmental Health Project (SPEHP), found that residents exhibited a pattern of symptoms that increased when emissions surged in the neighborhood, as measured by particulate matter monitors and air samples during “odor events.”

The compressor tripled ambient levels of fine particulate matter, which produces inflammation throughout the body and increases the likelihood of heart attacks and other ailments, according to Harvard environmental epidemiologist Joel Schwartz. Volatile organic chemical emissions that SPEHP identified included formaldehyde and benzene, which are considered unsafe at any level and associated with childhood leukemia by the World Health Organization.

Rob was one of 12 of the 35 in the survey who developed headaches after the compressor began functioning. A Baum child was one of 10 who had rashes. Respiratory problems affected 22 people—six of the 12 surveyed children had nosebleeds; at least two adults became asthmatic. And, consistent with what the Baums noticed in their children, “Overall mental health and wellbeing levels were below normal for half of the respondents,” according to the survey summary.

These results echoed findings around the country near other gas infrastructure, including drilling sites. Wilma Subra, an environmental health consultant who received a MacArthur Fellowship “genius” grant for her community work, found that 90% of people living and working within two to three miles of a compressor develop such symptoms. Resulting chronic problems included organ damage, birth defects and leukemia. Two hundred homes are within a half mile of the Minisink compressor. A plan by Competitive Power Ventures, LLC, to build a gas power plant a few miles away, in Wawayanda, would increase compressor use and would generate the same emissions as the compressor but in multiple amounts. For people living within a few miles of a power plant, adverse health effects are intensified, says Subra.

The Baums had been in the habit of opening their windows at night, but Brown said, “You don’t want to do that,” Leanne recalls. “It sent a chill through me.”

Safety issues also loomed. Fumes near the compressor prompted a neighbor to call 911 on a Sunday night when Leanne was home alone with her baby.

“When emergency responders got to the compressor, they couldn’t get beyond the locked gate,” she recalled. “What was I supposed to do? Stay? Leave?”

Columbia Pipeline Group (CPG), Millennium’s parent company, monitors the compressor remotely from Charleston, WV, according to Scott Castleman, CPG senior communications specialist. CPG officials declined to provide information about on -staffing hours.

By the time health survey results came out early in 2015, the Baums, collaborating with other Minisink residents, had lost their federal court case against Millennium and the Federal Energy Regulatory Commission (FERC), which had approved the compressor. It could have been built in an industrially zoned area in Deerpark, where Millennium already had facilities; they were just avoiding costly replacement of seven miles of pipeline, the Minisink group said. Also, the compressor application’s environmental impact statement omitted mentioning plans for a Wawayanda power plant, secretly documented years before.

“The gas industry and FERC refer to Minisink as a host community, but we are not hosts. We are hostages,” said Pramilla Malick, a Minisink resident and founder of Protect Orange County. “FERC’s decision in the Minisink case raises serious questions about the constitutionality of the permitting process. Millennium admitted they had a viable alternative, but rejected it based on economics. If they had a viable alternative, then why was the Minisink compressor declared a ‘public necessity’? And why are the financial interests of a billion dollar company more important than the basic rights of ordinary citizens? Given the magnitude of the CPV Valley project, adverse health and economic impacts will continue to increase throughout the region.”

She points out that building power plants creates a need for constructing other gas infrastructure, including pipelines and metering stations, as well as compressors, all of which have problematic health effects from emissions and leaks, Subra found.

However, the FERC has continued issuing permits without apparent regard for these concerns. So, for five days, Malick participated in an 18-day hunger strike in front of FERC offices in Washington, DC, with Beyond Extreme Energy, a national group demanding a stop to fossil fuel infrastructure permitting.

Health professionals are also joining the gas opposition. In October, members of Physicians for Social Responsibility and Concerned Health Professionals of New York sent a letter to New York Gov. Andrew Cuomo requesting a moratorium on gas infrastructure construction because of public health problems from toxic emissions.

The Baums and other Minisink residents fought the compressor for two years before its construction, when Farmstead Land Development LLC, whose principal is Dean Ford Sr., sold Millennium the land, contingent on local and federal approvals. Ford blamed the sale on hard times for farmers, Leanne said.

“It was the last large farm in the area,” she said. “If he’d come to the neighbors, we could have made the land a park, and he would have been a hero.” She feels that both local and federal officials failed the community.

“We thought, how can they be so blind? But the government says industry must survive. Get out of the way. The federal decision was the hardest. Where do we go from here? We were bogged down by the house and mortgage. You can’t just walk away, can you? But we started taking the house apart, downsizing, giving away furniture. We packed like we were moving, with no destination in mind. It was kind of bizarre. We stopped paying the mortgage and decided we’d step away at some point.”

When Brown explained the health survey results that was the “catalyst,” said Baum. “Would I be taking one of my children for chemotherapy in 15 years because we’d stayed too long?”

The Baums had visited friends in the Midwest over the winter, and their friends connected Rob with a job possibility. Early in 2015 he received an offer and decided to take it. He would be shifting from a white collar job as corporate buyer for an outdoor equipment company to a blue collar job digging water wells.

“My husband is a Renaissance man who does what he puts his mind to. Now he comes home dirty,” said Leanne.

The Baums are working with the bank to get a “deed in lieu of foreclosure.”

“We didn’t just drop the keys on the doorstep,” says Leann. “But our credit is severely damaged.”

They now live in a rented house in a Midwestern city.

“People say to us, ‘You uprooted your family to start a new job. What made you do that? We sit them down and explain,’” says Leann. “On the street downtown, we see people walk past petitions to stop fracking. It’s not on their radar.”

*Retrieved on April 18, 2016 from:*

<http://www.riverreporter.com/news/4302/2015/11/24/house-abandoned-because-compressor-station-family-walks-away-250000>

People's Dossier: FERC's Abuses of Power and Law  
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**Deficient EIS Analysis Attachment 7, Neighbors  
Oppose Wawayanda Gas Plant; Health Concerns Top the  
List, July 31, 2015.**

# Neighbors oppose Wawayanda gas plant; Health concerns top the list

By JESSICA COHEN

July 31, 2015 —

WAWAYANDA, NY — Community fears about toxic emissions from the Competitive Power Ventures (CPV) gas power plant planned for Wawayanda, NY, have not troubled town supervisor John Razzano. He expressed skepticism about reports of adverse health effects among residents near the Minisink gas compressor seven miles away.

The compressor releases just a fraction of the same emissions the plant would produce. One Minisink family, unable to sell their house, abandoned it. Others sold at a loss, fearing the health implications of symptoms that appeared when the compressor began operation.

“People often oppose projects,” said Razzano, “but we hired environmental consultants, and the Department of Environmental Conservation issued a permit.”

He points to the \$1 million a year the plant would pay in school taxes and the \$100 million construction payroll that would result from building the plant.

But Pramilla Malick, of Minisink, founder of Protect Orange County, says only 25 jobs would remain in the area, and construction workers would come from elsewhere. She is also concerned by the impending acquisition of CPV by foreign investors, Global Infrastructure Partners II. While ownership becomes more distant, health hazards are local.

Malick cites the work of environmental health expert David Brown, who has documented symptom patterns among Minisink residents. Brown, at 78, is a veteran in the world of environmental health, having been Connecticut Chief of Environmental Epidemiology and Occupational Health, and an investigator of superfund sites for the U.S. Centers for Disease Control. Employing a doctor to survey residents, Brown found that common Minisink ailments mirror what another environmental health expert, Wilma Subra, has found around the country, not only near gas compressor stations, but also gas power plants and gas drilling sites.

Subra typically finds symptoms such as asthma, allergies, coughs, nosebleeds, dizziness, weakness and rashes among 90% of residents and workers in a two- to three-mile radius of gas infrastructure. Symptoms are “more frequent and severe” around power plants, Subra says. Resulting chronic ailments she cites include lung, cardiovascular, reproductive, liver, kidney, and neurological damage; birth defects and leukemia.

“People have memory loss and confusion and trouble picking things up,” Subra says. “Babies are born missing fingers and toes.”

Subra was awarded a MacArthur Fellowship “genius grant” for her community environmental work and periodically consults for the U.S. Environmental Protection Agency. She identified symptom patterns using surveys and found toxic chemicals from gas infrastructure emissions in residents’ air.

Their symptoms resemble those of the Parr family, who lived near Aruba Petroleum’s hydraulic fracturing (gas fracking) site in Decatur, TX. The family was awarded \$2.95 million last year in a lawsuit alleging that environmental contamination from drilling sickened them, their livestock, and pets, compelling them to leave their home. Subra provided testimony, including evidence of toxic gas emission chemicals in the family’s blood.

“We’ve told the EPA and state agencies,” says Subra. “But they still grant the permits. They say emissions meet regulatory requirements. So it’s important to educate people about impacts coming their way.”

CPV spokesman Steve Sullivan, managing director of Power Communications in Saratoga Springs, rebutted her findings. Of the plant’s emissions, he said “They’re dispersed and diluted over such a wide area with such a high volume of air that they do not appreciably impact local air quality. Think of an eyedropper of lemon juice in an Olympic swimming pool. This is precisely why the stacks are so tall.”

However, Brown points out that not all smokestack emissions go elsewhere. Weather variations alter their direction, causing “looping” that brings plumes back down near their origin. Also, he says, “fugitive emissions” escape from other parts of the plant.

To compensate for emissions exceeding local limits, CPV bought emission reduction credits from other companies not using their permitted amounts. But those companies are in Philadelphia, 375 miles away.

CPV ERCs include credits for 75 tons of volatile organic compounds, which the World Health Organization deems unsafe and carcinogenic in any amount. So CPV’s total VOC emissions annually are actually 140 tons, more than twice the local limit. On an average day, the plant would emit a volume of VOCs that could fill a large barn.

Although Sullivan noted that emissions will be continuously monitored “like an electrocardiogram,” the only emissions that will be monitored in that way are carbon dioxide, oxygen, nitrous oxides and sulphur dioxide. The latter two have been found to promote heart and lung disease.

Other emissions include 95 tons annually of fine particulate matter (PM 2.5), more than a quarter ton per day. In addition to promoting and exacerbating respiratory and cardiovascular ailments, a recent study showed its potential to harm fetuses. When women are exposed to high levels of fine particulate matter during her third trimester of pregnancy, the baby’s risk of autism doubles, according to a study published in *Environmental Health Perspectives* in December by Harvard epidemiologist Marc Weisskopf and his colleagues.

Even small increases in PM 2.5 increase mortality rates, according to a new study by Harvard Environmental Epidemiology Professor Joel Schwartz and his colleagues, published in Environmental Health Perspectives in June 2015. They found that any environmental increases of PM 2.5, even at substantially below the EPA limit, significantly increased rates of mortality from all causes for the 65 and over age group they studied in New England, using Medicare and zip code data.

For every microgram of particle concentration increase, the death rate increased by 1% in the areas they investigated. They focused on places where particle levels were less than 10 micrograms per cubic meter, significantly below the 12 micrograms limit imposed by the EPA, demonstrating that EPA limits on PM 2.5 fail to protect the populace. PM 2.5 generates inflammation throughout the body, stimulating white blood cell production. Among other consequences this causes scabbing in plaque in the arteries, increasing the likelihood of a heart attack.

Smokestacks merely spread particle emissions, so the mortality increase is dispersed over a wider area, says Schwartz, but the same number of people die.

“PM 2.5 emissions could be minimized by using a fabric filter,” he says. “Any emissions can be reduced. It just has to be required.”

But when the EPA tries to further limit emissions, industry sues, Schwartz says. He has observed the incapacitation of the EPA, as Congress shrinks the agency’s budget. He recently attended an American Thoracic Society meeting, where he usually sees a dozen EPA representatives presenting studies on pollution.

“This year maybe one showed up,” said Schwartz. “They have very little money for research or travel.”

Meanwhile, Sullivan, the CPV spokesman, cited the power plant emissions analysis provided by Gradient Corporation, in Cambridge, MA. They explained emissions in terms of equivalencies, for instance asserting that one year at “maximum ground-level exposure to fine particulate matter” would be “equivalent to 3.2 hours mowing the lawn with a gas-powered lawn mower.”

As for Gradient’s consultants, Sullivan described them as “former Harvard School of Public Health professors.” But David Brown, whose doctorate in toxicology is from Harvard, describes them as “apologists” for industrial polluters.

“They make these goofy comparisons that are nonsense,” he says. “They’re ubiquitous. They’re always there, saying there’s no problem. If you want a plant approved, you go to them.”

By segmenting and averaging emissions over long periods and shortening technology operation periods, he says, emissions levels can be calculated that fall below a level designated “major source.” A project designated “major source” necessitates an Environmental Impact Assessment that requires hazards to be more thoroughly investigated. Brown sees such an investigation as crucial for gas compressors and power plants, but avoided by analyses such as Gradient prepares.

“For a major source, they’d have to evaluate all the chemicals coming out of the plant,” says Brown. “Health standards rather than regulatory standards would come into play.”

The EPA process of developing regulatory standards begins with a panel of scientists establishing “health standards,” he says. “Regulatory standards” are revisions of health standards that result from industry representatives’ challenges and legal actions, a process confirmed by EPA spokesperson Enesta Jones.

“A compromise is reached that balances costs and benefits,” says Brown. “Some number of injured are allowed with regulatory standards, to avoid higher costs to industry. Regular reviews are required every so many years, but they never happen, because of cost and political influence. Consequently, regulatory standards are usually much weaker than health standards.”

Jones said EPA officials declined to comment on the record about findings of Brown and Subra that indicate health problems resulting from weak gas regulations. Also asked about those findings, New York State Department of Environmental Conservation spokesperson Wendy Rosenbach said she referred the questions to air quality staff but received no answer.

As a consultant with Southwest Pennsylvania Environmental Health Project, Brown has been studying adverse health effects around fracked gas infrastructure, which, he predicts, will likely become superfund sites.

“Seeing the victims of superfund sites is the saddest thing,” he says. “They usually result from the oversight failures of local government.”

The avoidance of “major source” designation concerns him.

“Without detailed information on ground water releases, air emissions and dispersion into the community, it’s impossible to determine the safety of living near any natural gas facility,” Brown says. “Without an environmental impact assessment, setbacks from schools, hospitals, daycare centers, and nursing homes are not required.”

In such circumstances, he says, “The local health director is the only entity who can require that information on health and safety under the public health code.”

Laws giving local health directors that power date back to epidemics when emergency directives were needed to stop the spread of illnesses, he says.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 8, NH Pipeline  
Committee Letter to Secretary Bose, January 14, 2016.**

January 14, 2016

Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street NE Room 1 A  
Washington, DC 20426

re: Tennessee Gas Pipeline Company, L.L.C., Docket No. CP16-21

From Mason (NH) Pipeline Committee

RE: Protection from the Health Impacts of Compressor Stations is Lacking – **Baseline Air Quality Studies Needed Near Proposed Compressor Sites**

Dear Secretary Bose:

The health effects of gas pipeline compressor stations have been documented by EPA, the SW Pennsylvania Health Project, environmental chemist Wilma Subra of Earthworks, and Dr. Curtis Norgaard, Boston pediatrician. These researchers find the following **medical conditions prevalent in individuals living in close proximity to compressor stations**:

- \* More than half the people suffer from respiratory impacts, throat and nasal irritation, weakness and fatigue and muscle pains.
- \* Close to half the people suffer from vision impairment and sleep disturbance.
- \* 42% suffer from allergies, eye irritation, and sinus problems.
- \* 39% suffer from joint pain, breathing difficulties and severe headaches.

The chemicals detected in the air near compressor stations are associated with these medical conditions.

The chemicals of most concern are three carcinogens -- benzene, formaldehyde and radon -- as well as nitrogen dioxide and fine particulates (PM2.5). PM2.5 acts to increase deep lung absorption of air pollutants. Other volatile organic compounds (VOCS) and hazardous air pollutants (HAPS) are emitted by compressor stations. The mixture of these chemicals in the air people breathe contributes to an array of negative health effects.

Subra has documented acute and chronic health impacts experienced by people living and working near compressor stations. **In addition to the above prevalent conditions, many people suffer the following acute impacts:**

- \* Nausea, vomiting
- \* Dizziness, light-headedness
- \* Irregular heartbeat
- \* Depression, anxiety

**Serious chronic long-term impacts that have been documented are:**

- \* Damage to Liver, Lung, Kidney, Cardiovascular system
- \* Damage to Developing Fetus and Reproductive system
- \* Mutagenic Impacts and Developmental Malformations
- \* Brain impacts and Damage to Nervous system
- \* Aplastic Anemia
- \* Leukemia, and Changes in Blood Cells and Blood Clotting Ability

From EPA Office of Inspector General: (Report No. 13-P-0161, Feb, 20, 2013, page 3)

**“EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector”**

**Table 2: Health impacts of significant pollutants emitted from upstream oil and gas production activities**

<b>Greenhouse gases (methane/ carbon dioxide)</b>	Potential health impacts related to climate change will vary, but threats include increased incidence of serious infectious disease, extreme temperatures that lead directly to loss of life, and warmer temperatures that can increase air and water pollution and result in human health impacts.
<b>NOx and VOCs, which contribute to ground-level ozone</b>	Health impacts may include reduction of lung function, inflammation of airways, aggravation of asthma, increased susceptibility to respiratory illnesses (e.g., pneumonia and bronchitis) and premature death. Vulnerable populations (e.g., people with lung disease, children, and the elderly) are especially at risk.
<b>Fine particulate matter (PM 2.5)</b>	Health impacts may include worsening of lung function, asthma attacks, bronchitis, increased susceptibility to respiratory infections, and premature death.
<b>Air toxics including benzene, toluene, ethylbenzene, and xylenes</b>	Health impacts from short-term exposure may include skin and sensory irritation, central nervous system problems, and respiratory problems. Health impacts from long-term exposure may include problems with kidney, liver, and blood systems. For example, benzene is a human carcinogen and health impacts from short-term exposure may include drowsiness, dizziness, headaches, and irritation of the eyes, skin, and respiratory tract. Long-term exposure has been linked to various blood disorders, reproductive effects, and increased incidence of leukemia.

EPA is aware of these health problems associated with compressor stations and other fracked gas infrastructure, but other than gathering more data to document these problems EPA has failed so far to establish air quality standards to protect people exposed to fracked gas infrastructure emissions.

Neither does NHDES appear to have air quality standards that would be protective. Both agencies consider compressor stations to be “minor” emitters, based on the National Ambient Air Quality Standards (NAAQS). These standards measure pollutants in tons per year averages, a totally inadequate measure for pollutants that may vary wildly over the course of a day or week -- from nothing at all to peaks many times the EPA limit. Human health is much more affected by frequency and duration of peak pollutant emissions, not annual averages. (Madison County NY Dept of Health Comments to FERC, Docket CP14-497, 10/15/2014)

Compressor stations have wide variations in their emissions from day to day and over the course of a day. Averaging pollutants in tons per year allows KM/TGP to say they meet EPA's air quality standards, while masking the extreme peaks of pollutants that compressor stations frequently emit.

It is a shame that EPA has so far failed to establish relevant air quality standards to adequately protect human health from compressor station emissions.

In southern NH the NED gas pipeline proposes a huge 41,000 HP compressor station that would affect air quality and human health in the towns of New Ipswich, Greenville, Temple, Mason, and Rindge. TGP has mapped 13 proposed alternative sites in or near these towns for Market Path Station 4. In addition, Market Path Station 3, also 41,000 HP, is proposed for MA or NH: 3 of its proposed alternative sites are located in Winchesster, NH.

**Baseline air quality in compressor station impacted areas needs to be established before NED is constructed, to determine air quality impacts from the proposed compressor stations.**

Ground level air sampling for benzene, formaldehyde, fine particulates (PM2.5), nitrogen dioxide and radon needs to be done on a periodic (perhaps monthly) basis throughout the year before construction begins, at sites near all sensitive receptors within 2 miles of all proposed compressor locations.

Mason Pipeline Committee asks FERC to require Tennessee Gas Pipeline Co. to fund air quality baseline studies that meet the above parameters in all areas where compressor station are proposed along NED's entire route, to gather baseline data on the air pollutants listed above. These studies should be done by independent contractors who have not previously worked for KM/TGP and do not anticipate doing so.

When private project developers apply to permitting agencies, they are often required to fund relevant studies by independent contractors to gauge the project's impact. Please apply these sensible standards to the NED project.

Sincerely,



Liz Fletcher  
For Mason NH Pipeline Committee

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The following publications are sources of health data quoted in this comment:

EPA Office of Inspector General, "EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector" Report No. 13-P-0161, Feb, 20, 2013

Macey et al. "Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study" Environmental Health 2014.13:82

Madison County, New York, Dept of Health, Comments to FERC, Docket CP14-497-000, Dominion Transmission, Oct. 15, 2014

Southwest Pennsylvania Environmental Health Project, "Summary on Compressor Stations and Health Impacts" Feb, 24, 2015.

Dr. Curtis Norgaard, speaking in Temple as reported in Monadnock Ledger Transcript by journalist Ashley Saari, December 17, 2015.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 9**, Times Union,  
*Bethlehem Lawmakers Oppose Natural Gas Pipeline*,  
February 11, 2016.

[blog.timesunion.com](http://blog.timesunion.com)

# Bethlehem lawmakers oppose natural gas pipeline

By Brian Nearing on February 11, 2016 at 3:23 PM

On Wednesday, the Bethlehem Town Board voted to oppose the planned Northeast Energy Direct (NED) natural gas pipeline that would pass through southern portions of Albany and Rensselaer counties to bring natural gas from Pennsylvania to metropolitan Boston.

Lawmakers urged a comprehensive health study of the pipeline's potential health effects and urged that the state take no action on required state permits until after the study was finished, according to the [resolution](#) adopted Wednesday. The measure also urged the Federal Energy Regulatory Commission to deny the project.

Houston-based energy company Kinder Morgan is seeking federal approval to build the \$5 billion NED pipeline to bring natural gas more than 400 miles from the hydrofrack fields of Pennsylvania to northern Massachusetts and Boston. The proposed expansion also would connect into the company's existing Iroquois pipeline in the Schoharie County town of Wright.

The 30-inch pipeline's northward route would take it through Schoharie County and southern Albany County towns of Knox, Berne, New Scotland and Bethlehem before crossing beneath the Hudson River at Schodack.

It would then continue through Schodack, Nassau and Stephentown. It would head northeast, continue to south of Burden Lake and on to the intersection of routes 43 and 66 at the hamlet of Alps. From there, it would run along Route 43 in Nassau and Stephentown for 14 miles before crossing into Massachusetts at Hancock for the rest of its eastward route.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 10**, Union  
Hill/Woods Corner Rural Historic District Comments on  
Docket No. CP15-554, June 2, 2016.

Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, DC 20426

Union Hill/Woods Corner Rural Historic District: FERC DOCKET NOs: CP15-554-000 et al.

Dear Secretary Bose,

We write to FERC to register our greatest concerns for the historic preservation of the Union Hill/Woods Corner Rural Historic District – a 2+ mile district of former plantation lands and buildings, colonial and slave cemeteries, historic Black churches, historic Black schools – proposed for the only ACP compressor station in Virginia in Buckingham County. We are a working body of preservationists and concerned citizens who reside in and have close family ties to this highest direct impact zone of the proposed ACP project in Virginia.

The cultural resource survey work done by ACP LLC, completed July 2015 as reported to FERC, is more than woefully inadequate. In fact, there is no actual cultural resource work done by ACP contractors on the proposed compressor station site. This is an egregious omission. ACP LLC purchased land secretly for this proposed complex and never contacted landowners that their lands now bordered a proposed major industrial complex with a plan to intersect the Transco Pipeline at this site. This intensification of pipeline networks, feeder lines, and 3 above ground storage facilities all combine to ensure that Union Hill/Woods Corner Rural Historic District will face the highest threats to all historical cultural resources of any place in Virginia.

98% of the landowners are African American whose property shares boundaries with the land purchased for the compressor station in secrecy. Many are descendants of slaves who purchased this land as Freedmen before or after Emancipation, and whose slave family burials lie in cemeteries or smaller clusters in the impact zone. In this district, there are 4 standing historic Black churches with 18th – 21st C cemeteries (Union Hill Baptist, Union Grove Baptist, Mulberry Grove Baptist, and Mt. Joy Baptist); 2 sites of historic Black schools at Union Hill and Union Grove; a large (100+) slave burial ground on the former Variety Shades plantation land, part of which was sold for the compressor station. In addition, in close proximity to the compressor station site are also standing plantation homes, Wilderness, two Woods' family homes, Willow Lake, National Historic Register home Perry Hill, all with 18th - 20th C cemeteries, Mt. Tabor Church (historic White) and cemetery, and many more. Taken together these resources represent a deeply significant place of plantation history for Virginia and American History.

We submitted an application to Preservation Virginia, the nation's oldest statewide historic preservation organization, established in 1889, for Most Endangered Historic Place in Virginia for the Union Hill/Woods Corner Rural Historic District. On May 3, 2016, the compressor station district was granted this status. In addition, taken as a whole, all slave cemeteries in Virginia were named by Preservation Virginia as Most Endangered Historic Places, thus magnifying awareness of threats to historic preservation of this rural district. The reasons cited for both listings are that slave history has been largely erased by non-recognition of its importance to both Virginia and American history. This district has great historic potential for slave history tourism since at the moment these burials and landscapes are untouched by development, maintaining their rural historic character.

Preservation Virginia has offered support with needed archaeological and cultural expertise necessary to identify and document our district's historic resources, which have been – especially in the case of

slave family histories in Buckingham – quite scarcely documented to date. Buckingham County’s representative to the Virginia Department of Historic Resources (VDHR) suggests we now file the initial PIF application for eligibility for nomination for National Register of Rural Historic District status.

We consider it gravely important that FERC consider the significance of Dominion Power and its partners choosing to locate the most harmful infrastructural threat to historic cultural resources of the ACP pipeline in Virginia on a former plantation – land sold for the compressor station by descendants of white plantation owners -- that will most greatly harm slave descendants’ health, current land uses, family burials, history, and land values by nearness to its operations.

The Union Hill/Woods Corner Rural Historic District preservation team is actively engaged with local historians and preservationists, including descendants of families who have owned property in this district since the early 1700s. Groups composed of local residents who have in-depth knowledge of the structures, landscapes and family histories of both White colonial and Black slave histories include the Buckingham African American Historical Society and members of the Buckingham Historical Society.

Thank you for considering a requirement that ACP LLC conduct cultural resource surveys to redress neglect toward historic cultural threats to the compressor station environs. We will follow this comment with many photographs of neglected historic resources that led to this rural district’s designation as a Most Endangered Historic Place.

Sincerely,

Lakshmi Fjord, Ph.D., Scholar in residence, Dept. of Anthropology, University of Virginia  
Charles R. White, historian, Chair of the African American Historical Society of Buckingham  
John & Ruby Laury, local residents, descendants of slaves & Freedmen landowners  
Chad Oba, local landowner, Chair of Friends of Buckingham  
Quinn Robinson, local resident, descendant of landowners from 1852  
Dorothy Bowling, local resident, member of African American Historical Society of Buckingham,  
descendant of slaves & Freedman landowners  
Justin Sarafin, Director of Historic Preservation Initiatives, Preservation Virginia  
Sonja Ingram, Staff Archaeologist, Preservation Virginia

Document Content(s)

Union Hill comment 6.2.16.DOCX.....1-2

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 11**, Delaware Riverkeeper Network, Field-Truthing and Monitoring of the Proposed PennEast Pipeline, FERC Draft EIS, September 2016.

**Field-Truthing and Monitoring of the Proposed PennEast Pipeline,  
FERC Draft EIS, Docket No. CP15-558**



September, 2016

Prepared by: Delaware Riverkeeper Network

Thank you to Dr. Ann Rhoads, Sarah Chamberlain, Steve Kunz, Stephen Sousa, Betsy Leppo, Stephen Metts, Darren Klein, Mike Spille, Fairfax Hutter, Bob Dahl, and the volunteer monitors and community who provided technical reviews, species ID, photo documentation, expertise or their time to help document habitats along the Penn East Pipeline route.

## **Introduction**

Delaware Riverkeeper Network (DRN) conducted visual assessments and stream monitoring along sections of the proposed Penn East pipeline route as part of ground-truthing information supplied for the Federal Energy and Regulatory (FERC) Draft Environmental Impact Statement (DEIS) for the proposed Penn East Pipeline project. DRN walked accessible portions of the pipeline route, focusing on areas where forested habitats, steep slope impacts, and stream and wetland impacts would occur with a goal to spot check information provided about these impacts in the FERC DEIS and to determine how well these resources were mapped out in the field. Spot areas monitored targeted sections of the pipeline route proposed to be located in Pennsylvania State Gameland (SGL) 168, Appalachian Trail across Blue Mountain, Ted Stiles Preserve at Baldpate Mountain in New Jersey, and proposed stream crossings of Alexauken Creek, Wickecheoke Creek and Harihokake Creek, three C1 streams in New Jersey.

## **Methods**

DRN used a combination of Penn East wetland delineation maps and reports (dated Sept 2015 and 3/3/2016), the FERC DEIS (August, 2016), PE alignment sheets Revision D (dated 9/23/2015), and digitized GIS based field mapping tools (Sept., 2015 route and Feb, 2015 route) to conduct assessments. Photo documentation and habitat assessments were conducted along areas of the proposed pipeline route. For C1 stream assessments, each stream station was assessed and selected based on its proximity to an existing Right of Way (ROW) or proposed PE route, accessibility and property permissions. Calibrated automatic temperature probes (HOBO) were temporarily installed into the stream water column to document hourly summer water temperatures from Mid-August to early September. DRN used approved PA DEP methodologies for probe placement and referenced New Jersey's Integrated 303 (d) listings and water quality classifications to select stream locations.<sup>1</sup>

## **Mapping Errors, Inadequate and Incomplete Information in DEIS**

### **Flaws in Wetlands Analyses – Avoidance & Minimization Measures not Fully Considered**

According to the FERC DEIS, construction of the PE pipeline would temporarily impact 56 acres of wetlands (26 acres in Pennsylvania and 30 acres in New Jersey) and permanently impact about 35 acres of wetlands (17 acres in Pennsylvania and 18 acres in New Jersey). According to the DEIS, in New Jersey, 17.57 acres of forested or scrub shrub wetlands will be permanently converted to herbaceous wetland and in Pennsylvania 17.27 acres of forested or scrub shrub wetlands will be permanently converted to herbaceous wetland. Wetland crossing widths in Pennsylvania and New Jersey are estimated in the DEIS to be 22,541 ft. and 16,443 ft., respectively. Wetland crossings proposed, are mostly proposed to be open cuts and at least 173 wetlands are proposed for open cut methods which are documented to leave long term and cascading impacts to these sensitive habitats often including but not limited to changes in hydrology, temperature changes, potential invasive plant colonization, and nutrient changes.<sup>ii</sup> The FERC DEIS states that *“emergent vegetation regenerates quickly (in wetlands), typically within one to three years and in scrub shrub and forested wetlands, PE would maintain a 10 foot wide corridor centered over the pipeline in an herbaceous state and would selectively cut trees within a 30-foot-wide corridor centered over the pipeline. The remainder of forested and scrub-shrub vegetation would be allowed to return to preconstruction conditions and would not be affected during operation. No permanent fill or loss of wetland area would result from construction and operation of the Project.”* DRN has documented continued and irreversible impacts to wetlands from pipeline crossings that are sustained beyond this short term view, especially in forested wetlands where tree regrowth can take decades to recover.<sup>iii</sup> In light of deer browse and other impacts to changed soils, trees may never establish as they had prior to the ROW impact in these forested wetlands. Invasive plant species often move into these wetlands and impact the wetland ecology long term.<sup>iv</sup>

These impacts are not fully outlined in the DEIS and the wetland habitats themselves to be impacted are not all accurately included or represented in the DEIS and have missing information regarding their features and habitats. While the DEIS states that FERC acknowledges that not all wetland surveys, especially related to vernal pools, are completed it recommends that PE, prior to construction, will provide a revised table of impacts on vernal pools within or near proposed workspaces based on completed surveys.

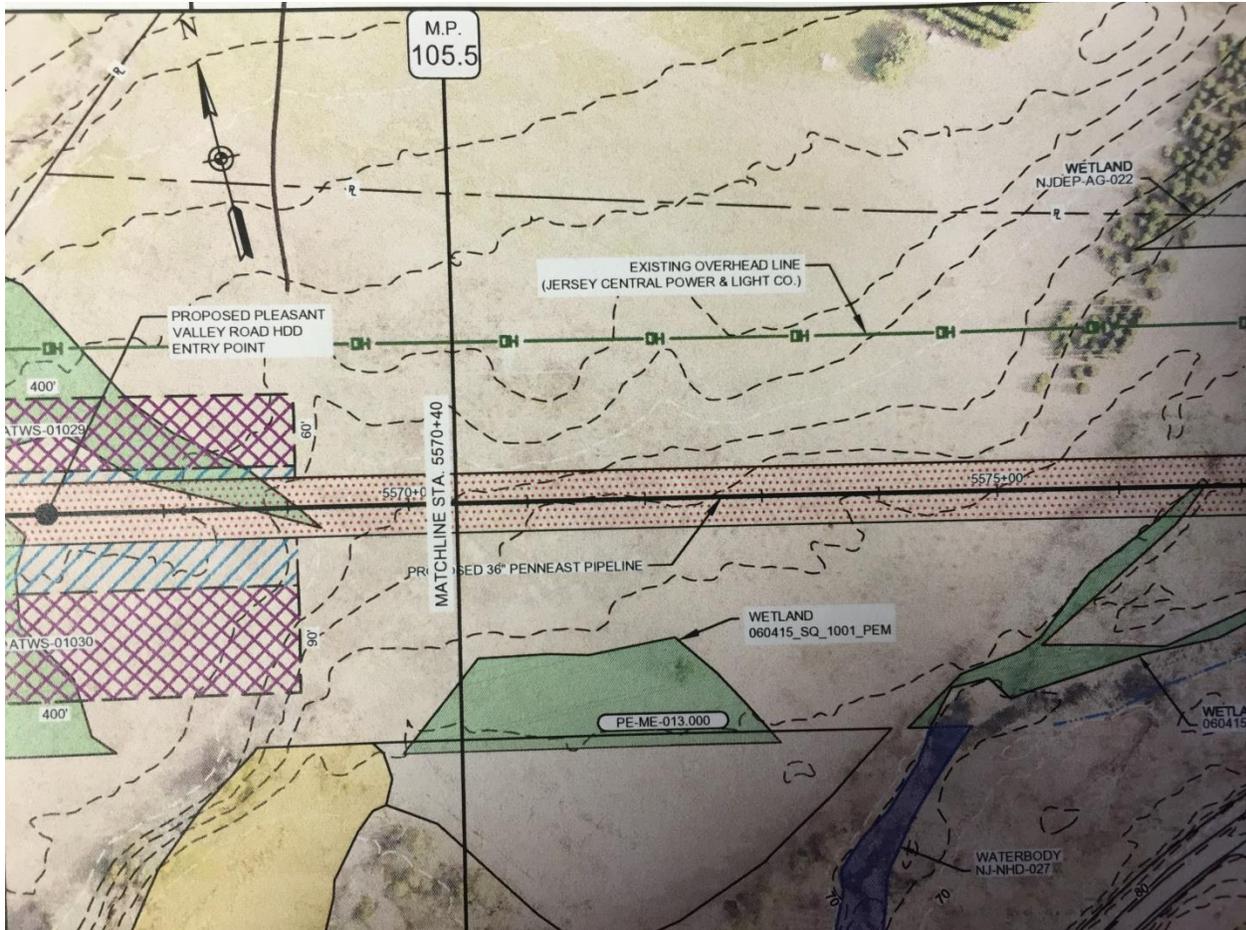
Upon limited field reviews and alignment sheet reviews by DRN and field reviews provided by Schmid & Company<sup>y</sup>, the characterization of wetland impacts by FERC is erroneous, inadequate and incomplete. FERC's rationale and request of updated wetland information being provided before construction does not allow for thorough and adequate public and technical review. Given the wealth of inaccuracies and misinformation the Delaware Riverkeeper Network and experts have documented regarding the wetlands and vernal pools, and/or lack thereof, in areas where PennEast has fully surveyed and intends to engage in construction, operation and maintenance activities, demonstrates that third party public vetting of any claimed future data is necessary. FERC's rationale that jurisdiction by other agencies will lead to proper mitigation and restoration is also not based on science and restoration ecological principles and what is actually observed on the ground.

The DEIS states that there is only one wetland along the PE route with "extremely saturated soils" and requests PE identify special construction techniques for wetlands as well as justification of any resulting required additional workspace for crossings of these saturated wetland soils. It is unclear what FERC means by highlighting this one wetland. By nature, most wetlands have saturated soils and most wetland crossings identified in the PE alignment sheets indicate significant temporary work space (TWS) and additional temporary work space (ATWS) that are often located just adjacent to the waterbody and wetland and that often involve the cutting of mature trees and compaction of soils adjacent to those wetlands. In some instances ATWS is proposed to be located in actual wetlands. Avoidance and minimization of these wetlands are not being fully considered. The DEIS lists 211 wetland and waterbodies that are proposed to have ATWS impacts within 50 feet of these wetlands and waterbodies (Table G-10) which is the majority of waterbodies to be cut. PE states and FERC agrees that citing ATWS within 50 ft of wetlands is justified and allowed for when the following conditions occur: HDD under roads and interstates, to store excavated material, to cross steep slope and wetlands, and to cross railroad corridors. Minor and major road crossings alone appear to jeopardize sensitive wetland habitats in at least 59 wetlands (Table G-10).

PE is proposing Open Cut trenching for 130 of the wetlands proposed to be crossed. Other wetlands not cut by open cut are noted in the DEIS as N/A for crossing type – it is unclear what

is meant by N/A – there is no description of that condition in the notes of the table (Table G-11). Still a few other wetlands are noted as Bore/Open Cut or Open Cut/HDD. Despite open cuts making up the majority of the waterbody crossings and despite the exceptions of allowing ATWS within 50 feet of sensitive wetlands at least in 211 instances, FERC concludes that there is adequate justification for ATWSs and that there will be minimal harm. FERC's conclusion is a false conclusion and avoidance of these sensitive areas was not fully and adequately investigated.

HDD long borings should be considered and analyzed for feasibility for each and every waterbody crossing along the route to reduce impacts to sensitive habitats.<sup>vi</sup> However, in some instances, HDD entrance and exit points which often require large land clearings and impacts to soils are proposed by PE to be located in sensitive wetland and forested habitats. This practice is another indication that avoidance and minimization is not fully being considered for wetlands and waterbodies and the most technological advanced measures and proper citing of HDD are not being considered. For example, in Mercer Co. New Jersey, a horizontal directional drill (HDD) is proposed under Pleasant Valley Rd. and an adjacent stream and wetland complex (between MP 105.5 and 106.0) (see figure 1). However, in this instance, the HDD entry point is proposed to be located at MP 105.4 and within a large PEM wetland complex (1002-PEM and 1001-PEM). According to alignment sheets, that HDD entry point in the wetland would require temporary work space on either side of the permanent ROW in addition to a 400' by 90' and 400' by 60' ATWS on either side of the permanent ROW within the wetland. It would be less impactful to extend the HDD entry point westward away from the waterbody or forest to reduce impacts and to encourage longer HDD borings to better avoid impacts from open cuts.



**Figure 1. Penn East Alignment Drawing 000-03-01-212 Revision D. Illustrating an HDD entry work space within a wetland**

The exit point for this same proposed HDD section is proposed just adjacent another wetland complex and just north of and paralleling a stream (see figure 2). The faded aerial overlays that are provided by Penn East in alignment sheets are unclear but it appears mature trees may be cut for this HDD exit point. Again, it would be less impactful to extend the HDD to a location where already impacted land would not be harmed since technology is feasible to drill for longer segments, thereby reducing impacts. An HDD should be required in this MP area to minimize harm to the point pleasant wetland and stream complex but the citing for the exit and entrance points is inappropriate yet it has been deemed acceptable impact by FERC.

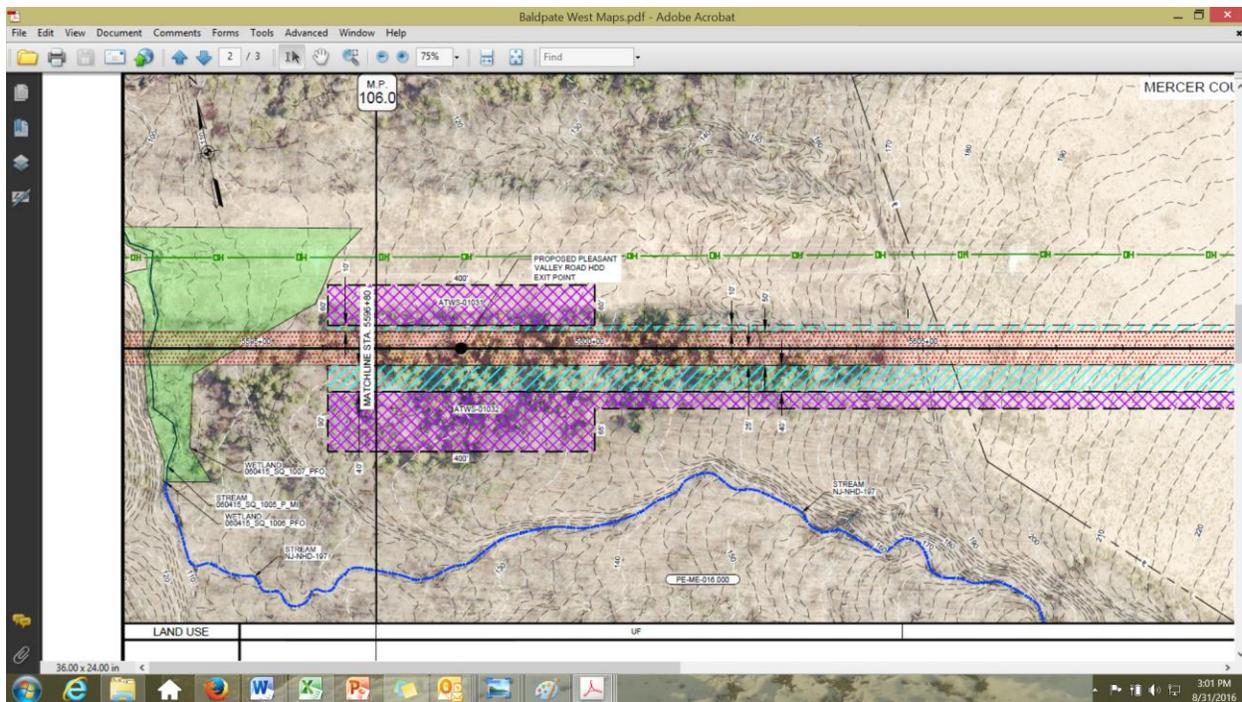


Figure 2. Penn East Alignment Drawing 000-03-01-213 Revision D. Illustrating an HDD exit work space adjacent a wetland and parallel a stream. Mature trees also appear to possibly located in this reach though faded alignments are provided by PE which make land use determination difficult.

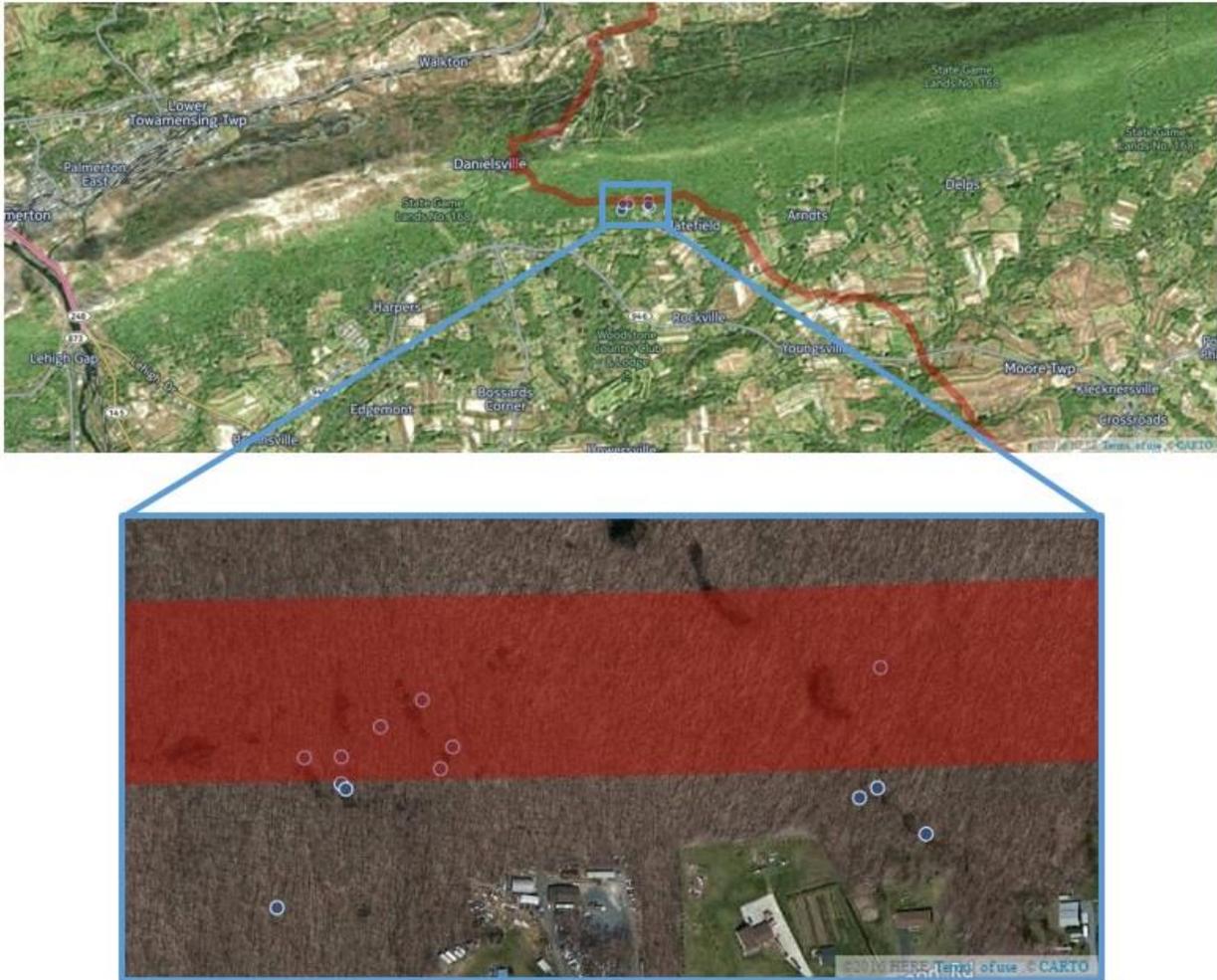
## FERC Analysis Flaws, Missing Vernal Pool Habitat Documentation & Incomplete Cumulative Review of Impacts to Amphibians

FERC's recommendation in the DEIS that PE provide missing information on vernal pools and revise its impact tables on vernal pools within or near the proposed workspace before construction is not protective of these important wetlands types nor adequate for public review or proper avoidance or minimization of these impacts.

The FERC DEIS states that approximately 0.13 acre of vernal pool habitats would be impacted by construction of the Project, with 0.11 acre permanently impacted during operation. Based on the sensitive areas along the 115 mile proposed route, this acreage sounds low. Spot field checks in short sections of already surveyed areas of the route, make clear that vernal pools and wetlands have been missed and not accurately depicted by field surveys or the DEIS.

For example, DRN field-truthed and surveyed SGL 168 along MP 52.4 to MP 52.9 on August 28, 2016 after reviewing PE wetland delineation maps (maps not part of the DEIS) and alignment

sheets (Revision D) that showed there were only three vernal pool habitats present in this area of the route. (072415\_JC\_1001\_VP, 072415\_JC\_1003\_VP, 72415\_JC\_1002\_VP on Figure 3 Sheets 129 and 130, PE wetland delineation map). When DRN assessed and walked this section of pipeline, it was clear vernal pool habitats were missed even in areas that PE has noted as being surveyed. DRN documented 12 vernal pools or potential vernal pool complexes and groundwater seeps and depressions that may serve as habitat along this same area of the pipeline route (see Figure 3). Table G-11 of the DEIS notes only two vernal pools in this area at MP 52.4 and MP 52.6 and both are forested yet an open cut (25 feet and 67 feet) is the crossing type PE is proposing. One stream, an UNT to Indian Creek at 52.4 is documented by PE on Table G-7. No groundwater seeps or springs have been documented by PE in this area. This is not protective of the vernal forested pool habitats that obligate and facultative vernal pool species require and it also does not include or map all vernal pools and groundwater seeps that were present in this reach of the proposed route. Table G-11 in the FERC EIS and the wetland delineation maps provided by PE are also not consistent.



**Figure 3: Vernal pools and groundwater seeps along base of Blue Mountain. Note red line depicts pipeline route with 400 ft. survey area. Herpetologists recommend 1,000 ft buffer of upland to protect vernal pool species.**

This section of the pipeline route is in a stretch of high quality PA State Gameland 168 forest that has sensitive vernal pool species present since surrounding upland intact mature forest is present – a much needed component for vernal pool species during times of the year when the vernal pools are dry. Protecting vernal pools and the surrounding 1,000 feet of upland habitat is critical for protection of water quality, amphibian breeding, and terrestrial habitat for adult and juvenile amphibians.<sup>vii</sup> Residents along Cottonwood Drive that are about 500 feet from the proposed route and that back up to the SGL property forest, have noted amphibian calls during the breeding season.

Furthermore, this area that DRN field truthed was in an area that PE stated they had surveyed. However during assessment of this route, there were only a few pink flags marked by the PE surveyors for a short section of the route and no wetland flagging at all was present at vernal pools located along the proposed route. The pipeline route either intersects or runs adjacent to these vernal pool areas which would inflict harm to species that rely on these vernal pool wetlands to breed yet no documentation of these actual surrounding habitats is provided by PE in the information provided in the DEIS.

Though these photos were taken during the dry season on August 29, 2016, it is evident that they likely serve as wetland vernal pool areas during the vernal pool season.



**Figure 4. Note depression, stained leaves, cardinal flower in bloom and ground indicative of forested vernal pools**



**Figure 5. This depression - another likely seasonal vernal pool habitat not identified in the DEIS or maps.**



**Figure 6: note buttressed tree roots, sedges, depression, stained leaves and ground indicative of forested vernal pools – a third vernal pool that was not positively ID'd in the DEIS or maps.**

These omissions and lack of FERC considering upland habitat impacts 1000 feet surrounding these habitats in the DEIS exemplifies the incomplete assessments that were provided for wetland and vernal pool features even when they are located in areas as sensitive and accessible as PA State Gamelands. Given that this area was already surveyed by PennEast, and is public land that is easily accessible, there is no reason that PennEast, FERC and the DEIS do not provide thorough and complete surveys and assessments.

Finally, in the early spring of 2016, DRN volunteer monitors documented vernal pools that are missing from the DEIS. In PA, one DRN volunteer monitor documented a vernal pool near MP 43.5 – 44 by observing wood frog egg masses (a vernal pool obligate species). In NJ, volunteer monitors documented vernal pools near MP 95 – 95.5 and MP 107 – 109 by observing wood frog egg masses, wood frog tadpoles, and springtime fairy shrimp (vernal pool obligate species).



**Figure 7: Photo of wood frog egg mass (obligate vernal pool species) documented by DRN volunteer on 3/15/16 between MP 43.5 and 44.**



**Figure 8: Photo of wood frog egg mass (obligate vernal pool species) documented by DRN volunteer on 3/19/16 between MP 95 and 95.5.**



**Figure 9: Photo of vernal pool documented by DRN volunteer on 3/19/16 between MP 95 and 95.5.**



**Figure 10: Photo of wood frog tadpoles (obligate vernal pool species) documented by DRN volunteer on 4/13/16 between MP 107 and 109.**

FERC's DEIS conclusion that with the time of year restriction during key breeding periods (March to June) for obligate and facultative amphibian species and restoration construction practices, that impacts on wetland resources, including vernal pools, would not be effectively minimized or mitigated. This is a grossly false conclusion. The DEIS does not consider the full forest impacts and forest upland habitats at least 1,000 feet from the vernal pools that these amphibians rely on for other times of the year that will be cut down and lost; this analysis does not include the thermal and likely hydrological impacts that will change these vernal pools compromising water temperature and flow for breeding amphibians; this does not include the temperature changes and dry compacted soil conditions and changes to vegetation of a ROW that will make it near impossible for migrating amphibians to return to their breeding pool post pipeline construction; this does not include the repetitive pipeline maintenance impacts like herbicide applications to the ROW and routine cutting and unauthorized ATV use that would impact amphibians long term creating a new cut along the base of the mountain where there is currently no existing co-location; this FERC analysis does not even include or require a thorough mapping of all vernal pools and wetlands and FERC recognizes information is complete yet gives the green light without full information being provided or mapped; finally this does not include the climate change impacts that impact vernal pool and wetland species.

### **Climate Change Impacts Not Included in DEIS for Amphibian Species**

The timing of amphibian breeding is largely driven by environmental cues such as temperature and moisture, and because of this, their breeding phenology may be directly affected by global warming. Amphibians in regions such as the northeastern United States (where the proposed PennEast pipeline would be) may be even more susceptible to increases in temperature. Amphibian species in the northeast spend a large portion of the year inactive, escaping either cold winters or hot summers. Subtle increases in temperature or moisture trigger them to emerge from their hibernacula in the spring. Immediately upon emergence, they migrate to ponds or streams to breed. As average air temperatures increase from climate change, amphibians will start to emerge and breed earlier in the year. If amphibians breed too early in the season, they may be more vulnerable to early snowmelt induced floods and early season

freezes that are usually less common later in the season. Amphibians tricked by the warm temperatures from climate change may emerge too early and then die when a cold front comes in.

Amphibians are also affected by extreme weather events associated with climate change, particularly drought. In addition to requiring water for breeding, amphibians need to keep their skin moist to avoid drying up in the sun. Rain water, shade from trees, and moist soil are very important to amphibians. In drought conditions caused by climate change, long periods with no rain can be detrimental to amphibian populations. These effects are worsened by deforestation because it eliminates the shade that the trees provide. Shade keeps the soil on the forest floor moist by blocking the sun's rays. Many amphibians, particularly salamanders, burrow in this moist soil in between periods of rain. Without the shade from the canopy and with no rain, this soil is exposed to full sun exposure and quickly dries up and amphibians become desiccated. Natural gas pipeline construction involves the clearing of many acres of forest, so this is a prime example of natural gas infrastructure working hand-in-hand with climate change and compounding impacts.<sup>viii</sup>

In addition, local changes in the environment can decrease immune function and lead to pathogen outbreaks and elevated mortality in amphibians. Conditions can change to become more favorable for the growth of a pathogen. For example, the chytrid fungus (*Batrachochytrium dendrobatidis*) grows best in culture between 6-28 degrees C and dies at 32 degrees C. The chytrid fungus causes an infectious disease in amphibians called chytridiomycosis which has killed millions of amphibians worldwide and has affected about 30% of all amphibian species in the world. Climate change may make environmental conditions more conducive for this disease to spread as well as cause weakened immune systems, making it more difficult for amphibians to fight off the disease. This disease has been documented in Pennsylvania and New Jersey which are both home to multiple state listed amphibian species. Clearly, these amphibian species are at great risk and they would be put at an even greater risk by the combined impacts of climate change and the construction of the PennEast pipeline.

### **Lack of Field Surveys and Protection of Sensitive Waterbodies and Wetlands**

According to the DEIS, construction of the Project would require 210 wetland crossings, 106 in Pennsylvania and 104 in New Jersey. Based on the information provided by PennEast the Project would impact a total of 56 acres of wetlands during construction, of which about 26 acres would be in Pennsylvania and 30 in New Jersey (see table 4.4.2-1 in section 4.4.2). But this analysis is based on incomplete information and incomplete field surveys and little data.

The FERC DEIS inadequately relies on remote sensed data even in the case of sensitive wetlands habitat. Again, this means that the information provided is not complete yet the public is made to comment on incomplete information and FERC has conducted its cumulative impact conclusions based on incomplete data. The DEIS states that in New Jersey 73 wetland locations were based on estimated acreages from the NJDEP GeoWeb database. PennEast classified wetlands in Pennsylvania (see appendix G-11) using information from the NWI mapping database (FWS 2009) for about 19 miles (23 percent) of the pipeline. FERC's recommendation that PE file prior to construction with FERC a complete wetland delineation report for the entire project that includes all wetlands delineated in accordance with the USACE and the applicable state agency requirements is not protective enough nor does it give the public adequate time to field verify information.

Independent wetland delineation experts indicated during field truthing of wetlands that occurred by them along the PE route in Pennsylvania the following: *"The boundaries of wetlands were reported to have been fieldmarked with surveyor's tape, and the flagged boundaries recorded with a handheld GPS unit. In our experience, such flagging typically persists in the field for several years at least, although pieces of some flags may become torn or lost and some markings may become illegible over time as a result of wind, rain, and general exposure to the elements. Upon field inspection during May 2016, the location of the proposed pipeline centerline, the pipeline corridor, and wetlands and streams within the pipeline corridor in general were found to be very poorly marked. We did not encounter a single wetland with delineation flags completely outlining it. At most we saw isolated, unnumbered pink flags pre-printed with "Wetland Delineation", or isolated numbered (or unnumbered) flags that did not connect in sequence with other numbered (or unnumbered) flags. Thus it was not possible to*

*confirm with any precision in the field the accuracy of the wetlands depicted on the applicant's drawings".<sup>ix</sup>* DRN observed this same spotty and often completely missing flagging or non-existent flagging along the pipeline routes that were assessed – even in areas where PE stated the route had been surveyed. When we did observe flagging, it looked relatively new, like here in the case on SGL 168 yet there were very little flags present along the route and flagging was only in proximity to an easy access point.



**Figure 11:** Two of approx. 8 pink survey flags noting the pipeline center route along an area marked as “surveyed by PE” on SGL 168. Note flagging looks new so it is unusual that not more flagging is present throughout the SGL proposed route. None of the wetlands or vernal pool areas were flagged. On the top of Blue Mountain only 4 new pink flags were noted while no flagging was present along the steep slope away from the Appalachian Trail. Photo taken August 29, 2016.

### **Exceptional Value Wetlands in Pennsylvania Not Adequately Documented in DEIS**

Schmid expert reports highlight discrepancies and errors related to EV wetland protection for PE resource reports and subsequent EIS. Exceptional Value Wetlands in Pennsylvania exhibit one or more of the following characteristics:

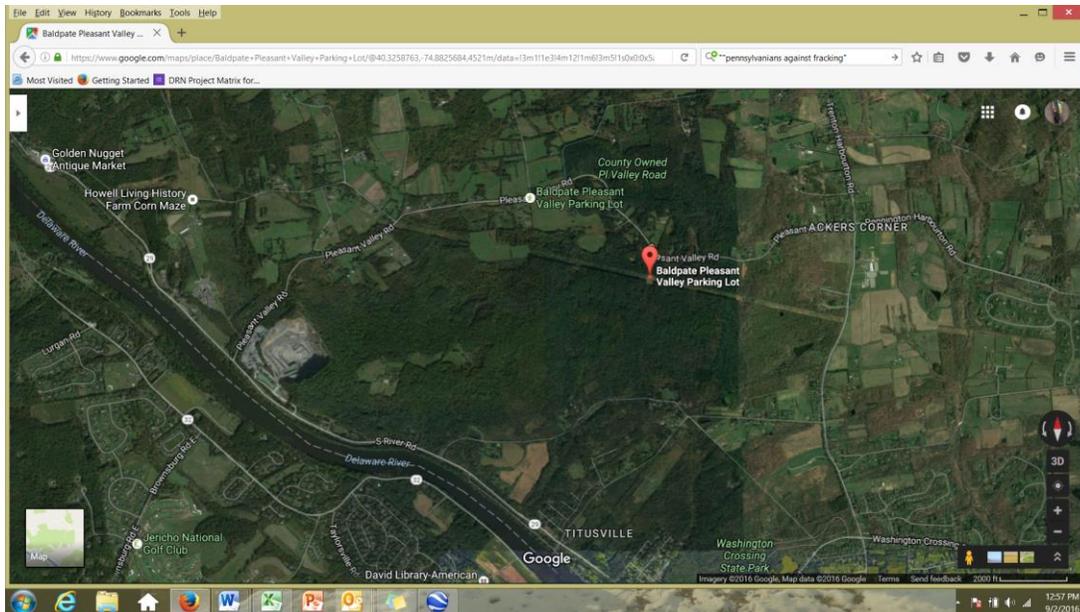
- (i) Wetlands which serve as habitat for fauna or flora listed as “threatened” or “endangered under the Endangered Species Act of 1973
- (ii) Wetlands that are hydrologically connected to or located within 1/2- mile of wetlands identified that maintain the habitat of the threatened or endangered species
- (iii) Wetlands that are located in or along the floodplain of the reach of a wild trout stream or waters listed as exceptional value under Chapter 93 (relating to water quality standards) and the floodplain of streams tributary thereto, or wetlands within the corridor of a watercourse or body of water that has been designated as a National wild or scenic river in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C.A. §§ 1271-1287) or designated as wild or scenic under the Pennsylvania Scenic Rivers Act (32 P.S. §§ 820.21-820.29).
- (iv) Wetlands located along an existing public or private drinking water supply, including both surface water and groundwater sources, that maintain the quality or quantity of the drinking water supply.
- (v) Wetlands located in areas designated by the Department as “natural” or “wild” areas within State forest or park lands, wetlands located in areas designated as Federal wilderness areas under the Wilderness Act (16 U.S.C.A. §§ 1131-1136) or the Federal Eastern Wilderness Act of 1975 (16 U.S.C.A. § 1132) or wetlands located in areas designated as National natural landmarks by the Secretary of the Interior under the Historic Sites Act of 1935 (16 U.S.C.A. §§ 461-467).

The DEIS indicates an abundance of Wild Trout Waters in Pennsylvania to be crossed by the pipeline. The Penn East lists at least 131 Wild Trout Waters in Pennsylvania to be cut across by the pipeline (Table G-5). Pennsylvania Fish and Boat Commission has been conducting frequent and regular additions to its Class A and Wild Trout Waters designations in recent years and every few months; its important those newer classifications are reflected in the DEIS and updated.<sup>xxi</sup> It is unclear from the table if all of these newer designations are included by PennEast and it would be a good recommendation that FERC require this review by PennEast and included updates as a requirement. Wetlands that are hydrologically connected to

Exceptional Value Waters and/or Wild Trout Waters and their tributaries are considered Exceptional Value (EV) Wetlands. Private drinking water supplies are also to be protected as EV wetlands as are wetlands that are home to threatened and endangered species. The DEIS does not make it possible nor does it appear to include wetland designations for each of the wetlands to be crossed (Table G-11). The DEIS also recognizes that private water supplies are not yet mapped, which means that wetlands associated with these water supplies are not yet fully analyzed under Pennsylvania requirements for EV wetlands. The DEIS mentions EV protections but provides no break out wetland by wetland of the characteristics and designations for each to adequately provide the detail needed to assess the impact to each of the many wetlands and waterbodies to be crossed. The DEIS also does not have tables or cross referenced documentation to depict each of the wetlands that are hydrologically connected or located within ½ mile of wetlands that maintain habitat of threatened or endangered species within the wetland. These are large omissions and failures of the DEIS.

### **Inadequate Documentation and Incomplete Current Mapping and Monitoring of Sensitive Waterbodies**

On July 30, 2016, DRN field-truthed a short section of the proposed PE pipeline corridor along Ted Stiles Preserve at Baldpate Mountain in Hopewell Township, New Jersey (MP 107.2 to MP 106.8). DRN walked west from the Baldpate parking area about a half mile just south of the existing electrical ROW.



**Figure 12: DRN walked west from the Access Pleasant valley road parking area on July 30, 2016 and documented within 0.5 miles one obvious intermittent stream missing from PE wetland and alignment sheet maps. Shagbark hickories and other important mature trees that provide refuge for bat species were documented. Invasive plants were documented along existing JCP&L ROW that would be exacerbated and spread with a new ROW.**

This Mercer County Public Park has over 12 miles of marked trails for hiking, horseback riding, mountain biking, and trail running. According to the DEIS and PE alignment sheets, this area had been surveyed by PE. No flagging was observed during ground-truthing for the pipeline center line, or any of the wetlands or streams along the proposed pipeline route we encountered as late as July 30, 2016. An intermittent stream was not delineated on the PE alignment sheets nor was there flagging present to note this water feature despite the fact that the stream is delineated on state freshwater mapping layers available to the public. Table G-6 in the DEIS also does not list this stream as a waterbody to be cut.

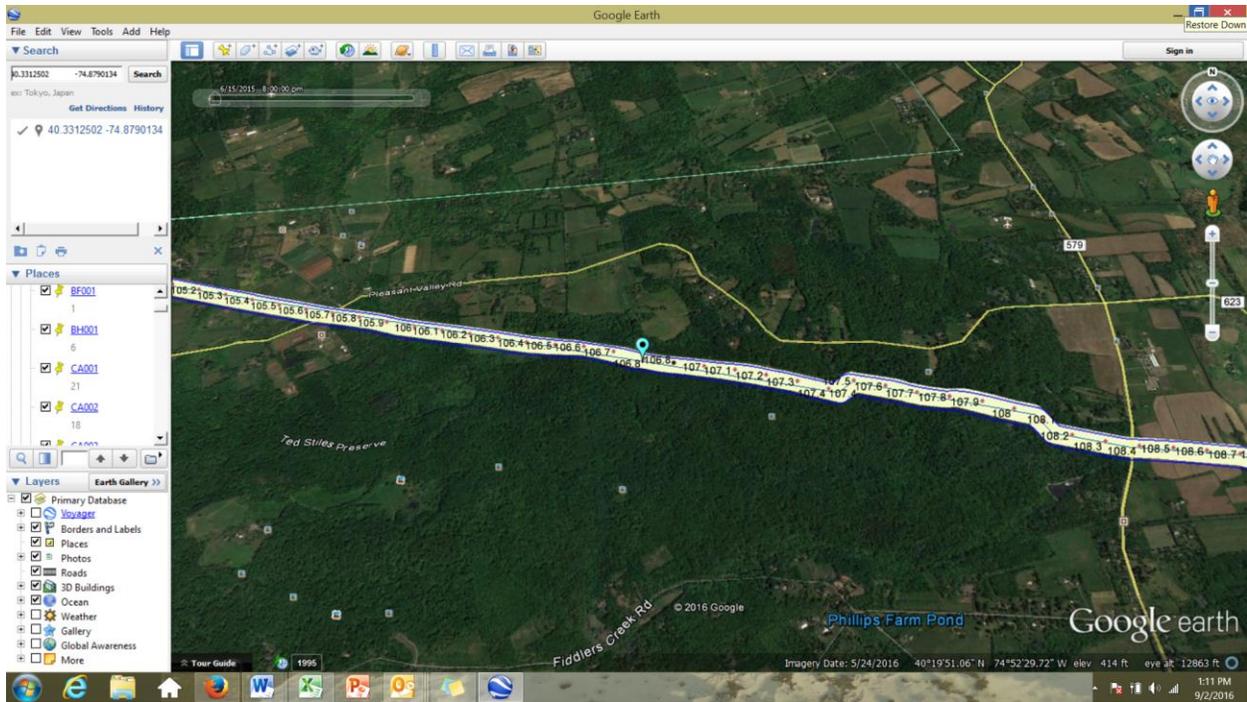


Figure 13. Approx. location of the intermittent stream within proposed ROW corridor on Ted Stiles Preserve at Baldpate Mountain not mapped by Penn East

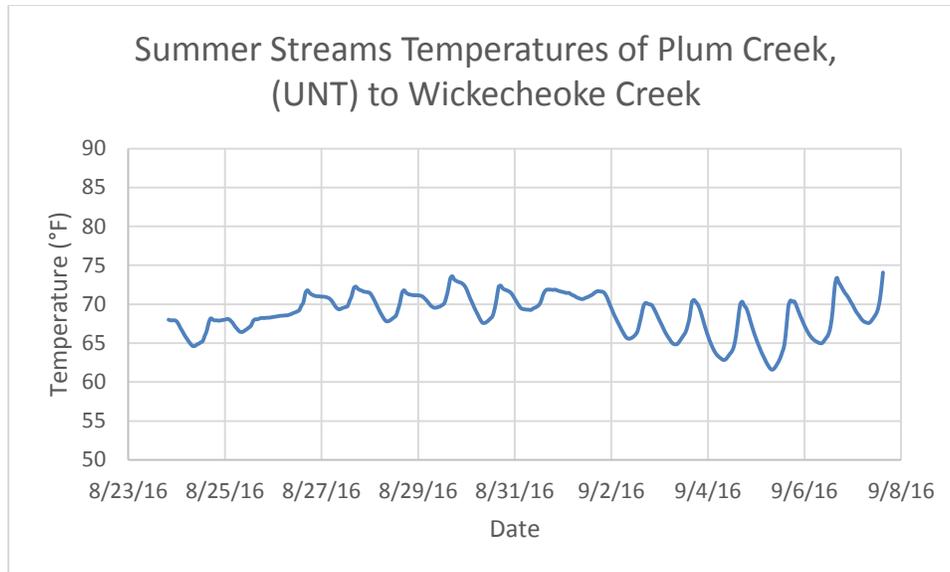


**Figure 14. Intermittent stream and wetland documented along pipeline corridor, Baldpate Mountain that is not mapped on PE alignment sheets or Table G-6 in the DEIS despite this being public land. MP 106.8 (photo taken facing away from existing ROW)**



**Figure 15. Intermittent stream undocumented in the DEIS mapping and Table G-6 that DRN documented along the pipeline corridor. Note abundance of invasive Japanese stiltgrass encroaching and advancing into the mature forest spreading inland into the forest from the existing ROW. Photo taken facing the existing ROW.**

The DEIS Table 4.31-5 notes only 4 groundwater seeps in Pennsylvania and only one groundwater seep in New Jersey. This number of seeps along the entire Penn East pipeline route is not complete in light of DRN documenting missing water features along all areas that we assessed. The DEIS states surveys are not yet complete meaning again, the public is reviewing incomplete information and FERC's analysis of no significant environmental harm is based on incomplete habitat information. On September 7, 2016 DRN conducted field visits and documented two groundwater seeps, critical sources for aquatic life during the critical hot and dry summer months when the associated intermittent streams can run dry (which was the case this year). Often these groundwater seeps and interfaces within the streams are critical remaining habitat for fish, amphibians, and macroinvertebrates working to survive these dry conditions by congregating in these wet and colder areas that remain in what otherwise would be largely a dry stream bed. The two groundwater seeps that DRN documented were located in areas where PE proposes to build its pipeline. An open cut could change the hydrology of these sensitive and important features. Furthermore, these seeps and interfaces with groundwater assist in cooling stream temperature throughout the year. An expert groundwater hydrologist has recommended that the DEIS should include a complete inventory of springs and seeps within a quarter mile of the pipeline to adequately consider the changes which could occur due to pipeline construction rather than limiting it to just 150 ft. within the construction workspace that is currently proposed by FERC.<sup>xii</sup> Vernal pools and wetlands are often interfaced with groundwater and hydrologically connected and we illustrated missing vernal pool habitats in the DEIS above. Streams also have these groundwater interfaces which are important refuge habitat and a source of scarce water during droughts conditions which are becoming more exacerbated due to climate change and poor stormwater management practices. These groundwater interfaces and springs are especially important to some of our headwater and intermittent streams that are usually proposed for open cuts by PE.



**Figure 16: Stream temperatures for UNT to Wickecheoke Creek (Plum Creek) (MP 95.1)**

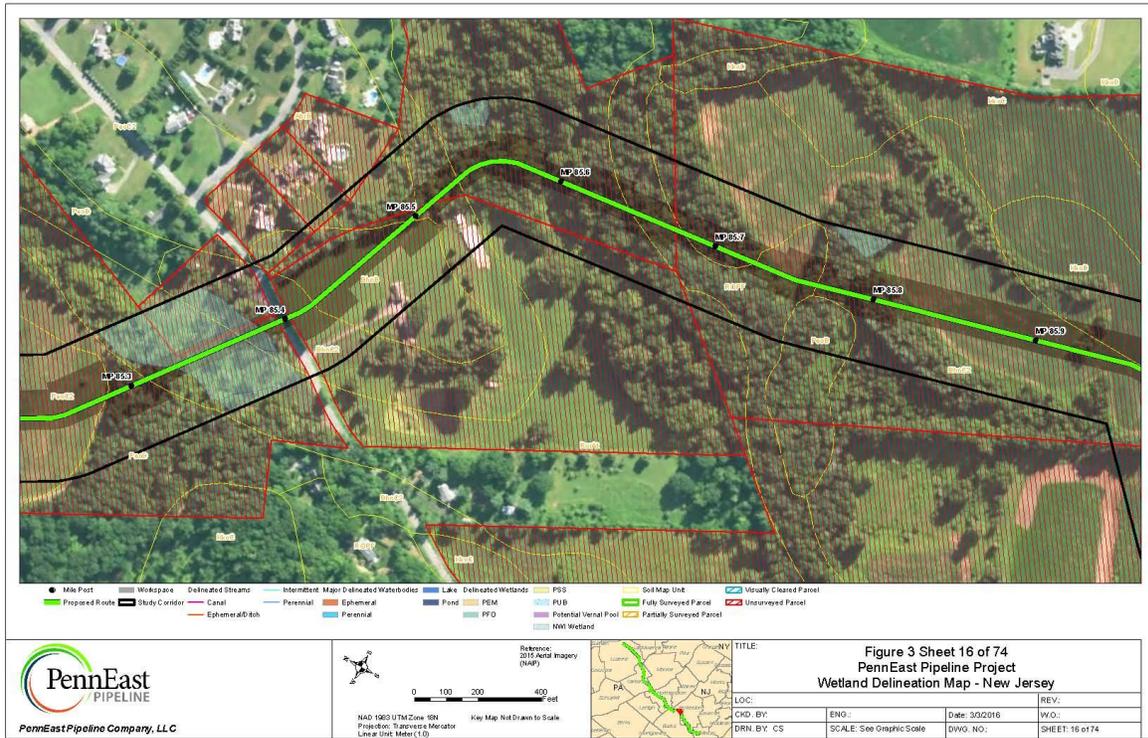
The temperatures observed in Plum Creek, an UNT to Wickecheoke Creek, a C1 stream (FW2-NTC1) in New Jersey (located at MP 95.1) indicates conditions that groundwater seepage is assisting to help sustain and cool this important C1 tributary. This area of the stream is in the very headwaters and upstream of a large pond that eventually continues downstream to feed the Wickecheoke Creek. The temperatures range from 61.6°F to 74.0°F, with a mean of 68.7°F. The conductivity of Plum Creek on 9/7/2016 was 270 uS/cm and on In addition this stream, is currently private and preserved farmland and native plant meadows with a healthy forested riparian buffer along the stream. The PE is proposing to cut down mature trees and cut across this stream using a dry crossing and the construction period is estimated to be July 16 – September 30. However, if the proposed pipeline ROW crosses the stream at this location, it would impact and likely alter groundwater flows. Furthermore, Table G-6 in the DEIS lists 10 pipeline cuts across the Wickecheoke watershed proposed just for the Penn East pipeline alone. Most cuts are proposed to be dry crossings conducted 7/1 to 9/30 or 6/16 to 9/30 with the exception of one bore at MP 96.8. Table G-8 at MP 95.3 lists a waterbody as UNK. Despite multiple cuts across these watersheds, FERC fails to require any other measures to ensure cumulative impacts for these cuts is adequately monitored or considered on a sub-watershed or a larger watershed context.



**Figure 17. Photo of one of the few remaining pools and groundwater sources sustaining Plum Creek, an UNT to Wickecheoke Creek that was largely dry in early September, 2016. Photo taken Sept 7, 2016.**

DRN monitored stream temperature and conducted site visits to an UNT to Harihokake Creek that is proposed to be cut near MP 85.4 in Milford, NJ. This habitat is comprised of a sensitive stream and wetland complex that is now located along a deviation of the PE route so no updated alignment sheets were provided by PE in the DEIS in this case at this time. Harihokake Creek is a FW2-TMC1 (trout maintenance) stream in New Jersey. This UNT and wetland complex appears to be intermittent in flow especially in late summer so the pools and wetland pockets of groundwater fed areas that remain during these drought conditions, are critical areas and refuges for aquatic life and animals. This diverse wetland and stream complex is of high quality wetland habitat with abundant native plant species and wetland types. The DEIS lists this wetland complex as PFO, PSS, and PEM and there is no existing gas ROW cutting across this wetland at this time.

The crossing lengths identified by PE appear inaccurate and photos below indicate more disturbance of PFO depending on the alignment. The DEIS lists for this wetland complex the PFO is only 1 ft., the PSS 227 ft., and the PEM 79 ft. With some mature trees being present in the wetland, a 1 foot PFO estimate does not adequately account for the large trees likely to be cut. But no alignment sheets are updated for this deviation of the pipeline route in the DEIS plus alignment sheets included do not have MPs delineated like earlier versions which makes it difficult to cross reference waterbody crossings with MPs in the field esp. since so much of the areas have not been flagged by PE in the field. Without updated alignments sheets which FERC states only need be provided before construction, field visits and independent reviews cannot easily be provided by the public for a thorough review of ATWS or TWS which may be included at this crossing. Landowners on deviations also do not appear to have access to the alignment sheets at this time either. This inadequacy of mapping in the draft EIS is a gross omission by FERC. The map below is from the wetland delineation report for this wetland and stream (MP 85.3 to MP 85.4) which does not provide detailed construction plans as the alignments do (these maps were obtained from the DRBC website not the DEIS). Note the unsurveyed field parcels here by PE (red hatch). These delineation maps were not part of the DEIS volumes provided by FERC which indicates another missing piece and data source that is not readily accessible nor made available at all to the public and community reviewing the DEIS.



**Figure 18: Wetland delineation maps not part of DEIS package**

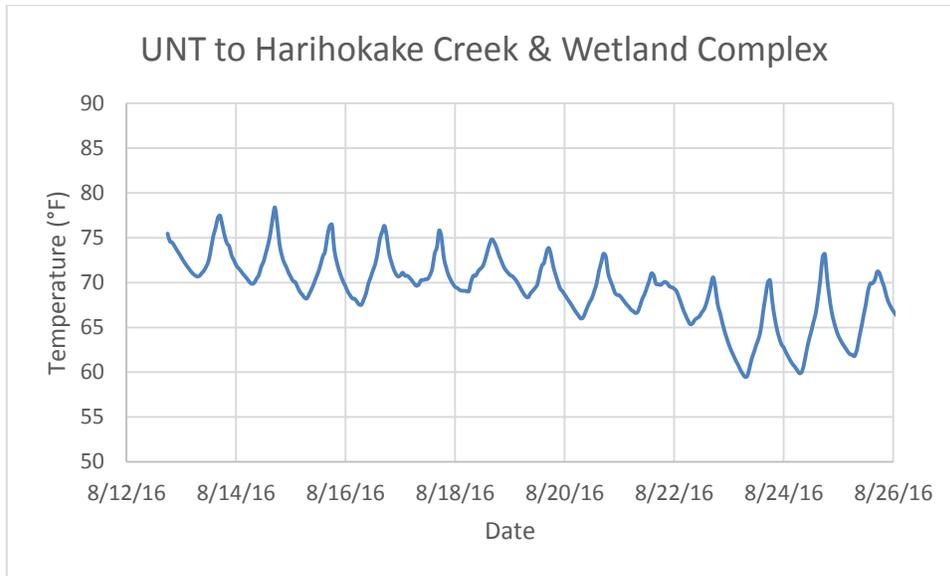
Some of the native plant species in the wetland or shading the wetland observed (not all identified here) include cattail, sensitive fern, wool grass, bull rush, golden rod, jewelweed, deer tongue, and ironweed. Mature trees and shrubs within the wetland or shading the wetland and along the streambank that would be cut include: red maple, willow, oak, dog wood, and witch hazel. Invasives present include Japanese stiltgrass and phragmites. The landowner has conducted several invasive species removals over the years in this wetland area – mostly targeting multiflora rose removals to ensure native plants reside in this important wetland. In the spring the wetland teams with amphibians and frog choruses are abundant according to the landowner.



**Figure 19. Wetland and stream complex that could be cut by PennEast pipeline around MP 85.3-84.4. The crossing widths (1 ft.) PE provides per wetland type especially related to PFO do not appear comprehensive from observations in the field. Photo taken August 12, 2016.**



**Figure 20. Wetland and stream complex that could be cut by PennEast pipeline around MP 85.3-84.4. The crossing widths (1 ft.) PE provides per wetland type especially related to PFO do not appear comprehensive from observations in the field. Shade from mature trees just outside the wetland would also likely be cut. Photo taken August 12, 2016.**



**Figure 21: Temperature Data from UNT to Harihokake Creek that flows through wetland complex**

The summer stream temperatures collected from this station on the UNT and wetland are indicative of good water quality, ranging from 59.5°F to 79.0°F, with a mean of 69.4°F. The conductivity of the stream on 8/12/16 was 371 uS/cm. From Aug 27 to Sept 7, 2016 the stream was dry and the HOBO probe was taking air temps as a result (air temps. removed from graph above). These dry conditions indicate the very sensitive nature of these headwater streams and wetland complexes PE proposes to cross. The proposed ROW would cut across this wetland and stream complex bringing with it cascading and long term impacts that would impact stream and wetland temperatures and reduce shading and habitat that is currently present in this wetland complex. The proposed ROW would cross the Harihokake and its tributaries at 7 different locations (MP 85.4, 85.6, 85.8, 85.9, 86, 86.3, 86.7), which poses a threat to this watershed individually and cumulatively. Again, FERC has not assessed the cumulative impact of all of these cuts across watersheds, FERC has not required in situ information or stream water quality conditions to be collected by PE, FERC has not required updated alignment sheets and maps – all gross errors and omissions in the DEIS.

C-1 streams like this one in New Jersey also appear to receive limited protection from FERC even though C-1 is a special stream designation in New Jersey. FERC states that before the end of the DEIS period PennEast must file and identify any special construction procedures that

would be implemented to minimize impacts on C-1 streams. It is unclear if this filing has been done. FERC also states that there should be consultation with appropriate federal and state agencies regarding C-1 streams, including identification of any agency recommendations and PennEast's responses. However examining other ROW cuts in C1 watersheds, it appears this is a flawed conclusion since C1 streams have suffered sustained and prolonged impacts that are not temporary in nature (see section on Alexauken Creek below).

### **Alexauken Stream Temps and Example of Cumulative Impacts Not Monitored or Considered in DEIS**

DRN deployed HOBO automatic temperature probes in several C1 watersheds in New Jersey in August, 2016. Locations were selected based on the proximity to the Penn East pipeline route and where we could get access on private lands. The data clearly show long term cascading impacts to streams where existing ROWs cut across these streams. FERC's point that with agency review the CEQ regulations under NEPA will be fulfilled is a false statement. Even with all mitigation measures in place or deemed complete by the agencies on other ROW projects, the data show stream impacts persist. The locations of the HOBO probes can be seen in purple, in Figure 1 below. In addition, a 400-foot buffer zone (200 feet on either side of the proposed ROW) of the proposed pipeline can also be seen on the figure in red.

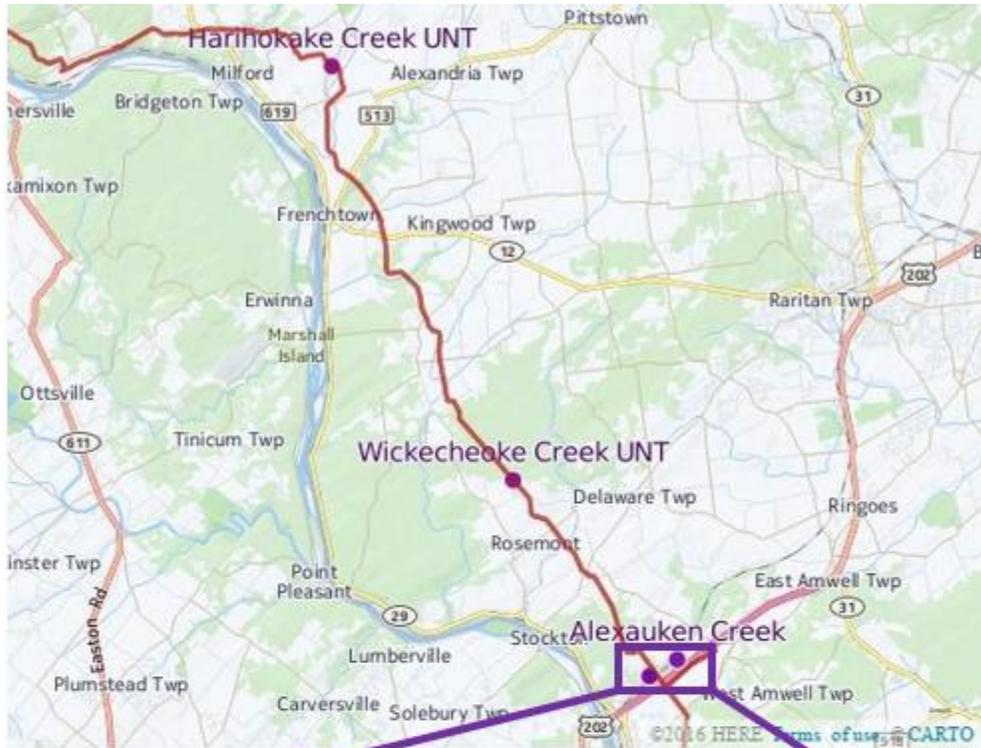
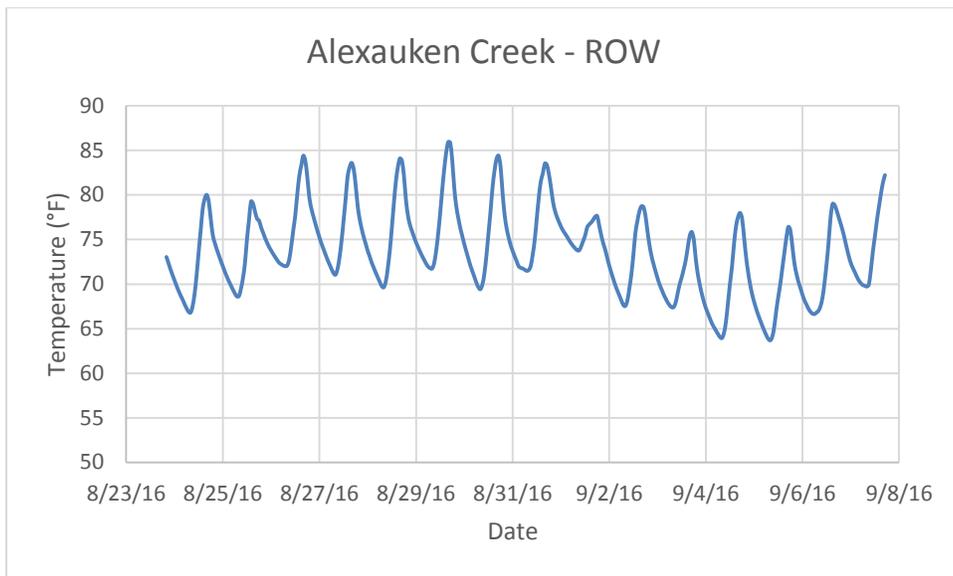
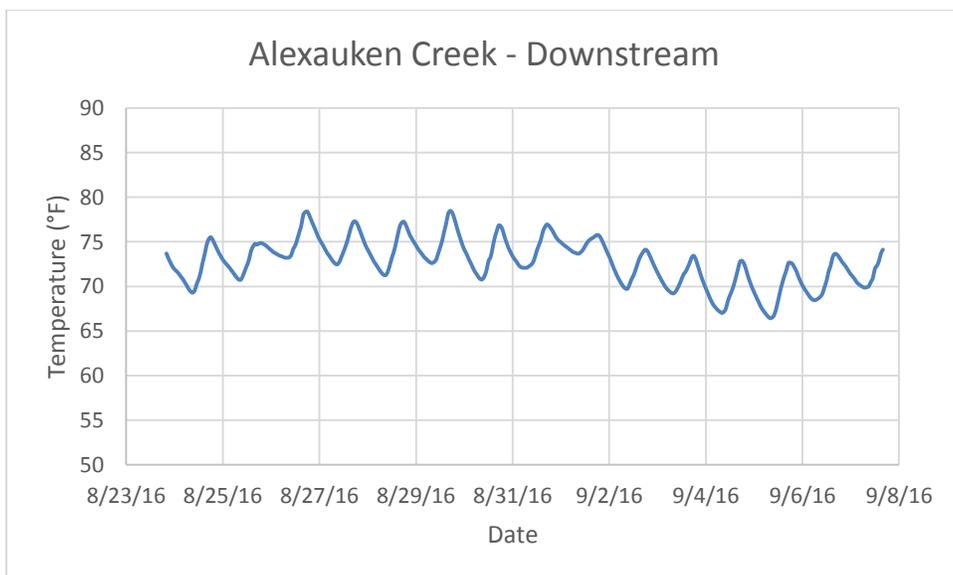


Figure22: HOBOKA Probe Locations along C-1 streams in New Jersey

The Alexauken Creek has two temperature logging stations collecting hourly temperatures. The station located in the existing restored electrical utility ROW and the existing restored gas pipeline corridor indicates higher temperature readings during critical summer months when aquatic life often become impaired when compared to a reference location located upstream along the Alexuaken Creek. On the other hand, the downstream station located away from ROW impacts, shows a much lower healthier habitat for aquatic life. Temperatures from both these stations can be seen in the Figures below.



**Figure 23: Temperature data for Alexauken Creek, by ROW**



**Figure 24: Temperature data for Alexauken Creek, away from ROW impacts**

The data from the ROW logging station on the Alexauken show daily fluctuation. The temperatures range from 63.7 °F to 85.9 °F, with a mean of 73.7 °F. Whereas, the data collected from the other non-ROW station show much less fluctuations in temperature. For this station, the temperatures ranged from 66.4 °F to 78.5 °F, with a mean of 72.7 °F. Aquatic species generally have a preferred temperature range, and thrive in more stable temperature conditions. A ROW close to a waterbody means that air temperature would affect water temperature more rapidly. These rapidly fluctuating temperatures can wreak havoc on aquatic life. In comparison, a water body away from ROW and surrounded by forested land, would not be affected by air temperature as much, since the forest would act as a buffer to regulate water temperature. These trends can be clearly seen in the data collected for Alexauken Creek. The station by the ROW not only had a higher mean temperature, a much higher maximum temperature than the other station.

Warmer water holds a lesser amount of Dissolved Oxygen (DO). DO is essential for the sustenance of aquatic life. It should also be noted that algae growth is very abundant in the ROW corridor. Algae blooms are indicative of higher temperatures, and make living conditions tough for other aquatic life. As algae die out and decay, they rob DO in water, available to other aquatic life species (see photo below).



**Figure 25: Abundant algae growth in Alexauken Creek, a C1 stream in New Jersey growing in an existing gas ROW**

Alexauken Creek is classified as a trout maintenance stream (FW2-TMC1). According to N.J.A.C. 7:9B-1.14(d), the temperature for this stream shall not exceed 25°C (77°C). The temperatures from Alexauken Creek certainly exceeded this standard, which shows that the stream is already impacted (it is an impaired waterbody). With the proposed pipeline ROW, right along these stations (as seen in Figure 1), the degree of impact will be greater, which can prove fatal to the local ecosystem. The proposed PE pipeline would cross the Alexauken and its tributaries 7 times, which poses a threat to the already impacted stream. In a December 2010 report, by Princeton Hydro (in collaboration with the Delaware Riverkeeper Network), Alexauken Creek

was found to be impacted for temperature and nutrients. This report presents a protection plan for the Alexauken Creek watershed, in order to maintain its classification. Even with this protection plan in place and a TMDL plan, the temperature data shows that the watershed is still struggling. An additional 7 ROW crossings in the creek and its tributaries will present a major threat to the already struggling watershed.

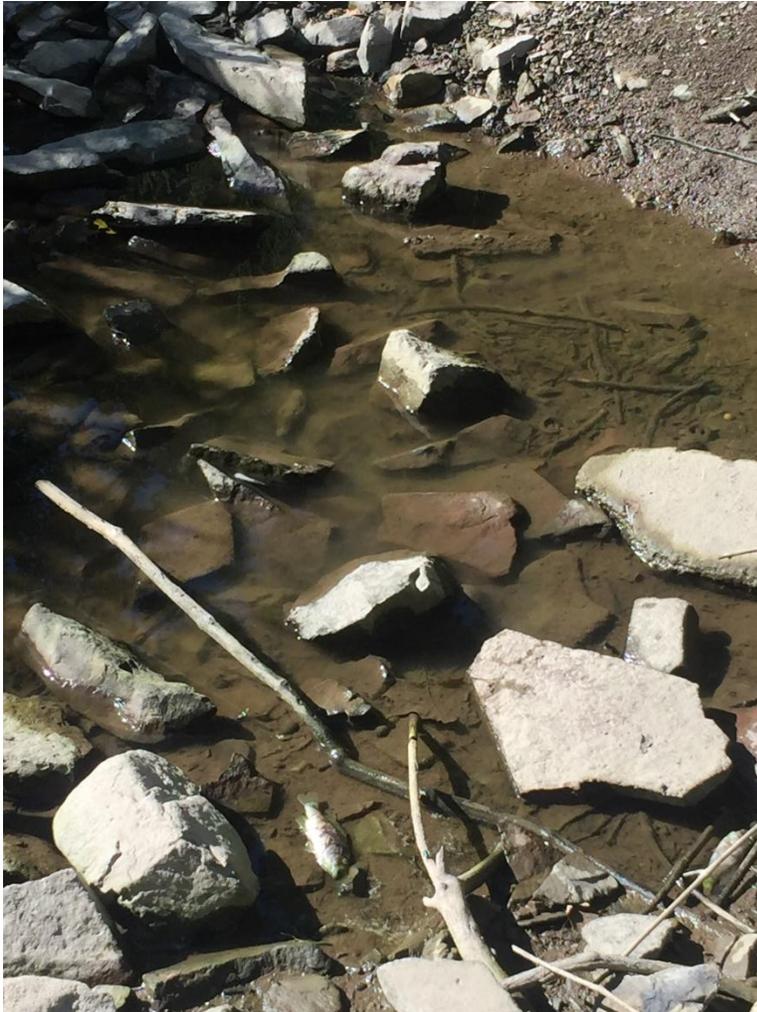
A third temperature logging station was located along an unnamed tributary of Alexauken Creek. This station was located southeast of the downstream Alexauken Creek station. The probe was installed on August 23, 2016. However, on August 28 the unnamed tributary ran dry. During the 5 days the probe was in the water, the temperatures ranged from 63.9°F to 73.0°F, with a mean of 67.0°F. This small tributary is just one of many intermittent streams that are along the proposed PE pipeline ROW. This UNT tributary alone is proposed to be crossed 3 times by the pipeline, which would cause serious harm to an already stressed system and watershed. A picture of the dry streambed observed on Sept 7 below is provided and again these streams that have groundwater seeps within the ROW will be disrupted if another cut is allowed.



**Figure 26: UNT to Alexuaken Creek be cut by PE pipeline. Low flows and drought conditions already cause harm to these sensitive streams. A groundwater seep remains in this tributary just upstream where aquatic life and fish are congregating and it is located directly in the path of the proposed ROW which could alter groundwater flow – a key survival need during low flow times and summer months for this tributary.**

According to the National Weather Service, precipitation in the Alexauken Creek Watershed area was 5.6 inches below average. This is the probable cause for the dry unnamed tributary to Alexauken Creek. The lower than average rainfall is a result of extensive development in the area. It goes without saying that a dry stream is not good for aquatic life. An added right of way

would decrease transpiration from local vegetation, leading to an even lesser amount of rainfall in the area. The impacts of existing rights of way (such as utilities, roads, etc.) are already visible in the form of dry streams, and would worsen with an addition pipeline ROW. Thus, it would not only affect aquatic life directly (in the form of higher temperatures), but would also have longer term impacts such as dry streams.



**Figure 27: Remaining groundwater seep in the dry UNT to Alexauken Creek. Note dead fish. Over 100 small fish were located in this pool which is directly in the route of the proposed PE pipeline.**

### **Additional Forest Fragmentation Not Fully Considered in the DEIS**

This map below based on April alignment sheets helps illustrate the additional forest fragmentation impacts that are being proposed for a public preserve that has some of the last remaining forest in the region and that already has an existing ROW. The DEIS states that

colocation is less impactful but this is not what the maps document since in the gas line would run adjacent to the existing ROW cutting through new habitat in the Ted Stiles Preserve on Baldpate mountain instead of being built within the current ROW footprint which means more habitat disturbed, trees cut, and an extension of forest fragmentation further into the woods (in the instance above).



Figure 28: April 2016 Map showing increased fragmentation proposed by PE ROW

**DEIS has Inappropriate Practices Proposed for Steep Slopes, Sensitive Soils, Important and Unique Reptile Habitat and National Significant Trail Systems**

DRN surveyed sections of the pipeline route that would cut through State Gameland (SGL) 168 on August 28 and 29, 2016. Homeowners along N. Cottonwood Drive provided access from the base of the mountain and the pipeline was accessed to the north from the Appalachian Trail (AT) and Blue Mountain Trail Road. DRN walked the AT and the pipeline path from about MP 51.1 MP to 51.6. This stretch of the Blue Mountain was dominated by steep slopes, glacial thin soils and abundant outcroppings and boulder fields indicative of ideal timber rattlesnake habitat. Due to the geology, blasting would likely be required (see section on blasting). And

there would be very high likelihood of erosion and increased stormwater runoff from tree removal.<sup>xiii</sup>



**Figure 29: Outcropping and optimum rattlesnake and copperhead habitat along the AT and approx. 25 feet from the proposed ROW. Steep slopes and glacial soils with thin top soils and mature forest dominate this area.**



**Figure 30. Outcropping and outlook along Appalachian Trail, about 25 feet from the proposed pipeline route. Photo taken facing towards the top of the ridge, white pines in right side of the frame are within the proposed ROW and would be cut.**

This area of SGL 168 and the AT is pristine for the region and includes sensitive glacial soils and features, steep slopes, and areas with shallow bedrock. These areas, the DEIS states will likely require blasting due to shallow bedrock conditions. Along the steep slope down the Blue Mountain where the pipeline would cut, boulder areas dominate the slope.

Currently the area surveyed on SGL is dominated by native vegetation, mature forest and optimal rattlesnake habitat with sensitive vernal pools and groundwater interfaces present at the base of the mountain. Some of the plant species noted and identified within the proposed ROW include: **Mature canopy trees and seedlings:** eastern hemlock (indicative of thin glacial soils), white pine, green ash, chestnut oak, red oak, white oak, American beech, red maple, catalpa, shagbark hickory (ideal bat habitat), and birch species.

**Midstory layer:** sassafras, witch hazel, spicebush, maple leaf viburnum, striped maple, and low bush blueberry **Groundcover:** indian pipe, greenbriar, wood aster, shining clubmoss (*Huperzia lucidula*), raspberry, cut-leaved grape fern (*Botrychium dissectum*), Virginia creeper, wintergreen, hay-scented fern, unknown fern sp., Christmas fern, and cardinal flower. All of these diverse layers in the forest help filter rainwater and slow stormwater on steep slopes and all of these layers of this mature forest are proposed to be cut by the pipeline which will lead to significant stormwater runoff without these plant communities present. The Meliora report provides more detail on stormwater impacts anticipated. Invasive plants are minimal and absent in a majority of this area of SGL 168 but currently most noted along old logging roads entering SGL's from Cottonwood Rd area. Japanese stiltgrass has colonized many of the old linear logging roads between MP 52.4 to 52.5. Japanese barberry is colonized in sections of the steep slope areas but currently at a low infestation rate. This is a clear example of how road ROWs , and a future pipeline will spread these invasive plants that are beginning to take hold on these state lands along edges. The DEIS does not currently include an Invasive Species Management Plan by PennEast and FERC requests that one be developed but again, without having this information as part of a complete DEIS, the public is made to comment on an incomplete analysis of the harm.

Vernal pools located at the foot of mountains, like the ones observed and described earlier in this report, likely fill with groundwater so there are also groundwater seeps in this reach of the pipeline route that are not mapped in the DEIS section related to groundwater seeps. A pool located on a slope may actually receive groundwater on the upslope side and discharge it to the water table on the downslope side.<sup>xiv</sup> DRN has documented severe changes to a similar lateral hillside cut along a base of a smaller mountain but steep slope on another pipeline in Pike County, PA so likely similar changes would occur here since most standards and E&S control measures would be similar.<sup>xv</sup>

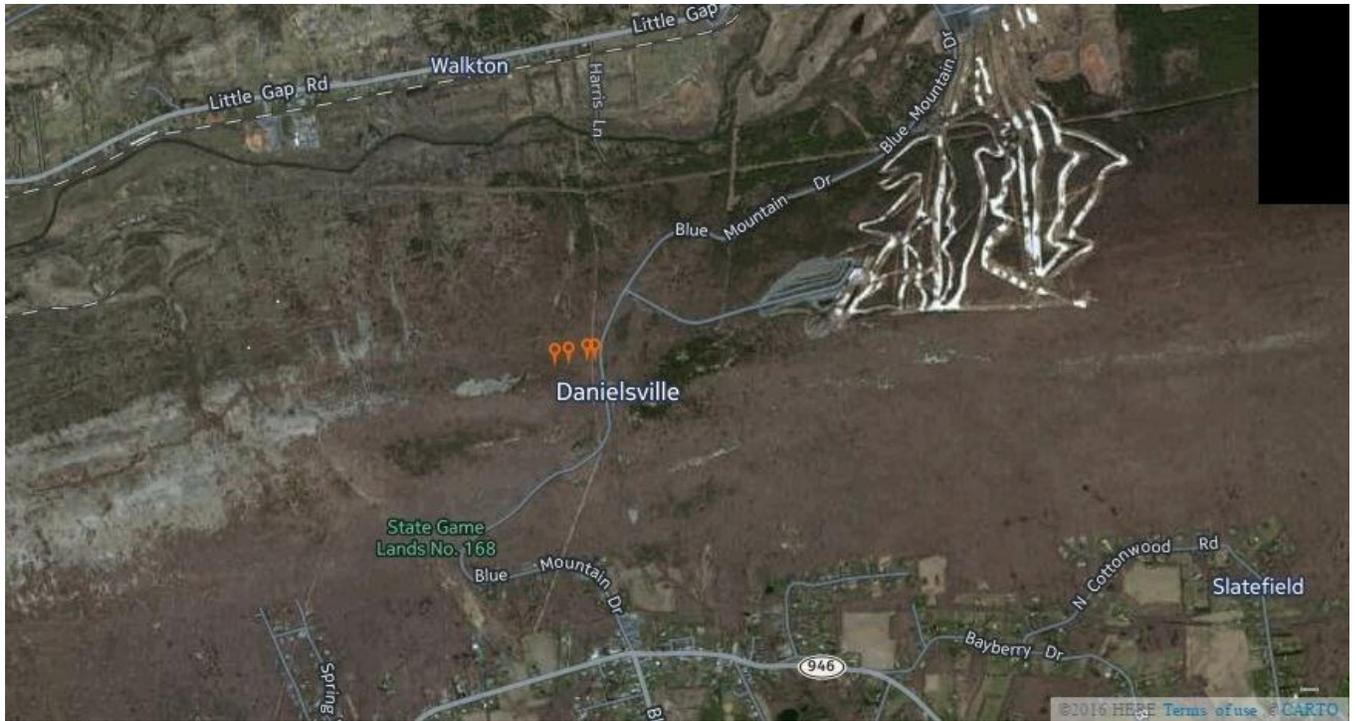
### **Disregard for Siting Pipeline in Existing ROW or Impacted Developed Areas**

Blue Mt Ski area is highly impacted with massive cuts for ski slopes yet the pipeline proposed near the ski center would add an additional cut rather than utilize one of the current clear cut paths. There is an existing Buckeye oil pipeline present about <0.5 miles from the proposed new greenfield PE route that would be closer to the Blue Mountain Ski area and that already cuts across the steep slope and the Appalachian Trail (AT). It is unclear why co-location is not being considered here within the existing oil pipeline route or on an existing ski slope since the resort plans to use the gas especially with such sensitive habitat, steep slopes, and cultural impacts in jeopardy. This harm would be significant and the DEIS conclusion that it would not be incorrect. The information in the DEIS related to reviewing alternate routes and co-location also does not provide all information for reviewers to understand the full analysis done or not done for alternate routes. PE notes that 44 miles of the pipeline route (37%) would be located adjacent to existing ROWs but full analysis of this is not provided.

### **Temperature Impacts and Forest Fragmentation Calculations Not Fully Examined**

DRN conducted a snapshot temperature study along the existing Buckeye oil gas transmission ROW that is west of the proposed Penn East ROW. DRN used a Lamotte calibrated thermometer to record air temperatures at four locations on or adjacent the existing pipeline route. It is logical to assume that much of the long term impacts on the Buckeye Route in this reach on Blue Mountain would be similar impacts for the proposed PE route.

Sensitive glacial soils, extreme compaction, continued and repeated ATV traffic and pipeline maintenance, lack of diverse growth, bare soils, and thermal heat and fragmentation impacts to the ROW and within the mature forest paralleling the Buckeye ROW were observed.



**Figure 31.** Locations of temperature readings taken on existing Buckeye ROW and from distances away from ROW to illustrate forest fragmentation and thermal impacts. Note Blue Mountain Ski area also to the right frame of the photo.

**Figure 32: Air Temperatures Documented on August 28, 2016 by Delaware Riverkeeper Network in Proximity to an Existing Gas Pipeline**

Location	Air Temp (°F)	Distance from ROW (ft.)	Elevation (ft)	Lat. and Long.
Buckeye existing Pipeline ROW	107	0	1,134	40.80763, -75.53507
On AT	89.4	115 ft.	1,139	40.80766, -75.53548
On AT	85.4	410 ft.	1,170	40.80751, -75.53653
On AT	83.4	615 ft.	1,264	40.80742, -75.53725

DRN recorded extreme temperatures on the existing ROW and temperature impacts that continued into the forest and away from the ROW for over 615 feet. These forest impacts are also cited in the literature and expert reports submitted authored by Kevin Heatley. The distance an edge effect extends into a forest/woodland is variable, but most studies point to at least 300 feet (Rodewald 2001; Ontario Ministry of Natural Resources 2000; Robbins 1988;

Rosenberg et al. 1999). It would appear from this snapshot of air temperatures above that localized impacts from a ROW on this mountain may have more interior impacts.

The DEIS does not consider these cumulative impacts and severe forest fragmentation impacts. The DEIS does not include data like this nor require it to determine actual impacts on the ground.

### **Blasting Impacts Inappropriate and Unacceptable in DEIS And Steep Slopes To be Cut Near Waterbodies Will Cause Significant Harm**

The DEIS states 69% of Hunterdon Co, 35% of Northampton Co., 23% of Mercer Co., 25% of Luzerne Co., and 28% of Carbon County will require likely blasting to blast through shallow bedrock (page 4-13). In these steep slopes with sensitive glacial soils and thin top soils of the Blue Mountain, pipeline cuts and blasting would drastically change the character and environmental functions of this region. Blasting on steep slopes can also increase the risk of sediment pollution events and blowouts into nearby streams. The Myers and Meliora report submitted with DRN comment lay out more science on these impacts. At least 43 waterbody crossings have steep slopes that would be cut by the pipeline. These 43 crossings are proposed to have additional temporary work spaces (ATWS) within 50 ft. of sensitive water features, adding to the potential erosion threats to these steep banks, cuts to mature forest, and the nearby sensitive streams where sediment pollution can cause long term harm.

FERC does recommend that PE not use forested areas to place pipe yards (which is still being proposed in the DEIS) but this recommendation needs to be expanded greatly to minimize any areas where mature forest or trees would be cut for temporary placement or workspaces. Cutting mature trees for ATWS and TWS is not temporary in nature.

## Threatened and Vulnerable Species Impacts Not Fully Documented



Figure 33. Shagbark hickory and bat habitat along Baldpate Mountain PE proposed route. Shagbark also evident in SGL 168

### Missing sections to protect the timber rattlesnake and copperheads

ON August 29, 2016, DRN assessed the pipeline path from the base of SGL 168 from MP 52.9 walking westward to MP 52.5. The DEIS states that timber rattlesnake (*Crotalus horridus*) thrives in deciduous forest habitat with at least 70 percent canopy cover, rocky hillsides, and outcrops for use as hibernacula and exposed rocks for basking (PFBC 2011b) and it lists Luzerne, Carbon and Northampton PA as habitat for these snakes. The DEIS states Phase 1 surveys were completed between MP 10.5 to 10.7, 11.1 to 11.6, 12.9 to 13.1, 14.1 to 16.9, 22.5 to 23.1, 23.7 to 24.1, 29.3 to 29.5, 30.1 to 30.7, 32.9 to 33.3, 37.9 to 40.6, and 51.1 to 51.6. Phase 2 surveys are ongoing. The timber rattlesnake is listed as a candidate species by Pennsylvania and as an endangered species by New Jersey. The DEIS states that *PennEast conducted presence/absence*

*and/or habitat surveys for this species in the summer of 2015. These surveys were conducted by a qualified herpetologist in potential habitat areas designated by the PFBC. Suitable habitat for this species was identified within the Project area and one timber rattlesnake was observed within the Project area in Pennsylvania during wetland field surveys in 2015. For areas that were identified as potential habitat, PennEast has committed to following the PFBC recommendations to minimize impacts on this species: which include spring presence surveys, avoiding the habitat during construction, and the restoration of gestation habitat following PFBC guidelines (PFBC 2010). PennEast has also committed to avoiding denning habitat identified near MP 39.2 and adhering to a 300 foot no disturbance buffer around these dens, as well as the use of rattlesnake monitor on-site during construction in suitable habitats between April 15 and October 15. We recommend that PennEast continue to consult with the PFBC as needed to finalize plans necessary to avoid or minimize impacts on the timber rattlesnake (see section 4.6.2.25).*

The habitats that are listed in the DEIS as being surveyed are not complete and not protective of timber rattlesnakes and copperheads. DRN documented optimum timber rattlesnake habitat during assessments conducted in SGL 168 from at least MP 52.9 to 51.0 along Blue Mountain near Danielsville, PA. The DEIS states that 51.1 to 51.6 was surveyed for timber rattlesnake but this only includes one section of this habitat and does not include all of the optimal habitat areas in that area of SGLs; therefore the DEIS is not complete nor protective of these important species. Below some images of the habitat observed during field reconnaissance.



**Figure 34: Example of optimum rattlesnake habitat in SGL 168 that was not currently assessed in the herp studies.**



**Figure 35: Evidence of rodents among the boulder habitat – another primary requirement of rattlesnakes**

Rattlesnakes use different areas of a mountain at different times of the year and it would be more protective to ensure all areas are surveyed by a certified herpetologist at various times in these ideal habitats. The seasonal movements of timber rattlesnakes vary greatly. Snakes emerge from hibernacula (dens) in the spring and come down along the base of the mountain to summer foraging and breeding grounds. As ectotherms, their movements are triggered by temperature and sun patterns and orientation. The habitat requirements for hibernating, foraging, and breeding are different so all suitable areas must be taken into account. Spatial ecology also varies between males and females. Gravid females generally stay within a half mile of the den, while nongravid females may travel over a mile away from the den. Males move significantly farther, particularly when searching for females, and may travel up to 4 miles away from the den. This large home range size means that there is a significant area of land that needs to be surveyed before presence or absence can be determined.

Rocky outcroppings, boulder habitat, and rodent populations and hiding places were all observed between MP 52.5 and MP 52.9. This SGL dominated area is natural and includes intact native plant habitat, boulder conditions, and mature forest on steep slopes and along the base of the mountain ideal for rattlesnakes and likely copperheads also. This area is not included in the MP Phase 1 surveys listed above and this is a large omission, especially in light of the DEIS stating that PE would adhere to the recommendations of the state agencies, including completing all necessary surveys for state species. Landowners along Cottonwood Road whose properties about the SGL 168 have heard and observed timber rattlesnakes over the past few years. Milk snakes and black racers have also been observed as well as black bears. Local residents also said that snakes are found on the top of the ridge along the AT very regularly. With these observations, it would be prudent to expand the Phase 1 studies to include ALL areas, especially in these intact habitats and public lands and to see a Phase 2 survey conducted in this area through this entire stretch. From the DEIS, this area largely in SGL 168, is not fully included. It also seems unusual that the DEIS lists only one den site for timber rattlesnakes considering the extensive length of the pipeline route in Pennsylvania counties containing known timber rattlesnake habitat.



**Figure 36. Typical geologic conditions and optimum rattlesnake habitat in SGL 168.**

In summary, DRN's spot investigations both by viewing and spot checking maps and field truthing and walking short sections of the pipeline path have documented gaps, omissions, incomplete information, vague mapping, and lack of comprehensive cumulative environmental impact considerations in the DEIS. As such, with incomplete information, DRN nor the public has adequate information to conduct a thorough review. Where DRN conducted limited field work, in all cases we found important features and habitat that are not fully considered in the DEIS. In light of these errors, omissions, and flaws it is recommended that the DEIS and the Penn East Pipeline be rejected due to the extensive harms it would cause to the region. It is recommended that the public be provided all details with another extensive open comment since third party verification is clearly necessary to ensure information is complete and cumulative impacts are considered.

## References

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<sup>i</sup> PA DEP Continuous Probe Monitoring Protocol. 2015

<sup>ii</sup> Schmid & Company, The Effects of the Proposed PennEast Pipeline on Exceptional Value Wetlands in Pennsylvania, July 2016.

<sup>iii</sup> Delaware Riverkeeper Network *Field Monitoring Report*, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams. Addendum to Comment for the PennEast Pipeline.

<sup>iv</sup> Schmid & Company, The Effects of the Proposed PennEast Pipeline on Exceptional Value Wetlands in Pennsylvania, July 2016.

<sup>v</sup> Ibid.

<sup>vi</sup> Tom Myers, Ph.D. Technical Memorandum Review of Draft Environmental Impact Statement, Proposed PennEast Pipeline, Docket No. CP15-558-000, FERC\EIS: 0271D, August 31, 2016

<sup>vii</sup> Brown, L.J. and R.E. Jung. 2005. "An introduction to Mid-Atlantic Seasonal Pool," EPA 903-B-05-001. U.S. Environmental Protection Agency, Mid Atlantic Integrated Assessment, Ft. Meade, Maryland.

<sup>viii</sup> Vredenberg, V., McDonald, M., & Sayre, T. (2008). Climate Change. *AmphibiaWeb: Information on amphibian biology and conservation, 2016, Berkeley, California*. Retrieved from <http://amphibiaweb.org/declines/ClimateChange.html>

<sup>ix</sup> Schmid & Company, The Effects of the Proposed PennEast Pipeline on Exceptional Value Wetlands in Pennsylvania, July 2016.

<sup>xi</sup> An example of a recent Wild Trout Waters Change, PA Fish and Boat Commission

<http://www.pabulletin.com/secure/data/vol46/46-30/1268.html>. July 23, 2016. Accessed Sept 12, 2016.

<sup>xii</sup> Tom Myers, Ph.D. Technical Memorandum Review of Draft Environmental Impact Statement, Proposed PennEast Pipeline, Docket No. CP15-558-000, FERC\EIS: 0271D, August 31, 2016

<sup>xiii</sup> Adams, Michelle and Henderson, Marc, Water Resources Engineers, Meliora Design, LLC, *Professional Review & Comment of the Draft Environmental Impact Statement and Supporting Documents Related to Surface Water Impacts of the Proposed PennEast Pipeline Project*, September 2016.

<sup>xiv</sup> The Nature Conservancy, Pennsylvania Vernal Pool Identification Guide. 2005.

<sup>xv</sup> Delaware Riverkeeper Network *Field Monitoring Report*, Pipeline Construction & Maintenance Irreparably Harms Rivers, Wetlands and Streams. Addendum to Comment for the PennEast Pipeline.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 12, Key-Log  
Economics, Economic Costs of the Atlantic Coast  
Pipeline, February 2016.**

# Economic Costs of the Atlantic Coast Pipeline:

*Effects on  
Property Value, Ecosystem Services, and Economic Development  
in Western and Central Virginia*

FEBRUARY 2016

UPDATED MAY 2016

*Highlanders for Responsible Development*

*Augusta County Alliance*

*Friends of Nelson County*

*Friends of Buckingham, Virginia*

*Yogaville Environmental Solutions*

Prepared by:

Spencer Phillips, PhD

Cara Bottorff

Sonia Wang



*Research and strategy for the land community.*

[keylogeconomics.com](http://keylogeconomics.com)

## EXECUTIVE SUMMARY\*

The Atlantic Coast Pipeline (ACP) is proposed to carry natural gas from the Marcellus Shale through a 564-mile-long swath of West Virginia, Virginia, and North Carolina to markets in Virginia and North Carolina and, potentially, overseas. It has been represented as both environmentally safe and economically beneficial, providing economic opportunity for local communities along the proposed route.

Promised economic benefits, however, are only part of the impact the Federal Energy Regulatory Commission (FERC) must review before deciding whether to approve the construction and operation of the pipeline. Under the National Environmental Policy Act, FERC's review must consider the full range of environmental effects of the proposed pipeline. These include the various ways in which environmental effects would result in changes in human well-being—that is, in economic benefits and costs. While estimates of positive economic effects including construction jobs and local tax payments have been developed and promoted as reasons to move forward with the pipeline, no systematic consideration of the potential negative economic effects—economic costs—of the ACP has been completed.

To help fill the gap in current information, five community groups from a four-county region in central and western Virginia commissioned this independent research into key economic costs of the ACP. This region, comprised of Highland, Augusta, Nelson, and Buckingham Counties, would experience three types of economic costs due to the construction, operation, and presence of the ACP. First, the pipeline would impact property values along the 126 miles of pipeline proposed for the region. Affected properties are those touched by the 75-foot-wide right-of-way, within the 1.4-mile-wide evacuation zone, in proximity to the compressor station proposed for Buckingham County, and throughout the viewshed of the proposed pipeline. Second, construction and the ongoing operation of the pipeline would alter land use/land cover in ways that diminish ecosystem service values, such as aesthetics, water supply, and timber and food production. Third, and in part due to a loss of scenic and quality-of-life amenities, there would be decreases in visitation, in-migration, and small business development and a loss of jobs and personal income those activities would otherwise support.

Considering this four-county region alone, estimated one-time costs range from \$72.7 to \$141.2 million. These one-time costs comprise lost property value and the value of ecosystem services lost during construction. Annual costs following the construction period include lower ecosystem service productivity in the ACP's right-of-way, lower property tax revenue due to the initial losses in property value, and dampened economic development. These total between \$54.8 and \$67.8 million per year, and would persist forever. (See "At a Glance," below for details.) Putting the stream of costs into present value terms<sup>1</sup> and adding the one-time costs, the total estimated cost of the ACP in Highland, Augusta, Nelson, and Buckingham Counties is between \$4.0 to \$4.9 billion. For reasons explained in the body of this report, these are conservative estimates.

The costs represented by the estimates presented here are what economists call "externalities," or "external costs," because they would be imposed on parties other than (external to) the company proposing to build the pipeline. Unlike the private (or internal) costs of the pipeline, external costs borne by the public do not affect the company's bottom-line. From an economic perspective, the presence of externalities is what demands public involvement in decisions about the ACP. Without consideration of all of the costs of the project, too much pipeline (which may mean any pipeline at all) is the inevitable result. FERC must therefore consider the true bottom line and ensure that the full costs of the pipeline, especially those external costs imposed on the public, are rigorously examined and brought to bear on its decision about whether or not to permit the ACP project to proceed.

\*This March 2016 update addresses a new report from the Interstate Natural Gas Association of America (INGAA) Foundation Inc., which purports to have found no property value impact from natural gas pipelines. See pages 32-35 of this report for a review of the INGAA study and similar studies.

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<sup>1</sup> The present value of a perpetual stream cost is the one-year cost divided by the 1.4% real discount rate recommended by the Office of Management and Budget for cost-benefit and cost-effectiveness analysis of public projects and decisions (<http://federalaccounting.org/2015/01/omb-updates-cost-benefit-analysis-discount-rates/>).

## At a Glance:

### The Atlantic Coast Pipeline in Western and Central Virginia ~ Highland, Augusta, Nelson, & Buckingham Counties ~

- Miles of Pipeline: 125.5
- Acres in the construction corridor and permanent right-of-way (ROW): 1,901 and 1,140
- Most impacted land cover types (ROW only): forest (795 acres) and pasture (247 acres)
- Parcels touched by ROW: 521
- Parcels in the 1.4-mile-wide evacuation zone: 6,148
- Parcels within one half mile of the compressor station: 87
- Residents and housing units in the evacuation zone: 15,128 people and 8,762 homes
- Parcels from which the pipeline would be visible: 31,117, or 29% of all parcels in the four-county study region
- Baseline property value at risk (and expected one-time cost due to the ACP):
  - In the ROW: \$277.1 million (\$11.6 to \$36.0 million)
  - In the evacuation zone: \$1.13 billion (\$43.0 million)
  - Near the compressor station: \$4.9 million (\$1.2 million)
  - In the viewshed: \$7.44 billion (to avoid double counting with lost aesthetic value under ecosystem services, this impact is not separately estimated)
- Total property value lost: \$55.8 to \$80.2 million
- Resulting loss in property tax revenue (annual): \$281,300 to \$408,400
- Lost ecosystem service value, such as for water and air purification, recreational benefits, and others:
  - Over the two-year construction period: between \$16.9 and \$61.0 million (a one-time cost)
  - Annually for the life of the ACP: between \$4.9 and \$17.8 million
- Lost economic development opportunities due to the erosion of these Counties' comparative advantages as attractive places to visit, reside, and do business. Under the scenarios described below, these could include:
  - Annual loss of recreation tourism expenditures of \$41.3 million that supports 387 jobs and \$7.4 million in payroll and generates \$1.8 million in state and \$1.3 million in local taxes
  - Annual loss of personal income of \$6.6 million due to slower growth in the number of retirees
  - Annual loss of personal income of \$1.6 million due to slower growth in sole proprietorships
- One-time costs (property value and ecosystem services during construction) would total between \$72.7 and \$141.2 million
- Annual costs (all other costs above) would range from \$54.8 to \$67.8 million

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## ABBREVIATIONS AND TERMS

**ACP:** Atlantic Coast Pipeline. For this report, this generally refers to the pipeline corridor itself as well as the compressor station proposed for Buckingham County.

**ACP LLC:** Atlantic Coast Pipeline, LLC, an entity formed by Dominion Resources, Inc., Duke Energy Corporation, Piedmont Natural Gas Co., Inc., and AGL Resources, Inc. to develop, own, and operate the proposed Atlantic Coast Pipeline (ACP)

**BTM:** Benefit Transfer Method, a method for estimating the value of ecosystem services in a study region based on values estimated for similar resources in other places

**DTI:** Dominion Transmission, Inc., the entity that would build and operate the proposed ACP under contract to ACP LLC

**EIS:** Environmental Impact Statement, a document prepared under the National Environmental Policy Act analyzing the full range of environmental effects, including on the economy, of proposed federal actions, which in this case would be the approval of the Atlantic Coast Pipeline

**FERC:** Federal Energy Regulatory Commission, the agency responsible for preparing the EIS and deciding whether to grant a certificate of public convenience and necessity (i.e., whether to permit the pipeline)

**NEPA:** National Environmental Policy Act of 1970, which requires the environmental review of proposed federal actions, preparation of an EIS, and, for actions taken, appropriate mitigation measures

## AUTHORS' NOTE:

We are grateful for the assistance the sponsoring organizations (Highlanders for Responsible Development, Augusta County Alliance, Friends of Nelson County, Yogaville Environmental Solutions, and Friends of Buckingham Virginia) have provided in identifying local information sources and making contacts in the study region. Key-Log Economics however, remains solely responsible for the content of this report, the underlying research methods, and the conclusions we draw from them.

## BACKGROUND

The proposed Atlantic Coast Pipeline (ACP) is a high-volume transmission pipeline intended, as described in filings with the Federal Energy Regulatory Commission (FERC), to transport 1.5 billion cubic feet (bcf) per day of natural gas from the Marcellus Shale region in West Virginia to power generation facilities, natural gas distributors, and commercial and industrial end users in Virginia and North Carolina (Natural Resource Group, 2015c).<sup>2</sup> Atlantic Coast Pipeline, LLC, would control the pipeline, while permit applications, construction, and operations would be managed by Dominion Transmission, Inc. (DTI).

The majority of the pipeline, and all of it in the four-county region considered in this study (Figure 1), would consist of 42-inch diameter pipe and would be operated at a pressure of 1,440 pounds per square inch gauge (PSIG). This pressure would be maintained by three compressor stations, including one proposed for Buckingham County, Virginia, which is part of the study region (Natural Resource Group, 2015c).

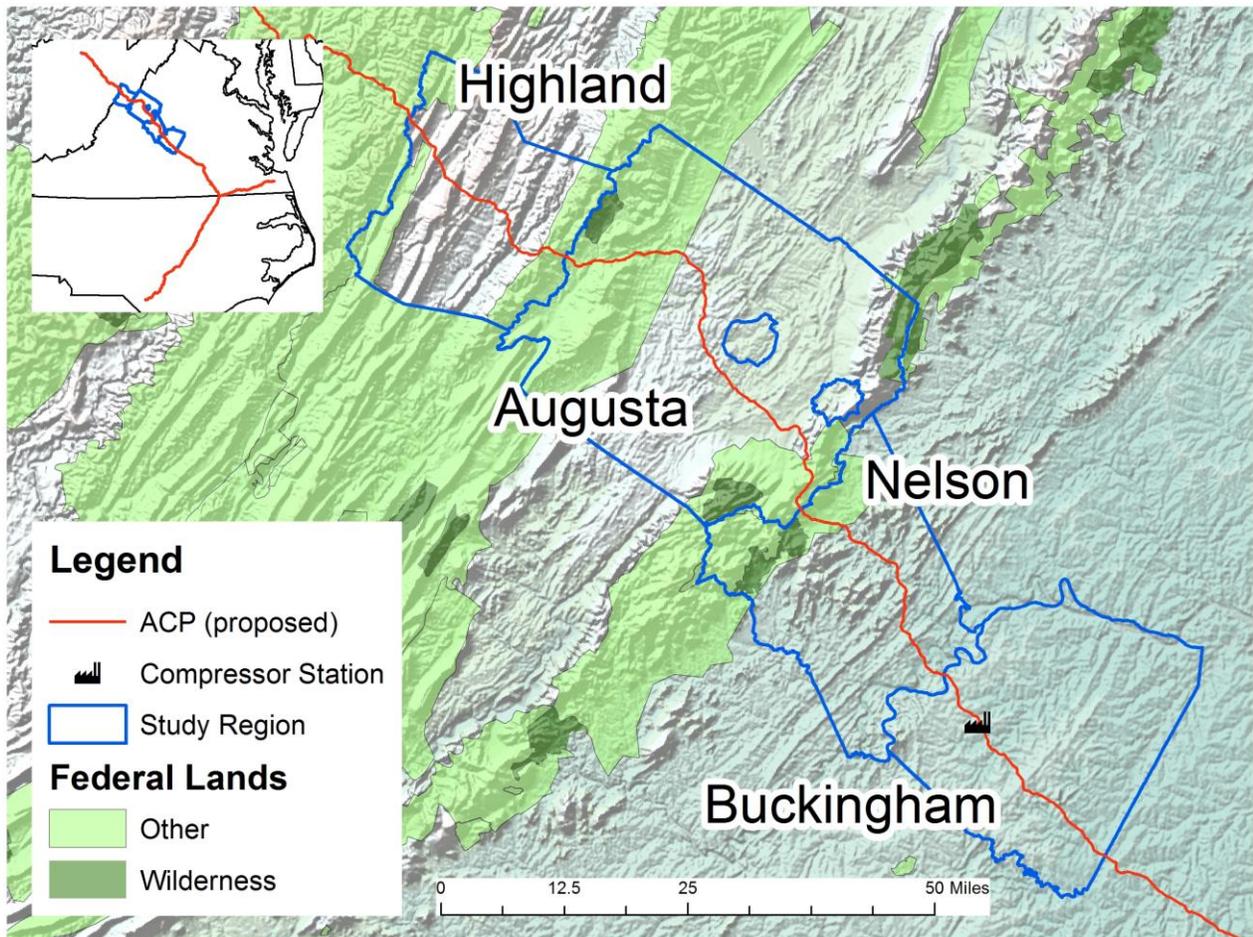
Along the way, the ACP would cross portions of the Monongahela and George Washington National Forests, Blue Ridge Parkway, the Appalachian Trail, and other public conservation, scenic, and natural areas. Its permanent right-of-way and temporary construction corridor—75 and 125 feet wide, respectively—would also cross thousands of private properties. Pipeline leaks and explosions could cause substantial physical damage and require evacuation of even wider swaths, affecting perhaps tens of thousands of homes, farms, and businesses. Still wider, but more difficult to gauge and estimate, are the zones within which the construction, operation, and presence of the pipeline would affect human well-being by changing the availability of ecosystem services such as clean air, water supply, and recreational opportunities. This would occur as the pipeline creates an unnatural linear feature on a landscape that otherwise remains largely natural or pastoral and dampens the attractiveness of the affected region as a place to live, visit, retire, or do business.

To date, such negative effects and estimates of their attendant economic costs have not received much attention in the otherwise vigorous public debate surrounding the ACP proposal. This report, commissioned jointly by five community groups<sup>3</sup> located in central and western Virginia is both an attempt to understand the nature and potential magnitude of the economic costs of the ACP in a particular four-county area, as well as to provide an example for FERC as it proceeds with its process of analyzing and weighing the full effects of the proposed ACP along its entire length and, by extension, throughout the region in which its effects will occur.

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<sup>2</sup> While pipeline backers maintain that the gas transported via the ACP would not be for export, the pipeline would add to overall national gas transmission capacity and thus would serve to free up more gas for export at Dominion Cove Point LNG LP's newly approved liquefied natural gas export facility in Calvert County, Maryland.

<sup>3</sup> These are, from west to east, Highlanders for Responsible Development, Augusta County Alliance, Friends of Nelson County, Yogaville Environmental Solutions, and Friends of Buckingham Virginia.



**Figure 1: Four-County Study Region.**

Note: Augusta County includes the independent cities of Staunton and Waynesboro

Sources: ACP route and compressor digitized from interactive map, Dominion Resources Inc. <http://dom.maps.arcgis.com/>, and Resource Report 1: Appendix A, Topographic Route Maps (Natural Resource Group 2015); Study Region (counties); federal lands, and hill shade from USGS and [http://nationalmap.gov/small\\_scale/](http://nationalmap.gov/small_scale/)

## Policy Context

Before construction can begin, the ACP must be approved by FERC. That approval, while historically granted to pipeline projects, depends on FERC’s judgment that the pipeline would meet a public “purpose and need.” Because the approval would be a federal action, FERC must also comply with the procedural and analytical requirements of the National Environmental Policy Act (NEPA). These include requirements for public participation, conducting environmental impact analysis, and writing an Environmental Impact Statement (EIS) that evaluates all of the relevant effects. Of particular interest here, such relevant effects include direct, indirect, and cumulative effects on or mediated through the economy. As the NEPA regulations state,

Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions

which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (emphasis added, 36 CFR 1508.b).

It is important to note NEPA does not require that federal actions – which in this case would be approval or not of the ACP – necessarily balance or even compare benefits and costs. NEPA is not a decision-making law, but rather a law that requires decisions be supported by as full as possible an accounting of the reasonably foreseeable effects of federal actions on the natural and human environment. It also requires that citizens have opportunities to engage in the process of analyzing and weighing those effects.

In addition to the requirements of NEPA, FERC’s own policy regarding the certification of new interstate pipeline facilities (Docket No. PL99-3-000) requires that adverse effects of new pipelines on “economic interests of landowners and communities affected by the route of the new pipeline” be weighed against “evidence of public benefits to be achieved [by the pipeline]” (Hoecker, Breathitt, & He’bert Jr., 1999, pp. 18–19). Further, “...construction projects that would have residual adverse effects would be approved only where the public benefits to be achieved from the project can be found to outweigh the adverse effects” (p. 23).

In principal, this policy is in line with the argument, on economic efficiency grounds, that the benefits of a project or decision should be at least equal to its total cost, including external costs. The policy’s guidance regarding what adverse effects must be considered and how they are measured is deeply flawed, however. The policy states, for example, that “if project sponsors...are able to acquire all or substantially all, of the necessary right-of-way by negotiation prior to filing the application...it would not adversely affect any of the three interests,” the third of which include communities through which the proposed pipeline would pass (Hoecker et al., 1999, p. 26). In effect, the Commission’s policy contends that the only adverse effects that matter are those that affect owners of properties in the right-of-way. Even for a policy adopted in 1999, this contention is completely out of step with then current understanding of the economic effects of development that alters the natural environment.

A further weakness of the FERC policy is that it relies on applicants to provide information about benefits and costs. The policy’s stated objective “is for the applicant to develop whatever record is necessary, and for the Commission to impose whatever conditions are necessary, for the Commission to be able to find that the benefits to the public from the project outweigh the adverse impact on the relevant interests” (Hoecker et al., 1999, p. 26). The applicant therefore has an incentive to be generous in counting benefits<sup>4</sup> and parsimonious in counting the costs of its proposal. Under these circumstances, it seems unlikely that the Commission’s policy will prevent the construction of pipelines

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<sup>4</sup> Dominion Resources and Dominion Transmission Inc. have published estimates of economic benefits in the form of employment and income stemming from the construction and operation of the ACP. As has been well documented elsewhere, both studies suffer from errors in the choice and application of methods and in assumptions made regarding the long-run economic stimulus represented by the ACP. Most significantly, the studies make no mention of likely economic costs, and their projections of long-term benefits extend far beyond the time period (of a year or so) within which economic impact analysis is either useful or appropriate. See Phillips (2015b) and Stanton et al. (2015) for details on these shortcomings.

for which the full costs are greater than the public benefits they would actually provide. Indeed, FERC has never rejected a pipeline proposal (van Rossum, 2016).

With ACP LLC having failed to acquire a sufficient portion of the right-of-way and with the need for other federal agencies, including the US Forest Service, to evaluate how the ACP would affect resources under its stewardship, the Commission issued a Notice of Intent to prepare an EIS in February of 2015 (Federal Energy Regulatory Commission, 2015). The process began with a series of scoping meetings at which members of the public could express their thoughts on the pipeline in general as well as what effects should fall under the scope of the EIS. Interested parties also had the opportunity to submit comments online and through the mail. FERC received more than 1,600 individual comment letters, another 1,239 form letters, and several petitions bearing multiple signatures each.<sup>5</sup>

Much of what FERC heard from citizens echoed and expanded upon the list of potential environmental effects listed in its Notice of Intent. Of those, several are particularly important as the sort of environmental effects that resonate in the lives of people. These effects can take the form of external economic costs that would be borne by individuals, businesses, and communities throughout the landscape the ACP would traverse. Table 1 lists these key issues along with the number of scoping letters from residents of Highland, Augusta, Nelson, and Buckingham County who mentioned the issue.

FERC also received input about both the legal and economic importance of considering the economic consequences of these environmental effects along with recommendations of the type and scope of economic analysis that should be undertaken to quantify, to the extent possible, the magnitude of the economic costs (see Phillips, 2015, for example). DTI responded to this input in a letter to FERC arguing against such analysis, stating “because there is no commonly accepted methodology to weigh the economic benefits of the ACP against possible environmental, health, and safety risks using all possible positive and negative externalities, the economic impact assessment can only address tangible economic benefits of the ACP using known variables and economic modeling” (Woolard & Natural Resource Group, 2015, p. 58).

Contrary to DTI’s claim, experts in the fields of natural resource, agricultural, environmental, and ecological economics have been developing, testing, and improving such methods since the 1960s (and the underlying economic models have been established for even longer). Textbooks such as *The Benefits of Environmental Improvement: Theory and Practice* (Freeman III, 1979) or *Valuing Natural Assets: The Economics of Natural Resource Damage Assessment* (Kopp & Smith, 1993) plus many thousands of peer-reviewed papers and other resources provide ample documentation of the methods

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<sup>5</sup> While the NEPA’s scoping phase is intended to generate guidance for the lead agency (FERC) on how to conduct the EIS and is not intended as a referendum, FERC nevertheless has heard opinions in support of the pipeline, and, as it turns out, many more opinions in opposition to the pipeline. Pipeline opponents cite a variety of concerns, including those that are the subject of this report. Key-Log Economics is preparing a full analysis of content of the scoping comments. Using crowd-sourcing, Key-Log Economics has reviewed and coded the content of all 2,875 individual letters, form letters, and petitions submitted to FERC through, and somewhat beyond, its announced formal scoping period. A report summarizing that content as a measure of citizens’ level of interest in the issues they have raised and, therefore, those they should most expect FERC to cover in the EIS process, will be released in early 2016.

by which one may estimate the negative externalities and other economic consequences of changes in environmental quality that projects like the proposed ACP would cause.

**TABLE 1: Environmental Concerns Raised During FERC Scoping Process**

Environmental Issue / Resource Value <sup>a</sup>	Mentions among 1,299 scoping comment letters <sup>b,c</sup>
Impacts on property values, tourism, and recreational resources	521 (property value) 630 (tourism) 381 (recreation)
Safety issues, such as construction and operation of the planned facilities near existing residences, schools, businesses, and military training facilities, and in karst and steep slope terrain	528 (risk of accidents) 467 (general safety) 420 (erosion)
Impacts on forested areas and other vegetation	739 (forested areas, vegetation, habitat, etc.)
Impacts on surface water resources including rivers springs, seeps, and wetlands	812 (waterways) 604 (water quality) 370 (water supply)
Impacts on groundwater resources and wells	370 (water supply)
Impacts on protected species and habitat	404 (wildlife)
Impacts on cultural resources including battlefields, cemeteries, and historic properties	489 (rural character) 240 (culture)
Concerns regarding construction and operational noise, especially related to compressor stations	334 (health) 517 (quality of life) 40 (compressor station)

Notes:

- a. This is a partial list of “Currently Identified Environmental Issues” from FERC’s Notice of Intent to prepare an Environmental Impact Statement regarding the ACP (Federal Energy Regulatory Commission, 2015, p. 12165).
- b. The categories in parentheses are related to the “currently identified environmental issues” listed in the FERC Notice of Intent (Federal Energy Regulatory Commission, 2015, p. 12165).
- c. These “mentions” are the number of comment letters written by or on behalf of residents of the study region (Highland, Augusta, Nelson, and Buckingham Counties) that noted or mentioned the listed issue. While detailed analysis of the full set of comments is ongoing, the vast majority of commenters from the study region expressed a belief that the ACP would have a negative impact on the resource/value listed in the first column.

Moreover, precedent from the Tellico Dam, to the Exxon Valdez settlement, to the national forest planning rule and recent guidance from the Council on Environmental Quality (with their emphases on ecosystem services) show that such methods do exist and are useful both for determining the costs of environmental damage and for guiding cost-effective environmental decision-making (Carson et al., 2003; Donovan, Goldfuss, & Holdren, 2015; Randall, 1987; USDA Forest Service, 2012).

The applicant’s professed ignorance of established methods for estimating the economic costs of environmental damage perhaps serves “to develop whatever record is necessary” (Hoecker et al.,

1999), for FERC to permit the pipeline, but it does nothing to develop a proper assessment of costs and or to serve the public interest. To ensure an economically efficient use of public and private resources and to meet its obligations under NEPA, FERC must obtain credible estimates of public benefit (which has so far not been demonstrated), develop rigorous estimates of the full suite of costs, and bring both sets of information to bear on its decisions regarding the Atlantic Coast Pipeline.

## Study Objectives

Given the policy setting and what may be profound effects of the ACP as proposed on the people and communities of central and western Virginia, we have undertaken this study to provide information of two types:

1. An example of the scope and type of analyses that FERC could, and should, undertake as part of its assessment of the environmental (including economic) effects of the ACP.
2. An estimate of the potential magnitude of economic effects in this four-county subset of the landscape where the ACP's environmental and economic effects will be felt.

We do not claim the estimates below represent the total of all of the potential costs that would attend the construction, operation, and presence of the pipeline. Specifically, we have not estimated costs in two categories: "passive-use value,"<sup>6</sup> including the value of preserving the landscape, without a pipeline, for future direct use; and increases in the cost of community services like road maintenance and emergency response that may increase due to the construction and operation of the pipeline.<sup>7</sup>

Therefore, our figures should be understood to be conservative, lower-bound estimates of the true total cost of the ACP in that sub-region and, of course, they do not include costs for the remainder of the region proposed for the ACP. We do urge that the FERC augment the results of this study with its own similar analysis for the entire region and with additional research to determine the costs of community services and other relevant classes of costs not counted here.

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<sup>6</sup> Passive-use values include *option* value, or the value of preserving a resource unimpaired for one's potential future use; *bequest* value, which is the value to oneself of preserving the resource for the use of others, particularly future generations; and *existence* value, which is the value to individuals of simply knowing that the resource exists, absent any expectation of future use by oneself or anyone else. In the case of the ACP, people who have not yet, but who may intend, to travel the Blue Ridge Parkway or attend the Highland Maple festival are better off knowing that the setting for activities is a beautiful aesthetically pleasing landscape. What such visitors would be willing to pay to maintain that possibility would be part of the "option value" of an ACP-free landscape.

<sup>7</sup> As in communities impacted by the shale gas boom itself, communities along the pipeline can expect spikes in crime as transient workers come and go, more damage to roads under the strain of heavy equipment, increases in physical and mental illnesses including asthma, depression, anxiety, and others triggered by exposure to airborne pollutants, to noise, and to emotional, economic, and other stress. See, for example, Ferrar et al. (2013), Healy (2013), Fuller (2007), Campoy (2012), and Mufson (2012).

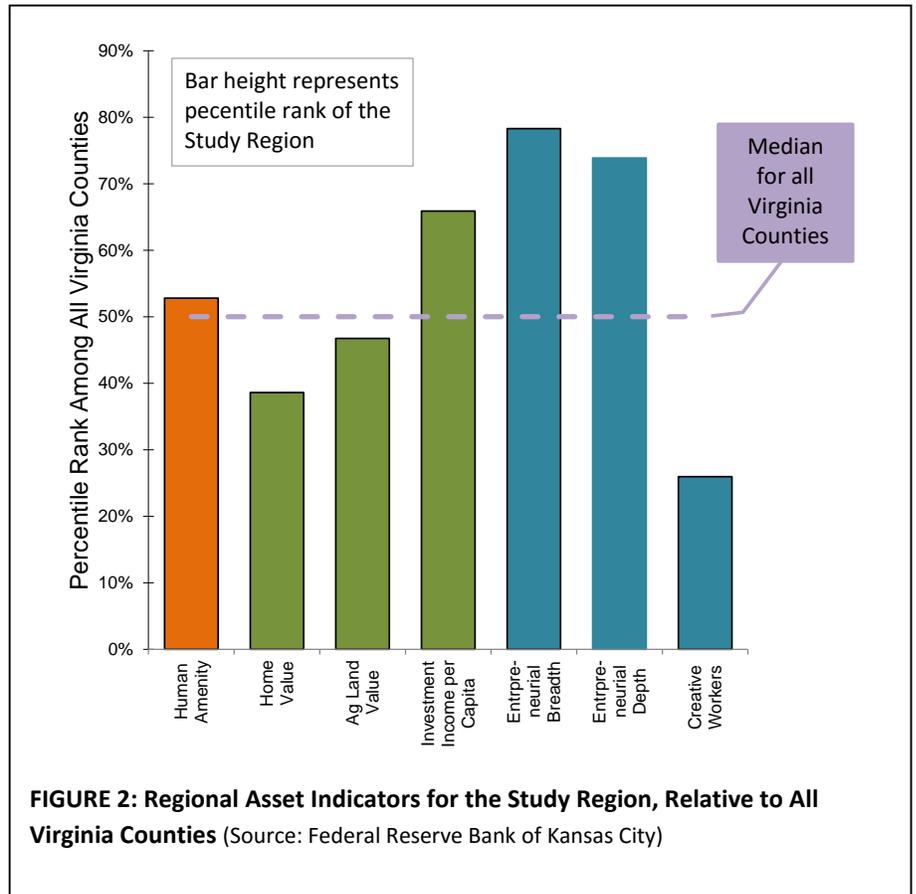
## Current Economic Conditions in the Study Region

Our geographic focus is a four-county region comprising Highland, Augusta,<sup>8</sup> Nelson, and Buckingham Counties in Virginia. This 2,480 square-mile region supports diverse land uses, from some of Virginia’s wildest forests, the iconic Shenandoah Valley, the heart of Virginia’s Blue Ridge traversed by both the Appalachian Trail and Blue Ridge Parkway, thriving cities, international retreat centers, historically and culturally significant human settlements, working farms, and extensive commercial timberland. These natural, cultural, and economic assets are among the reasons more than 150,000 people call this region home and an even larger number visit each year for skiing, sightseeing, music and maple festivals, spiritual retreats, weddings, wine tastings, brewery tours, and other pursuits.

Statistics from the Center for the Study of Rural America, part of the Federal Reserve Bank of Kansas City, further reveal the extent to which the region has the right conditions for resilience and economic success in the long run (Low 2004). These data show that the study region has a higher human amenity index (based on scenic amenities, recreational resources, and access to health care), more financial wealth in the form of investment income per capita, and stronger entrepreneurship than most Virginia counties (Figure 2).<sup>9</sup>

More traditional measures of economic performance suggest the region is strong and resilient. From 2000 through 2014, for example:

- Population in the study region grew by 8.5%, compared to a 0.2% loss of population for non-metro Virginia<sup>10</sup>



<sup>8</sup> Two independent cities, Staunton and Waynesboro, lie within the geographic borders of Augusta County. In this report, subject to some limitations where noted, statistics, estimates, and other information labeled as “Augusta County” reflect totals for the County plus the two independent cities.

<sup>9</sup> Note that the Fed’s statistics have not been updated since 2004-2006, and conditions in and outside the study region have undoubtedly changed. Some of these relative rankings may no longer hold.

<sup>10</sup> “Non-metro Virginia” comprises those counties that are not a part of a federally defined metropolitan statistical area (MSA). While Augusta is part of the Staunton-Waynesboro-Augusta MSA and Nelson and Buckingham are part of the

- Employment grew by 6.3%, compared to a drop of 6.7% for non-metro Virginia
- Personal income grew by 23.8%, compared to 13.1% for non-metro Virginia
- Earnings per job are higher, by about \$2,400/year, than the average for non-metro Virginia
- Per capita income is higher, by \$4,000/year, than the average for non-metro Virginia
- Unemployment grew by less and ended the period two points lower than the average for non-metro Virginia.<sup>11</sup>

These and other trends indicate not only that the region has been doing quite well, but also that it is doing well with, and perhaps because of, a relative absence of industrial development like the ACP. The region has what regional economists McGranahan and Wojan have called the “Rural Growth Trifecta” of outdoor amenities, a creative class of workers, and a strong “entrepreneurial context” (innovation-friendliness) (2010). Individual workers, retirees, and visitors are attracted to the natural beauty of the region while entrepreneurs are attracted by the quality of the environment, by the quality of the workforce, and by existing support from local government. Workers, for their part, are retained and nurtured by dynamic businesses that fit with the landscape and lifestyle that attracted them in the first place.

As four further indicators of this dynamic, consider since 2000:

- The region’s population growth has been primarily due to in-migration
- The proportion of the population 65 years and older has increased from 15.0% to 17.6%
- Proprietors’ employment is up by 28.1%
- Non-labor income (primarily investment returns and age-related transfer payments like Social Security) is up by 45.8%.<sup>11</sup>

These trends suggest that entrepreneurs and retirees are moving to (or staying in) this region. They bring their income, their expertise, and their job-creating energy with them.

Temporary residents – tourists and recreationists – are also an important part of the region’s economy. Tourists spent more than \$413 million in the study region in 2014. The companies that directly served those tourists employed 3,866 people, or 4.9% of all full- and part-time workers (Headwaters Economics, 2015; Virginia Tourism Corporation, 2015).

It is in this context the potential economic impacts of the ACP must be weighed and the apprehension of the region’s residents understood. The region has been doing quite well on the strength of its amenities and quality of life. Many believe the construction and operation of the pipeline will kill or at least dampen the productivity of the proverbial goose that lays its golden eggs in the region. This could

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Charlottesville MSA, each of the study region counties are predominantly rural in landscape and character and are much more like other non-metro counties than they are like Northern Virginia or Tidewater. Therefore, we believe that averages for non-metro Virginia provide a more appropriate point of comparison than statistics that include the Commonwealth’s more urban areas.

<sup>11</sup> These data are from Headwaters Economics (2015), US Bureau of Economic Analysis (2015), and US Bureau of the Census (2014, 2015).

result in a slower rate of growth, which would mean worse economic outcomes than would be expected with a continued absence of a pipeline. For example, if the pipeline is built, business groups Friends of Wintergreen and Nelson 151 identified \$75 million in foregone investments and between 200 and 300 new employees who will not be hired (Theiss, 2015). These businesses, which depend on the scenic and other amenities noted above, would simply not have enough business in the form of visitors, diners, skiers, golfers, and others to justify their now-on-hold expansions and new developments.

More dire is the prospect that such businesses will not be able to maintain their current levels of employment. Just as retirees and many business can choose where to locate, visitors and potential visitors have practically unlimited choices for

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*“Whether they are seeking a retirement home or a weekend retreat, people choose Highland county BECAUSE it doesn't have what people have in other places—over-development, noise, traffic or pollution. They want to get away from all that and be where they can enjoy the peace and beauty of the natural landscape. For my clients, the viewshed, along with the previously mentioned attributes, was a critical driving factor in where they would purchase.”*

*– Fran Davenport, retired Realtor  
Monterey, Virginia*

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places to spend their vacation time and expendable income. If the study region loses its amenity edge, other things being equal, people will go elsewhere, and this region could contract.

Instead of a “virtuous circle” with amenities and quality of life attracting/retaining residents and visitors, who improve the quality of life, which then attracts more residents and visitors, the ACP could tip the region into a downward spiral. In that scenario, loss of amenity and risk to physical safety would translate into a diminution or outright loss of the use and enjoyment of homes, farms, and recreational and cultural experiences. Potential in-migrants would choose other locations and some long-time residents would move away, draining the region of some of its most productive members. Homeowners would lose equity as housing prices follow a stagnating economy. With fewer people to create economic opportunity, fewer jobs and less income will be generated. Communities could become hollowed out, triggering a second wave of amenity loss, out-migration, and further economic stagnation.

## ENVIRONMENTAL-ECONOMIC EFFECTS AND WHERE THEY WOULD OCCUR

In the remainder of this report, we follow this potential cycle and estimate three distinct types of economic consequences.

First, corresponding to the direct biophysical impacts of the proposed pipeline, are effects on ecosystem services – the benefits nature provides to people for free, like purified water or recreational opportunities, that will become less available and/or less valuable due to the ACP’s construction and operation. Second are effects on property value as owners and would-be owners choose properties farther from the pipeline’s right-of-way, evacuation zone, viewshed, or, in the case of the compressor

station, noise. Third and finally are more general economic effects caused by a dampening of future growth prospects or even a reversal of fortune for some industries.

We begin with an exploration of the geographic area over which these various effects will most likely be felt.

### **Impact Zones within the Study Region**

Construction of the pipeline corridor itself would require clearing an area 125 feet (38.1 m) wide in most areas and 75 feet (22.9 m) wide in wetlands. After construction, the permanent right-of-way (ROW) would be 75 feet wide along the entire length of the pipeline. It is from within this construction zone and right-of-way that the greatest disruption of ecosystem processes will occur, so it is from these zones that reductions in ecosystem service value (ESV) will emanate. Since we are estimating ecosystem service values at their point of origin, we will focus on this zone in that analysis below. The value of land crossed by the ROW and the somewhat larger number of parcels crossed by the construction zone will be acutely affected.

Operated at its intended pressure and due to the inherent risk of leaks and explosions, the pipeline would present the possibility of having significant human and ecological consequences within a large “High Consequence Area” and an even larger evacuation zone. A High Consequence Area (HCA) is “the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure (Stephens, 2000, p. 3).” Using Stephens’ formula, the HCA for this pipeline would have a radius of 1,092 feet (332.8 m). The evacuation zone is defined by the distance beyond which an unprotected human could escape burn injury in the event of the ignition or explosion of leaking gas (Pipeline Association for Public Awareness, 2007, p. 29). There would be a potential evacuation zone with a radius of 3,583 feet (1092.1 m).<sup>12</sup> An explosion would definitely affect ecosystem processes within the HCA, but given the probability of an explosion at any given point along the pipeline at a given time is small, we do not include effects *on ecosystem service value* in this zone in our cost estimates.

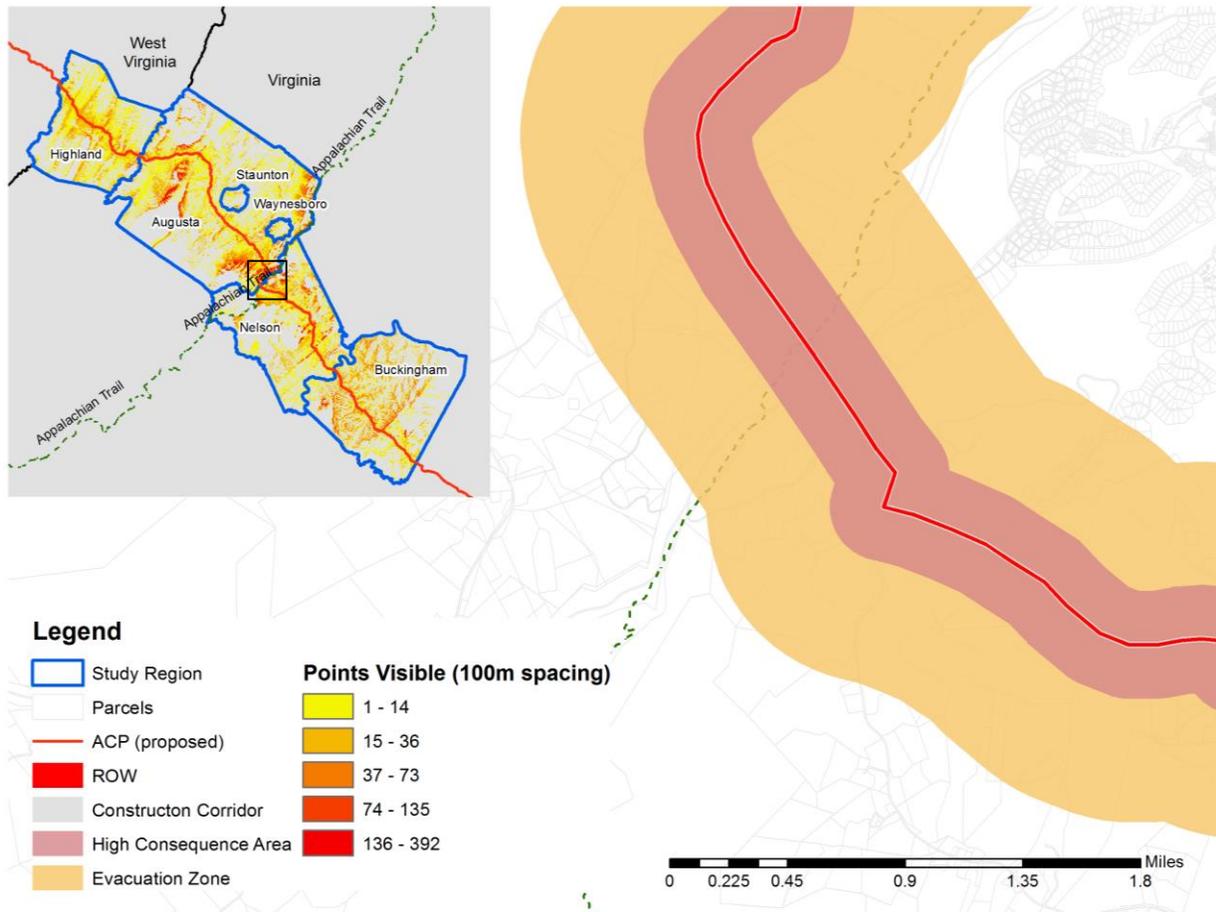
Effects on land value are another matter, and it is reasonable to consider land value impacts through both the high consequence area and the evacuation zone. As Kielisch (2015) stresses, the value of land is determined by human perception, and property owners and would-be owners have ample reason to perceive risk to property near high-pressure natural gas transmission pipelines. Traditional news reports, YouTube, and other media reports attest to the occurrence and consequences of pipeline leaks and explosions, which are even more prevalent for newer pipelines than for those installed decades ago (S. Smith, 2015). Information about pipeline risks translates instantly into buyers’ perceptions and, therefore, into the chances of selling a property exposed to those risks, into prices offered for those properties, and, for people who already own such properties, into diminished enjoyment of them.

Along similar lines, compressor stations have been implicated in a variety of illnesses among nearby residents. (Subra, 2009, 2015). The stations can also be noisy, with low-frequency noise cited as a constant nuisance. (“Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015).

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<sup>12</sup> See the map (Figure 3) which includes a close-up of these zones near the Augusta-Nelson County line.

These issues have led some homeowners to pull-up stakes and move away and to reduced property value assessments for others (Cohen, 2015; “Proximity of Compressor Station Devalues Homes by as much as 50%,” 2015). For the estimates of property value effects below, we consider just those properties within one half mile of the proposed compressor station in Buckingham County. Because this zone overlaps the ROW and the evacuation zone, and because we assume that the more acute and ever present effect of proximity to the compressor station would dominate all other effects, we ignore the ROW and evacuation zone effects for these properties.



**FIGURE 3: Study Region Showing Affected Viewsheds (Inset) and Parcels in Right-of-Way, Construction, High Consequence, and Evacuation Areas.**

Sources: ACP route digitized from interactive map, Dominion Resources Inc. (<http://dom.maps.arcgis.com/>); National Map Study Region (counties) from USGS ([http://nationalmap.gov/small\\_scale/](http://nationalmap.gov/small_scale/)), and Appalachian Trail from the Appalachian Trail Conservancy (<http://www.appalachiantrail.org/>).

In addition, loss of view quality would be expected for properties both near to and far from the pipeline corridor. Unlike leaks and explosions, view quality impacts will occur with certainty. If the pipeline is built, people will see the corridor as a break in a once completely forested hillside, and their “million-dollar” view will be diminished. Therefore, for our analysis of land value below, we consider any place where there is considerable potential to see the pipeline corridor to be within its direct impact zone.

Beyond the loss of ecosystem services stemming from the conversion of land in the ROW and the loss of property value resulting from the chance of biophysical impacts or the certainty of impacts on aesthetics, the proposed ACP would also diminish physical ecosystem services, scenic amenity, and passive-use value that are realized or enjoyed beyond the evacuation zone and out of sight of the pipeline corridor. The people affected include residents, businesses, and landowners throughout the study region, as well as past, current, and future visitors to the region. The impacts on human well-being would be reflected in economic decisions such as whether to stay in or migrate to the study region, whether to choose the region as a place to do business, and whether to spend one's scarce vacation time and dollars near the ACP instead of in some other place.

To the extent the ACP causes such decisions to favor other regions, less spending and slower economic growth in the study region would be the result. One would expect a secondary effect of that slower growth on land values, but in this study we consider the primary effects in terms of slower population, employment, and income growth in key sectors. Table 2 summarizes the types of economic values considered in this study and the zones in which they are estimated.

One would also expect economic development effects to spill beyond the county boundaries that define our study region. For example, the Satchidananda Ashram - Yogaville attracts thousands of visitors to the region each year (5,642 in 2014; 3,687 through early August, 2015) from around the world. Based on its own survey of past visitors, leaders there anticipate visits will decrease drastically, perhaps catastrophically if the ACP is built near its campus in Buckingham County. Most of its students, instructors, and other visitors come from out of state, so fewer visits to Yogaville will mean, for example, fewer flights into Charlottesville-Albemarle airport, fewer car rentals, and perhaps fewer side excursions to Monticello or extended stays in the wider region. Such negative economic effects of the pipeline would be felt in Charlottesville and Albemarle County and would be in addition to the direct effects felt by Yogaville and/or within the immediate study region.

The same dynamic would play out if, as business leaders fear, people from outside the study region make fewer trips to Wintergreen for skiing, attend fewer wine tastings or concerts in the Rockfish Valley, skip a stay in the Shenandoah Valley, or make fewer return visits to the Highland Maple festival.

We do not include those outside-the-region effects in the current study. This is a matter of study scoping and budget only, and should not be construed as a suggestion that these and other impacts cease at the Buckingham-Albemarle County line or any other study region boundary. The effects we do include are enumerated and estimated in more detail in the following sections. To recap before proceeding, Table 2 summarizes the geographic extent of the values and analyses included as well as those that should be considered as part of FERC's research agenda to gain an even more complete picture of the proposed ACP's economic effects.

**TABLE 2: Geographic Scope of Effects.**

A check mark indicates those zones/effects for which estimates are included in this study. The "X's" indicate areas for future study.

Values / Effects	Right-of-Way and Construction Zone	High Consequence Area	Evacuation Zone	Compressor Station Zone	Pipeline Viewshed	Entire Study Region	The World Beyond the Study Region
Ecosystem Services	✓	a	a		a	✗ <sup>a,b</sup>	✗
Land / Property Value	✓ <sup>c</sup>	✓ <sup>d</sup>	✓ <sup>d</sup>	✓	✓ <sup>e</sup>	✗	n/a
Economic Development Effects	f	f	f	f	f	✓	n/a

Notes:

- a. Changes in ecosystem services that are felt beyond the ROW and Construction zone may be key drivers of “Economic Development Effects,” but they are not separately estimated to avoid double counting.
- b. With the exception of the impact on visual quality, we do not estimate the spillover effects of alteration of the ecosystem within the ROW on the productivity of adjacent areas. The ROW, for example provides a travel corridor to invasive species that could reduce the integrity and ecosystem productivity of areas that, without the ACP would remain core ecological areas, interior forest habitat, etc.
- c. We estimate land value effects for the ROW but not for the construction zone.
- d. Properties in the HCA are treated as though there is no additional impact on property value relative to the impact of being in the evacuation zone. Also, we exclude properties in the compressor station zone from estimates of impacts related to the ROW and the evacuation zone. The reason is that while the compressor station’s effects on land value may be similar (that is, they are driven by health and safety concerns and possible loss of use), they are both more acute and more certain. (Noise and air emissions from the compressor stations will be routine, while leaks from the pipeline should be rare.) We assume that the ongoing effects of the compressor station on use and enjoyment of properties nearby would overshadow or dominate the possibility of a high-consequence event or the need to evacuate.
- e. To avoid double-counting, changes in property value due to an altered view from the property are considered to be part of lost aesthetic value under the heading of ecosystem services.
- f. Economic development effects related to these subsets of the study region are included in estimates for the study region.

## EFFECTS ON ECOSYSTEM SERVICE VALUE

The idea that people receive benefits from nature is not at all new, but “ecosystem services” as a term describing the phenomenon is more recent, emerging in the 1960s (Millennium Ecosystem Assessment, 2003). “Benefits people obtain from ecosystems” is perhaps the simplest and most commonly heard definition of ecosystem services (Reid et al., 2005). Other definitions abound, including the following from Gary Johnson of the University of Vermont. It is helpful both because it emphasizes that services are not necessarily things—tangible bits of nature—but rather, they are the effects on people of the functions of bits of nature:

Ecosystem services are the effects on human well-being of the flow of benefits from an ecosystem endpoint to a human endpoint at a given extent of space and time (2010).

This definition also makes clear that ecosystem services happen or are produced and enjoyed in particular places and at particular times.

No matter the definition, different types of ecosystems (forest, wetland, cropland, urban areas) produce different arrays of ecosystem services, and/or they produce similar services to greater or lesser degrees. Certain ecosystems or land uses simply produce a higher flow of benefits than others.

“Ecosystem services” is sometimes lengthened to “ecosystem goods and services” to make it explicit that some are tangible, like physical quantities of food, water for drinking, and raw materials, while others are truly services, like cleaning the air and providing a place with a set of attributes that are conducive to recreational experiences or aesthetic enjoyment. We use the simpler “ecosystem services” here. Table 3, lists the provisioning, regulating, and cultural ecosystem services included in this study.

At a conceptual level, we estimate the potential effects of the ACP on ecosystem service value by identifying the extent to which the construction and longer-term existence of the pipeline would change land cover or land use, which in turn results in a change in ecosystem productivity. Construction would essentially strip bear the 125-foot-wide construction corridor. Once construction is complete and after some period of recovery, the 75-foot-wide right-of-way will be

### Ecosystem Service Impacts 1: Water Supply

Currently the Cowpasture River Valley in Highland County enjoys naturally clean water thanks to environmental filtration. However, if the ACP is built any contamination that it causes through erosion, sedimentation, or spills would carry high costs.

For a domestic well, a landowner would face an estimated out-of-pocket expense of \$35,000 or more to drill into a potable aquifer. For a livestock operation, which needs more water, a contaminated aquifer would be even worse. Dairies and ranches in the Cowpasture River Valley that need to replace their water supply would face an estimated cost of \$50,000, and they would need an emergency supply of 20,000 gallons daily. If a city or town must replace a municipal water supply that becomes contaminated, the costs are even higher; it would take an estimated out-of-pocket cost of \$2.5 million to complete geophysical, hydrological, and engineering studies, purchase land, drill a well, and build the necessary surrounding infrastructure.

-Nelson Hoy, Cowpasture River Preservation Association

**TABLE 3: Ecosystem Services Included in Valuation**

<b>Provisioning Services<sup>a</sup></b>
<p><b>Food Production:</b> The harvest of agricultural produce, including crops, livestock, and livestock by-products; the food value of hunting, fishing, etc.; and the value of wild-caught and aquaculture-produced fish.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Forest</p>
<p><b>Raw Materials:</b> Fuel, fiber, fertilizer, minerals, and energy.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest</p>
<p><b>Water Supply:</b> Filtering, retention, storage, and delivery of fresh water—both quality and quantity—for drinking, irrigation, industrial processes, hydroelectric generation, and other uses.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest, Water, Wetland</p>
<b>Regulating Services<sup>a</sup></b>
<p><b>Air Quality:</b> Removing impurities from the air to provide healthy, breathable air for people.</p> <p><b>Associated land uses<sup>b</sup>:</b> Shrub/Scrub, Forest, Urban Open Space</p>
<p><b>Biological Control:</b> Inter- and intra-specific interactions resulting in reduced abundance of species that are pests, vectors of disease, or invasive in a particular ecosystem.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture, Grassland, Forest</p>
<p><b>Climate Regulation:</b> Storing atmospheric carbon in biomass and soil as an aid to the mitigation of climate change, and/or keeping regional/local climate (temperature, humidity, rainfall, etc.) within comfortable ranges.</p> <p><b>Associated land uses<sup>b</sup>:</b> Pasture/Forage, Grassland, Shrub/Scrub, Forest, Wetland, Urban Open Space, Urban Other</p>
<p><b>Erosion Control:</b> Retaining arable land, stabilizing slopes, shorelines, riverbanks, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest</p>
<p><b>Pollination:</b> Contribution of insects, birds, bats, and other organisms to pollen transport resulting in the production of fruit and seeds. May also include seed and fruit dispersal.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest</p>
<p><b>Protection from Extreme Events:</b> Preventing and mitigating impacts on human life, health, and property by attenuating the force of winds, extreme weather events, floods, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forests, Urban Open Space, Wetland</p>
<p><b>Soil Fertility:</b> Creation of soil, inducing changes in depth, structure, and fertility, including through nutrient cycling.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Forest</p>
<p><b>Waste Treatment:</b> Improving soil and water quality through the breakdown and/or immobilization of pollution.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Pasture/Forage, Grassland, Shrub/Scrub, Forest, Water, Wetland</p>
<p><b>Water Flows:</b> Regulation by land cover of the timing of runoff and river discharge, resulting in less severe drought, flooding, and other consequences of too much or too little water available at the wrong time or place.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forests, Urban Open Space, Urban Other</p>
<b>Cultural Services<sup>a</sup></b>
<p><b>Aesthetic Value:</b> The role that beautiful, healthy natural areas play in attracting people to live, work, and recreate in a region.</p> <p><b>Associated land uses<sup>b</sup>:</b> Forest, Pasture/Forage, Urban Open Space, Wetland</p>
<p><b>Recreation:</b> The availability of a variety of safe and pleasant landscapes—such as clean water and healthy shorelines—that encourage ecotourism, outdoor sports, fishing, wildlife watching, etc.</p> <p><b>Associated land uses<sup>b</sup>:</b> Cropland, Forest, Water, Wetland, Urban Open Space, Urban Other</p>

Notes:

- a. Descriptions follow Balmford (2010, 2013), Costanza et al. (1997), Reid et al. (2005), and Van der Ploeg, et al. (2010).
- b. “Associated Land Uses” are limited to those for which per-unit-area values are available in this study.

occupied by a different set of ecosystem (land cover) types than were present before construction. By applying per-acre ecosystem service productivity estimates (denominated in dollars) to the various arrays of ecosystem service types, we can estimate ecosystem service value before, during, and after construction. The difference between ecosystem service value during construction and before construction is the cost during construction. The difference between the ecosystem service value during ongoing operations (i.e., the value produced in the ROW) and the before-construction baseline is the annual ecosystem service cost that will be experienced indefinitely.

This overall process is illustrated in Figure 4 and the details of our methods, assumptions, and calculations are described in the following two sub sections.

## **Ecosystem Service Estimation Methods**

Economists have developed widely used methods to estimate the dollar value of ecosystem services and/or natural capital. The most widely known example was a study by Costanza et al. (1997) that valued the natural capital of the entire world. That paper and many others since employ the “benefit transfer method” or “BTM” to establish a value for the ecosystem services produced or harbored from a particular place.<sup>13</sup> According to the Organization for Economic Cooperation and Development, BTM is “the bedrock of practical policy analysis,” particularly in cases such as this when collecting new primary data is not feasible (OECD, 2006).

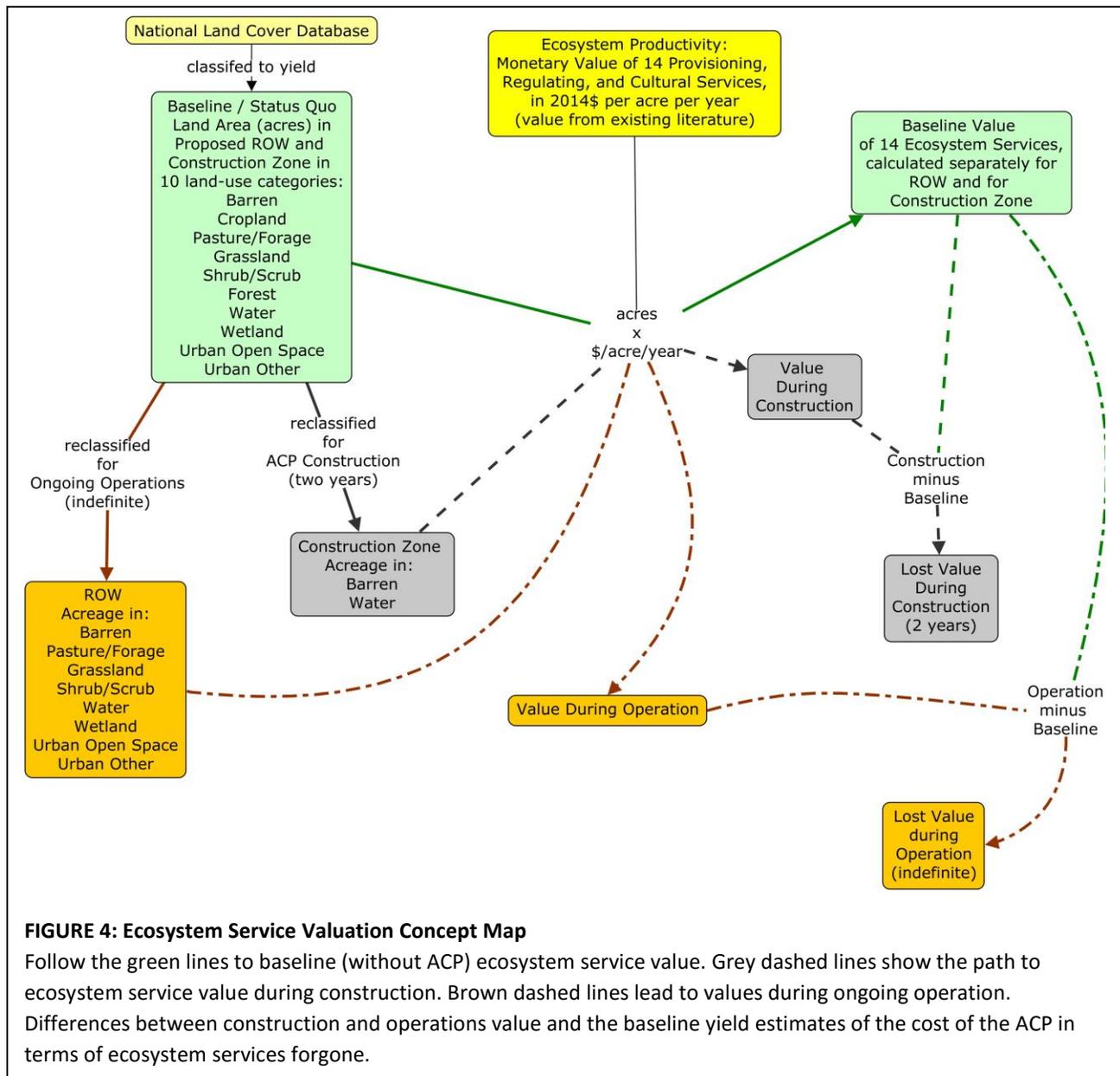
As the name implies, BTM takes a rate of ecosystem benefit delivery calculated for one or more “source areas” and applies that rate to conditions in the “study area.” As Batker et al. (2010) state, the method is very much like a real estate appraiser using comparable properties to estimate the market value of the subject property. It is also very much like using an existing or established market or regulated price, such as the price of a gallon of water, to estimate the value of some number of gallons of water supplied in some period of time. The key is to select “comps” (data from source areas) that match the circumstances of the study area as closely as possible.

Typically, values are drawn from previous studies that estimate the value of various ecosystem services from similar land cover or ecosystem types. Also, it is benefit (in dollars) per-unit-area-per-year in the source area that is transferred and applied to the number of hectares or acres in the same land cover/biome in the study area. So, for example, if data for the source area includes the value of forest land for recreation, one would apply per-acre values from the source area’s forest to the number of acres of forestland in the study area. Furthermore, it is important to use source studies that are from regions with underlying economic, social, and other conditions similar to the study area.

Following these principles as well as techniques developed by Esposito et al. (2011), Esposito (2009), and Phillips and McGee (2014, 2016), and as illustrated in Figure 4, we employ a four-step process to evaluate the short-term and long-term effects of the ACP on ecosystem service value in our study region. The steps are described in greater detail below, but in summary, they are:

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<sup>13</sup> See also Esposito et al. (2011), Flores et al. (2013), and Phillips and McGee (2014) for more recent examples.



**FIGURE 4: Ecosystem Service Valuation Concept Map**

Follow the green lines to baseline (without ACP) ecosystem service value. Grey dashed lines show the path to ecosystem service value during construction. Brown dashed lines lead to values during ongoing operation. Differences between construction and operations value and the baseline yield estimates of the cost of the ACP in terms of ecosystem services forgone.

1. Assign land and water in the study to one of 10 land uses based on remotely sensed (satellite) data in the National Land Cover Dataset (NLCD) (Fry et al., 2011). This provides the array of land uses for estimating baseline or “without ACP” ecosystem service value.
2. RE-assign or re-classify land and water to what the land cover would most likely be during construction and during ongoing operation.
3. Multiply acreage by per-acre ecosystem service productivity (the “comps”) to obtain estimates of aggregate ecosystem service value under the baseline/no ACP scenario, for the construction corridor (and period), and for the ROW during ongoing operation.

For simplicity and given the two-year construction period, we assume that the construction

corridor will remain barren for a full two-year period. We recognize that revegetation will begin to occur soon after the trench is closed and fill and soil are returned, but it will still be some time until something like a functioning ecosystem has actually been restored.

4. Subtract baseline ESV from ESV for the construction period (and in the construction corridor) and from ESV during ongoing operations (in the ROW) to obtain estimates of the ecosystem service costs imposed annually during the construction and operations period, respectively.

### **Step 1: Assign Land to Ecosystem Types or Land Uses**

The first step in the process is to determine the area in the 10 land use groups in the study region. This determination is made using remotely sensed data from the National Land Cover Database (NLCD) (Fry et al., 2011). Satellite data provides an image of land in one of up to 21 land cover types at the 30-meter level of resolution;<sup>14</sup> 15 of these land cover types are present in the study region (Table 4).

Looking forward to the final step, we will use land use categories to match per-acre ecosystem value estimates from source areas to the four-county study region. Unfortunately, there are not value estimates for all of the detailed land use categories present in the region. We therefore simplify the NLCD classification by combining a number of classifications into larger categories for which per-acre values are more available. Specifically, low-, medium-, and high-intensity development are grouped as “urban other,” and deciduous, evergreen, and mixed forest are grouped as “forest.”

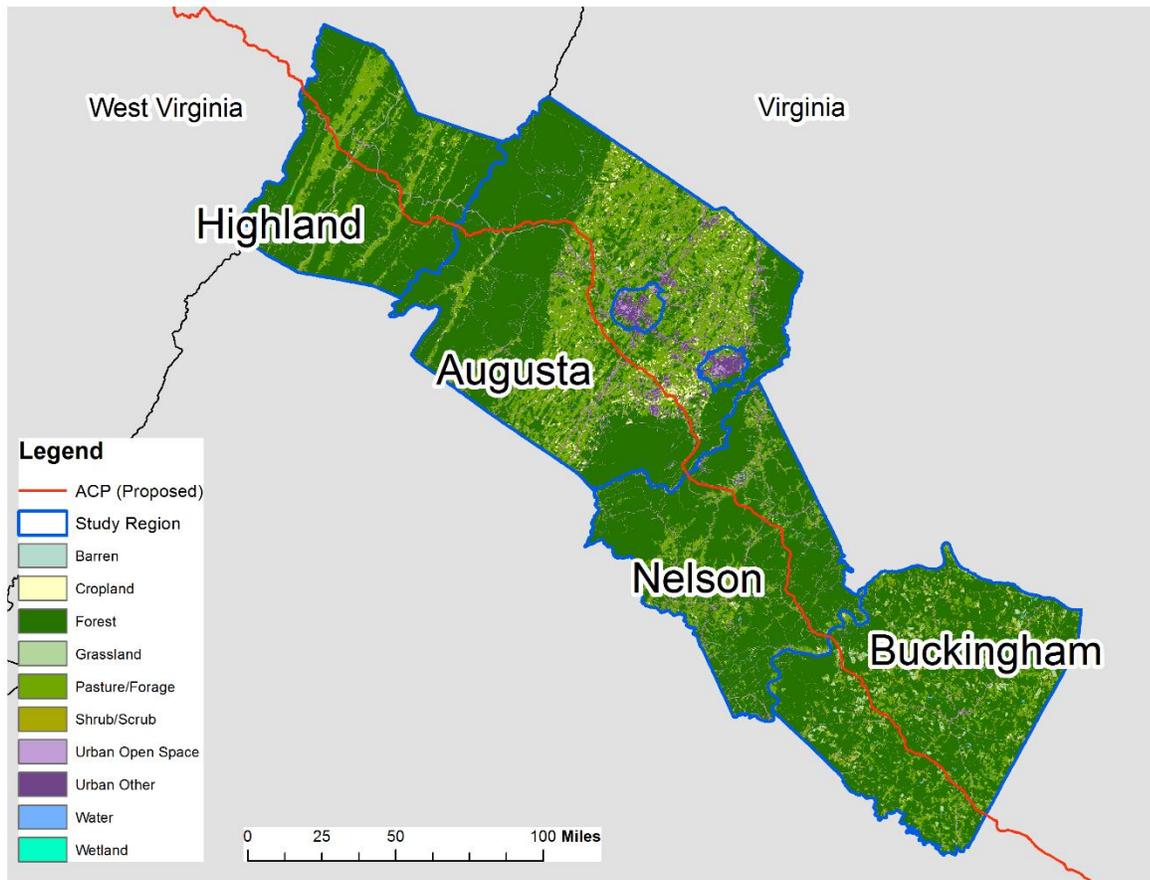
In addition, we add land in the NLCD category of “woody wetlands” to the “forest” category for two reasons. The first is that, left to their devices, such wetlands would normally become forest in the study region. Second, wetlands have some of the highest per-acre values for several ecosystem services. So, to avoid over-estimating the ecosystem services contribution of “woody wetlands,” we count them as “forest” instead of “wetland”.

In the end, at least for baseline conditions, we have land in 10 land uses. The total area that would be disturbed in the construction corridor through the study region is 1,900 acres,<sup>15</sup> and 1,140 acres would be occupied by the permanent right-of-way. Tables 5 and 6 show acreage in the land cover types across the four counties in the study region.

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<sup>14</sup> Because 30 meters is wider than the right-of-way and not much narrower than the 125-foot construction corridor, we resample the NLCD data to 10m pixels, which breaks each 30m-by-30m pixel into 9 10m-by-10m pixels. This allows for a closer approximation of the type and area of land cover in the proposed ROW and construction corridor.

<sup>15</sup> Note that these are minimum estimates of the land that would be taken during construction and for ongoing operations. Not counted in these totals are staging areas, temporary or permanent access roads, and the footprint of any infrastructure, such as the compressor station proposed to be sited in Buckingham County. Consequently (and in addition to other minimizing factors) the estimates of ecosystem service cost of the ACP will likely be much smaller than what would be experienced if the ACP were to be built and operated.



**FIGURE 5: Land Use in the Study Region, Classified for Ecosystem Service Valuation**

Land cover for the entire study region is shown to display the overall range and pattern of land use. The ecosystem service valuation itself covers only those portions of the study region that would be occupied by the ACP right-of-way and construction corridor.

Source: National Land Cover Database (Fry, et al. 2011).

**Step 2: Re-assign Acreage to New Land Cover Types for the Construction and Operation Periods**

Table 4 lists the reassignment assumptions in detail, but in general, we assume that all land in the construction corridor will be “barren” or at least possess the same ecosystem service productivity profile as naturally-occurring barren land for the duration of the construction period. Water will remain water during construction.

**TABLE 4: Land Cover Reclassification**

<b>NLCD Category</b>	<b>Reclassification for Baseline</b>	<b>Reclassification for Construction</b>	<b>Reclassification for Ongoing Operation</b>
<b>Barren Land</b>	Barren	Barren	Barren
<b>Cultivated Crops</b>	Cropland	Barren	Pasture/Forage
<b>Pasture/Hay</b>	Pasture/Forage	Barren	Pasture/Forage
<b>Grassland/Herbaceous</b>	Grassland	Barren	Grassland
<b>Shrub/Scrub</b>	Shrub/Scrub	Barren	Shrub/Scrub
<b>Deciduous Forest</b>	Forest	Barren	Shrub/Scrub
<b>Evergreen Forest</b>	Forest	Barren	Shrub/Scrub
<b>Mixed Forest</b>	Forest	Barren	Shrub/Scrub
<b>Woody Wetlands</b>	Forest	Barren	Shrub/Scrub
<b>Open Water</b>	Water	Water	Water
<b>Emergent Herbaceous Wetlands</b>	Wetland	Barren	Wetland
<b>Developed, Open Space</b>	Urban Open Space	Barren	Urban Open Space
<b>Developed, Low Intensity</b>	Urban Other	Barren	Urban Other
<b>Developed, Medium Intensity</b>	Urban Other	Barren	Urban Other
<b>Developed, High Intensity</b>	Urban Other	Barren	Urban Other

For the indefinite period following construction—during ongoing operations—we assume that pre-ACP forestland will become shrub/scrub, and cropland will become pasture/forage. We recognize that some pre-ACP cropland may be used for crops after construction has been completed, but as expressed in comments to FERC and elsewhere and as we discovered through personal interviews with agricultural producers in the region, it seems likely that the ability to manage acreage for row crops will be greatly curtailed, if not eliminated entirely by the physical limits imposed by the ACP and by restrictions in easements to be held by ACP LLC. These include limits on the weight of equipment that could cross the corridor at any given point and difficulty using best soil conservation practices, such as tilling along a contour, which may be perpendicular to the pipeline corridor. (This would require extra time and fuel use that could render some fields too expensive to till, plant, or harvest.) Reclassifying cropland as pasture/forage (which is generally less productive of ecosystem services) recognizes these effects while also recognizing that some sort of future agricultural production in the ROW (grazing and possibly haying) could be possible.

An additional effect not captured in our methods is long-standing harm to agricultural productivity due to soil compaction, soil temperature changes, and alteration of drainage patterns due to pipeline construction. As agronomist Richard Fitzgerald (2015) concludes, “It is my professional opinion that the productivity for row crops and alfalfa will never be regenerated to its existing present ‘healthy’ and productive condition [after installation of the pipeline].” Thus the true loss in food and other ecosystem service value from pasture/forage acreage would be larger than our estimates reflect.

TABLE 5: Acreage in Proposed Construction Corridor, by Land Cover and County, Baseline and in “With ACP” Scenario

Land Cover Classification	Highland		Augusta		Nelson		Buckingham	
	Baseline	w/ ACP						
Barren	0.0	386.0	0.3	708.1	-	395.9	12.6	409.0
Cropland	3.5	-	37.9	-	2.1	-	0.3	-
Pasture/Forage	76.4	-	249.0	-	35.2	-	52.4	-
Grassland	-	-	-	-	-	-	26.5	-
Shrub/Scrub	-	-	-	-	-	-	13.2	-
Forest	293.5	-	386.6	-	345.7	-	297.1	-
Water	0.2	0.2	-	-	0.8	0.8	0.4	0.4
Wetland	-	-	-	-	0.3	-	-	-
Urban Open Space	12.6	-	31.7	-	11.6	-	6.6	-
Urban Other	-	-	2.6	-	1.1	-	0.2	-
<b>Total</b>	<b>386.2</b>	<b>386.2</b>	<b>708.1</b>	<b>708.1</b>	<b>396.7</b>	<b>396.7</b>	<b>409.4</b>	<b>409.4</b>

TABLE 5: Continued

Land Cover Classification	Study Region	
	Baseline	w/ ACP
Barren	12.9	1,899.0
Cropland	43.8	-
Pasture/Forage	413.0	-
Grassland	26.5	-
Shrub/Scrub	13.2	-
Forest	1,322.9	-
Water	1.3	1.3
Wetland	0.3	-
Urban Open Space	62.5	-
Urban Other	3.8	-
<b>Total</b>	<b>1,900.3</b>	<b>1,900.3</b>

**TABLE 6: Acreage in Proposed Right-of-Way, by Land Cover and County, Baseline and in “with ACP” Scenario**

Land Cover Classification	Highland		Augusta		Nelson		Buckingham	
	Baseline	w/ ACP						
Barren	-	-	0.0	0.0	-	-	7.5	7.5
Cropland	2.0	-	23.2	-	1.2	-	0.2	-
Pasture/Forage	46.1	48.1	148.8	172.1	20.8	22.0	31.2	31.4
Grassland	-	-	-	-	-	-	16.3	16.3
Shrub/Scrub	-	176.4	-	233.0	-	207.6	7.7	185.9
Forest	176.4	-	233.0	-	207.6	-	178.2	-
Water	0.1	0.1	-	-	0.5	0.5	0.2	0.2
Wetland	-	-	-	-	0.2	0.2	-	-
Urban Open Space	7.7	7.7	18.4	18.4	6.8	6.8	4.1	4.1
Urban Other	-	-	1.5	1.5	0.6	0.6	0.1	0.1
<b>Total</b>	<b>232.3</b>	<b>232.3</b>	<b>425.0</b>	<b>425.0</b>	<b>237.8</b>	<b>237.8</b>	<b>245.5</b>	<b>245.5</b>

**TABLE 6: Continued**

Land Cover Classification	Study Region	
	Baseline	w/ ACP
Barren	7.6	7.6
Cropland	26.7	-
Pasture/Forage	246.9	273.6
Grassland	16.3	16.3
Shrub/Scrub	7.7	802.9
Forest	795.2	-
Water	0.8	0.8
Wetland	0.2	0.2
Urban Open Space	37.0	37.0
Urban Other	2.2	2.2
<b>Total</b>	<b>1,140.5</b>	<b>1,140.5</b>

**Step 3: Multiply Acreage by Per-Acre Value to Obtain ESV**

After obtaining acreage by land use in the construction corridor and the ROW, we are ready to multiply those acres times per-acre-per-year ecosystem service productivity to obtain total ecosystem service value in each area and for with- and without-pipeline scenarios. Per-acre ecosystem service values are obtained primarily from a database of more than 1,300 estimates compiled as part of a global study known as “The Economics of Ecosystems and Biodiversity” or “the TEEB” (Van der Ploeg et al., 2010).<sup>16</sup>

<sup>16</sup> Led by former Deutsche Bank economist, Pavan Sukhdev, the TEEB is designed to “[make] nature’s values visible” in order to “mainstream the values of biodiversity and ecosystem services into decision-making at all levels” (“TEEB - The Initiative,” n.d.). It is also an excellent example of the application of the benefit transfer method.

The TEEB database allows the user to select the most relevant per-unit-area values, based on the land use/land cover profile of the study region, comparison of general economic conditions in the source and study areas, and the general “fit” or appropriateness of the source study for use in the study area at hand. After eliminating estimates from lower-income countries and estimates from the U.S. that came from circumstances vastly different from central and western Virginia, we identified 91 per-acre estimates in the TEEB that adequately provide approximations of ecosystem service value in our study region.<sup>17</sup>

After selecting the best candidate studies and estimates in the TEEB database, we still had some key land use/ecosystem services values (such as food from cropland) without value estimates. To fill some of the most critical gaps, we turned to other studies that had examined ecosystem service value in this general region (Phillips, 2015a; Phillips & McGee, 2016) and to specific data on cropland and pasture/hayland value from Virginia Cooperative Extension and the National Agricultural Statistics Service (Lex & Groover, 2015).

For several land cover-ecosystem service combinations, either multiple source studies were available or the authors of those studies reported a range of dollar-per-acre ecosystem service values. We

## Ecosystem Service Effects 2: Food and Farmland

Cros-B-Crest Farm in Staunton was established in 1894 and is now recognized by the Commonwealth of Virginia as a “Century Farm.” Harry Crosby is the fourth generation to farm this land and has seen the damage that a utility corridor (last time it was a power line) can do to property values and quality of life. This time, Crosby says, the impacts would be even more profound.

The proposed ACP would affect the farm operations and the farm in several ways. First, the pipeline would run more or less directly down the natural slope of one of Cros-B-Crest’s best fields, while Mr. Crosby, to conserve soil and otherwise exercise good stewardship, farms the field along the natural contour. Interrupting the contour with the pipeline would lead to increased erosion. Due to restrictions on crossing the pipeline with larger farm equipment, the ACP would effectively take the entire field (30-40 acres in total) out of production.

Even if the field could still be used, Crosby expects that it would not return to its current high level of productivity any time soon. Digging up, trenching, filling, and attempting to put back the soil will, however carefully done, disrupt the soil profile, increase compaction and otherwise depress fertility that has taken nature and the Crosby family generations to build. (Crosby, 2015a, 2015b).

Beyond the impact on farm operations themselves, Crosby says, the ACP will reduce the enjoyment the family receives from owning and living on the property (Crosby, 2015b). The family might not realize the financial loss unless or until it sells the farm, but it will experience the loss of well-being every day.

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<sup>17</sup> Among those U.S. studies included in the TEEB database that we deemed inappropriate for use here were a study from Cambridge Massachusetts that reported extraordinarily high values for aesthetic and recreational value and the lead author’s own research on the Tongass and Chugach National Forests in Alaska. (The latter was excluded due to the vast differences in land use, land tenure, climate, and other factors between the source area and the current study region.)

are therefore able to report both a low and a high estimate based on the bottom and top end of the range of available estimates.

In the end, we have 162 separate estimates from 60 unique source studies covering 67 combinations of land uses and ecosystem services. (See Appendix A to this report for a full list of the values and sources that yielded these estimates.) This is still fairly sparse coverage, given that there are 140 possible combinations of the 10 land uses and 14 services. We therefore know that our aggregate estimates will be lower than they would be if dollar-per-acre values for all 14 services were available to transfer to each of the 10 land use categories in the study region. One can either live with that known underestimation, or one can assign per-acre values from a study of one land-use-and-service combination to other combinations. Doing so would introduce unknown over- or perhaps under-estimation of aggregate values. We prefer to take the first course, knowing that our estimates are low/conservative and urge readers to bear this in mind when interpreting this information for use in weighing the costs of the proposed ACP.

With acreage and per-acre ecosystem service values in hand, we can now calculate ecosystem service value for each of the four area/scenario combinations. To repeat, these are:

- Baseline ecosystem service value in the proposed construction corridor
- Ecosystem service value in the construction corridor during construction
- Baseline ecosystem service value in the proposed right-of-way
- Ecosystem service value in the right-of-way during the (indefinite) period of ongoing operations.<sup>18</sup>

Value calculations are accomplished according to this formula

$$ESV = \sum_{i,j} [(Acres_j) \times (\$/acre/year)_{i,j}]$$

Where:

$Acres_j$  is the number of acres in land use (j)  
 $(\$/acre/year)_{i,j}$  is the dollar value of each ecosystem service (i) provided from each land use (j) each year. These values are drawn from the TEEB database and other sources listed in Appendix A.

#### **Step 4: Subtract Baseline ESV from ESV in “with ACP” Scenario**

With the steps above complete, we can now estimate the cost in ecosystem service value of moving from the baseline or status quo to a scenario in which the ACP is built and operating.

The cost of construction is the ESV from the construction corridor during construction, minus baseline ESV for the construction corridor, times two. The multiplication by two is due to the conservative

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<sup>18</sup> Note that while the ROW and construction corridors overlap in space, they do not overlap in time, at least not from an ecosystem services production standpoint. During construction, the land cover that would eventually characterize the ROW will not exist in the construction corridor. Thus, there is no double counting of ecosystem service values or of costs from their diminution as a result of either construction or ongoing operations.

assumption that revegetation and restoration to a land use that is functionally different from barren land will take at least two years.

The ecosystem service cost of ongoing operations is ESV from the ROW in the “with ACP” scenario minus the baseline ESV for the ROW. This will be an annual cost borne every year in perpetuity.

### Ecosystem Service Value Estimates

In the baseline or “no pipeline” scenario, the construction corridor and land slated for temporary roads and workspaces produces between \$11.4 and \$41.1 million per year in ecosystem service value (ESV). The largest contributors to this total (at the high end) are aesthetic value, water supply, and protection from extreme events. Under a “with MVP” scenario, and not surprisingly given the temporary conversion to bare/barren land, these figures drop to near zero, or between \$451 and \$3,552 per year for each of the two years. Taking the difference as described above, estimated per-year ecosystem service cost of the ACP’s construction would be between \$11.4 and \$41.1 million, or between \$22.8 and \$82.2 million over two years in the eight-county study region.

Loss of aesthetic value and impacts on water (both supply and regulation of flow) represent the largest losses during the construction phase (Table 7).

**TABLE 7: Ecosystem Service Value Lost to the Construction Corridor and Temporary Roads and Workspaces in Each of Two Years, Relative to Baseline, by Ecosystem Service (2014\$)**

Ecosystem Service	Study Region			
	Baseline (low)	Loss (low)	Baseline (high)	Loss (high)
<b>Aesthetic Value</b>	8,046,503	(8,046,503)	32,491,871	(32,491,871)
<b>Air quality</b>	666,647	(666,647)	680,270	(680,270)
<b>Biological Control</b>	12,524	(12,524)	30,044	(30,044)
<b>Climate Regulation</b>	209,199	(209,199)	228,236	(228,236)
<b>Erosion Control</b>	15,104	(15,104)	146,466	(146,466)
<b>Protection from Extreme Events</b>	1,447,945	(1,447,945)	1,482,118	(1,482,118)
<b>Food Production</b>	10,929	(10,929)	10,929	(10,929)
<b>Pollination</b>	369,769	(369,769)	433,706	(433,706)
<b>Raw materials</b>	43,763	(43,763)	297,240	(297,240)
<b>Recreation</b>	64,090	(63,722)	967,718	(965,459)
<b>Soil formation</b>	12,837	(12,837)	41,061	(41,061)
<b>Waste Treatment</b>	22,692	(22,666)	527,395	(527,369)
<b>Water Supply</b>	84,501	(84,444)	2,306,613	(2,305,346)
<b>Water flows</b>	417,057	(417,057)	1,444,340	(1,444,340)
<b>Total</b>	<b>11,423,559</b>	<b>(11,423,108)</b>	<b>41,088,007</b>	<b>(41,084,455)</b>

The ecosystem service costs for the ROW are predictably smaller on a per-year basis, but because they will persist indefinitely the cumulative effect will be much higher. Under the “with MVP” scenario, and using minimum values, annual ecosystem service value from the ROW falls from \$4.2 million to about \$159,000 for an annual loss of over \$4.1 million. At the high end, the ecosystem service value of the ROW would fall from \$15.3million to about \$435,000 for an annual loss of \$14.8 million (Table 8).

Most of this loss is due to the conversion of forestland to shrub/scrub. Shrub/scrub naturally increases its share of overall ecosystem service value in the “with pipeline” scenario. Those gains are dwarfed, however, by the loss of much more productive forests. Similarly, the value of cropland falls due to its assumed transition to pasture/forage. While there is some gain in the pasture/forage category, there is a net loss of ecosystem service value from the two agricultural land uses of between \$1,700 and \$28,600 per year.<sup>19</sup>

**TABLE 8: Ecosystem Service Value Lost Each Year Post Construction in Right-Of-Way, Relative to Baseline, by Ecosystem Service (2014\$)**

Ecosystem Service	Study Region			
	Baseline (low)	Loss (low)	Baseline (high)	Loss (high)
<b>Aesthetic Value</b>	2,985,838	(2,945,731)	12,089,964	(12,040,073)
<b>Air quality</b>	248,102	(222,539)	251,931	(222,539)
<b>Biological Control</b>	4,062	(1,673)	10,554	(8,166)
<b>Climate Regulation</b>	68,141	(32,887)	75,238	(39,900)
<b>Erosion Control</b>	4,926	12,931	51,847	(26,014)
<b>Protection from Extreme Events</b>	536,977	(529,386)	547,721	(529,386)
<b>Food Production</b>	3,308	(1,043)	3,308	(1,043)
<b>Pollination</b>	137,114	(133,628)	160,576	(153,309)
<b>Raw materials</b>	16,306	(16,278)	110,739	(110,711)
<b>Recreation</b>	18,729	1,738	355,391	(332,073)
<b>Soil formation</b>	4,641	(4,083)	15,136	(14,579)
<b>Waste Treatment</b>	8,197	(7,182)	194,147	37,326
<b>Water Supply</b>	31,478	(31,450)	859,334	(857,620)
<b>Water flows</b>	155,301	(152,619)	536,635	(529,356)
<b>Total</b>	4,223,118	(4,063,831)	15,262,520	(14,827,442)

Finally, the establishment of permanent access roads and other surface installations will entail the conversion of land from various uses to what, from an ecosystem services perspective, will function as barren land. These areas amount to a total of only 76 acres across the study region, so the effect on ecosystem service values are correspondingly small, at least when compared to the impact of the construction zone and ROW. As with the ROW, however, these effect occur year after year for as long as the MVP would exist. The annual loss of ecosystem service value from these areas under a “with MVP” scenario would range from \$350,000 and \$1.3 million

It bears repeating that the benefit transfer method applied here is useful for producing first-approximation estimates of ecosystem service impacts. For several reasons, we believe that this

<sup>19</sup> Note that due to differences in the range of dollars-per-acre estimates available for the various combinations of land use and ecosystem service, there are some instances where an apparent gain at the low end turns into a loss at the high end. For example, and based on the estimates available from the literature, the minimum value for erosion control from shrub/scrub acres is higher than the minimum for forests. Because we assume that forests return to shrub/scrub after the pipeline is in operation, this translates into a net increase in erosion regulation. At the high end, however, available estimates show a higher erosion control value for forests than for shrub/scrub. Thus the high estimate shows a net loss of erosion control benefits. It is important, therefore, to keep in mind that these estimates are sensitive to the availability of underlying per-acre estimates.

approximation of the effect of the ACP's construction and operation on ecosystem service values is too low rather than too high. These reasons include:

- The estimates include only the loss of value that would otherwise emanate from the ROW and construction corridors themselves.
- The estimates do not account for the extent to which the construction and long-term presence of the ACP could damage the ecosystem service productivity of adjacent land. During construction, the construction corridor itself could be a source of air and water pollution that may compromise the ability of surrounding or downstream areas to deliver ecosystem service value of their own. For example, if sediment from the construction zone in Nelson County were to reach the Rockfish River or its tributaries, those surface waters will lose some of their ability to provide clean water, food (fish), recreation, and other services. This reduced productivity may persist well after construction is complete.<sup>20</sup>

Over the long term, the right-of-way would serve as a pathway by which invasive species or wildfire could more quickly penetrate areas of interior forest habitat, thereby reducing the natural productivity of those areas.

- Finally, these estimates reflect only those changes in natural benefits that occur due to changes in conditions on the surface of the land. Particularly because the proposed pipeline would traverse areas of karst topography there is well-founded concern that subsurface hydrology could be affected during construction and throughout the lifetime of the pipeline (Jones, 2015; Pyles, 2015). Blasting and other activities during construction could alter existing underground waterways and disrupt water supply. There is also a risk that sediment and other contaminants could reach groundwater supplies if sinkholes form near the pipeline during construction or afterwards. For example, in Nelson County, where steep slopes with shallow soils over bedrock is common (Nelson County Planning Commission, 2002), there is concern that erosion and landslides during and after pipeline construction will harm water quality. These scenarios would entail further loss of ecosystem service value and, for the homeowners or municipalities affected, major expenditures. Officials in Augusta County estimate it would cost at least \$2.1 million to establish a new municipal well, for example (Hoover, 2015).

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<sup>20</sup> This is not a small risk. As noted by the Dominion Pipeline Monitoring Coalition “pipeline construction over steep Appalachian mountains creates significant runoff and slope-failure problems” (Webb, 2015b). In one example, multiple problems during and after construction of a relatively small pipeline on Peters Mountain in Giles County caused extensive erosion and damage to waterways (Webb, 2015a). The coalition points out that “the potential for water resource problems will be greatly multiplied for the proposed larger projects [like the ACP], both in terms of severity and geographic extent.”

## Buckingham County Compressor Station

One way the ACP impacts air quality is by converting forests, which remove normal levels of impurities from the air, to other land uses. There is also concern for impacts that would occur due to the dumping of excess impurities into the air in the first place. While there is some chance of leaks occurring at any place along the proposed route, leaks and major releases of gas and other substances (lubricants, etc.) at the 40,645 horsepower (hp) compressor station proposed for the Union Hill section of Buckingham County would certainly occur.

The negative effects of the compressor station would include noise and air pollution from everyday operations plus periodic “blowdowns,” or venting of gas in the system to reduce pressure. As a recent study by the New York Department of Environmental Conservation indicates, pollution around compressor stations is common and severe. The five-state study found that “more than 40% of the air samples from compressor stations exceeded federal regulations for certain chemicals like methane, benzene, and hydrogen sulfide” (Lucas, “Officials To NYS: Take A Second Look At Pipelines.”). The study also found high rates of illnesses such as nosebleeds and respiratory difficulties among people living near the stations.

While more definitive epidemiological studies are needed to determine the extent to which natural gas compressor stations *add to* background rates of various illnesses, these stations are implicated as contributing to a long list of maladies. According to Subra (2015), individuals living within 2 miles of compressor stations and metering stations experience respiratory impacts (71% of residents), sinus problems (58%), throat irritation (55%), eye irritation (52%), nasal irritation (48%), breathing difficulties (42%), vision impairment (42%), sleep disturbances (39%), and severe headaches (39%). In addition, some 90% of individuals living within 2 miles of these facilities also reported experiencing odor events (Southwest Pennsylvania Environmental Health Project 2015). Odors associated with compressor stations include sulfur smell, odorized natural gas, ozone, and burnt butter. (Subra, 2009). Finally, compressors emit constant low-frequency noise, which can cause negative physical and mental health effects (Lockett, Buppert, & Margolis, 2015).

In Buckingham, 471 people live within 2 miles of the proposed compressor station (US Census Bureau, 2015). This would mean 424 people experiencing odor events, 334 people experiencing respiratory impacts, 273 people experiencing sinus problems, and 184 people experiencing sleep disturbances and/or severe headaches.

In addition to the health impacts discussed above, this pollution can cause damage to agriculture and infrastructure. One study found that shale gas air pollution damages in Pennsylvania already amount to between \$7.2 and \$30 million, with compressor stations responsible for 60-75% of this total (Walker & Koplinka-Loehr, 2014). Using the low estimate of 60% that is between \$4.32 and \$18 million in damages associated with compressor stations.

Yogaville, an ashram, teaching, and retreat center located approximately 5 miles from the proposed compressor station, is especially concerned about these impacts on its 10,000 annual visitors and on the peace, tranquility, and air quality available at its iconic Mount Kailash and Lotus Shrine. Officials there worry that the air and noise pollution may entirely destroy the Shrine’s ability to serve as a place of silent prayer, meditation, and healing (Yogaville, 2015).

The selection of Union Hill for the compressor station also raises environmental justice questions that FERC and others must consider as part of their review (Lockett, Buppert, & Margolis, 2015; Executive Order 12898).

## **Buckingham County Compressor Station, Continued.**

In addition to the direct effects on nearby residents' health and quality-of-life, compressor stations have caused some homes to lose value and some homeowners to move away rather than endure the noise, smells, and illnesses they have experienced. In one case from Minisink, New York, a family of six moved to escape the effects of a 12,600 hp compressor station operated by Millennium Pipeline LLC. After two years of headaches, eye irritation, and lethargy among the children and even lost vigor in their fruit trees, the couple, unable to find a buyer for their home, moved away, leaving their \$250,000 investment in the property on the table with their bank holding the balance of the mortgage (Cohen 2015).

In Hancock, another New York town with a slightly larger (15,000 hp) compressor station, three homeowners have had their property assessments reduced, two by 25% and one by 50%, due to the impact of truck traffic, noise, odors, and poor air quality associated with the compressor station ("Proximity of Compressor Station Devalues Homes by as Much as 50%" 2015). The larger of these reductions was for a home very close to the station and reflected physical damage that led to an increase in radon concentrations above safe levels. The two properties devalued by 25% were approximately one half mile away (Ferguson, Bruce, Personal Communication, 12/31/2015).

As of this writing, there have not been statistical studies of the relationship between a property's value and its proximity to a compressor station. The mounting anecdotal information does suggest that there is a negative relationship, however, and that depending on the particular circumstances, the effect can be large—up to the 100% loss sustained by the family in Minisink (less whatever the bank can recover at auction). With the caveat that the effect on property value of the compressor station in Buckingham County may be different in scope and intensity, we do include such effects among the total estimated cost of the pipeline in the study region.

For our estimates, we follow the example of the Hancock New York case and assume that properties within one half mile of the Buckingham compressor station would lose 25% of their value if the station is built. We believe this assumption provides a conservative estimate in part because the Buckingham compressor station would be nearly three times the size. It is therefore likely that its noise, odor events, and other physical effects would be experienced at a greater distance and/or with greater intensity than in the New York case. The resulting loss of value would affect Buckingham landowners over a wider area and, possibly, the percentage reduction would be greater at any given distance.

Beyond health and safety concerns, compressor stations might also affect property values due to a "stigma of industrialization" similar to that found for high-voltage lines, according to real estate expert Kurt Kielisch of the Forensic Appraisal Group (Personal Communication 1/6/2016). It is reasonable to assume that such an effect would occur if a portion of Buckingham County's landscape of working forests, farms, and small villages were turned into a compressor station.

## EFFECTS ON PROPERTY VALUE

### Land Price Effects

To say that the impacts and potential impacts of the ACP on private property value is important to people along its proposed route would be an extreme understatement. Some 521 comment letters submitted by study region residents to FERC during the scoping period mentioned property value (Docket (PF15-6)). Of these, 517, or 99.2%, expressed a belief that the pipeline would have a negative effect on that value. Those reductions are not merely hypothetical. Landowners and Realtors along the proposed route of the Atlantic Coast Pipeline report that buyers have backed out of contracts and that other buyers are simply less interested in potentially affected properties (Davenport, 2015; Hotz, 2015; R. Smith, 2015a).<sup>21</sup> In the words of one Realtor, “every single one of my buyer clients who are looking to buy property in Augusta County have told me that they do not want to even look at properties that are located ON or NEAR the proposed locations of the ACP” (Adler, 2015). While it is impossible to know how large an effect the specter of the ACP, including the compressor station in Buckingham County, has already had on land prices, there is strong evidence from other regions that the effect would be negative.

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*“Buyers are concerned about safety, views, and resale values. The permanent easement that it will create will devalue every property in its path.”*

*– Daniel Hotz, Realtor  
McDowell, Virginia*

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In a systematic review, Kielisch (2015) presents evidence from surveys of Realtors, home buyers, and appraisers demonstrating that natural gas pipelines negatively affect property values for a number of reasons. Among his key findings relevant to the ACP:

- 68% of Realtors believe the presence of a pipeline would decrease residential property value.
- Of these Realtors, 56% believe the decrease in value would be between 5% and 10%. (Kielisch does not report the magnitude of the price decrease expected by the other 44%.)
- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home. This is not merely an inconvenience, but a true economic and financial cost to the seller.
- More than three quarters of the Realtors view pipelines as a safety risk.
- In a survey of buyers presented with the prospect of buying an otherwise desirable home with a 36-inch diameter gas transmission line on the property, 62.2% stated that they would no longer buy the property at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21%, on average, below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer.

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<sup>21</sup> FERC’s docket for the pre-filing phase of the Atlantic Coast Pipeline (PF15-6) is rife with testimony from landowners concerned that their property will be or already has been negatively affected by the mere possibility of the pipeline’s construction.

Not incidentally, the survey participants were informed that the risks of “accidental explosions, terrorist threats, tampering, and the inability to detect leaks” were “extremely rare” (2015, p. 7).

If one considers just those buyers who are still willing to purchase the property, the expected loss in market value would be 10.5%.<sup>22</sup> This loss in value provides the mid-level impact in our estimates. A much greater loss (and higher estimates) would occur if one takes into account the fact that 62% of buyers are effectively reducing their offer prices by 100%, making the average reduction in offer price for all potential buyers 66.2%.<sup>23</sup> In our estimates, however, we have used the smaller effect (-10.5%) based on the assumption that sellers will eventually find one of the buyers still willing to buy the pipeline-easement-encumbered property.

- Based on five “impact studies” in which appraisals of smaller properties with and without pipelines were compared, “the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%” (Kielisch, 2015, p. 11). The average rises to a range of -12% to -14% if larger parcels are considered, possibly due to the loss of subdivision capability.

These findings are consistent with economic theory about the behavior of generally risk-averse people. While would-be landowners who are informed about pipeline risks and nevertheless decide to buy property near the proposed ACP corridor could be said to be “coming to the nuisance,” one would expect them to offer less for such a property than they would offer for a property with no known risks.

Kielisch’s findings demonstrate that properties on natural gas pipeline rights of way suffer a loss in property value. Boxall, Chan, and McMillan (2005), meanwhile, show that pipelines also decrease the value of properties lying at greater distances. In their study of property values near oil and gas wells, pipelines, and other infrastructure, the authors found that

### **Diminished Property Value, Lost Revenue, Higher Costs: Mt. Rush Farm**

Mt. Rush Farm located in Buckingham County is a 1,000-acre family farm that has been operated by the Leech family for over 100 years. About half the farm is in managed forests, with the remainder in Angus cattle and crop production. It is one of the largest remaining active farms in the county. The farm typically employs 3 full-time workers, and 4 families live on the property.

The pipeline will bisect the property mainly through the un-wooded portion, which is in daily use. The pipeline will be directly in the way of bringing the cattle in from pasture, a monthly activity. To simply feed their cattle the Leech family would need to cross the pipeline twice daily with heavy equipment. With restrictions on where they could cross the pipeline, these trips would be more time consuming and costly, creating a serious burden on the farm.

“We do not make a lot of money; margins are tight. The pipeline could make it so that we cannot continue farming.” If farming is no longer viable, the family worries that the pipeline will also hurt its value for other uses such as housing.

-Irene Ellis Leech, Owner of  
Mt Rush Farm

<sup>22</sup> Half of the buyers would offer 21% less, and the other half would offer 0% less; therefore the expected loss is  $0.5(-21\%) + 0.5(0\%) = -10.5\%$ .

<sup>23</sup> This is the expected value calculated as  $0.622*(-100\%)+0.189*(-21\%)+0.189*(0\%)$ .

properties within the “emergency plan response zone” of sour gas<sup>24</sup> wells and natural gas pipelines faced an average loss in value of 3.8%, other things being equal.

The risks posed by the ACP would be different – it would not be carrying sour gas, for example—but there are similarities between the ACP scenario and the situation in the study that makes their finding particularly relevant. Namely, the emergency plan response zones (EPZs) are defined by the health and safety risks posed by the gas operations and infrastructure. Also, in contrast to ACP-cited studies showing no price effects (see below), the Boxall study examines prices of properties for which landowners must inform prospective buyers when one or more EPZs intersect the property.

The ACP has both a high consequence area (HCA) and an evacuation zone radiating from both sides of the pipeline that are defined by health and safety risks. Whether disclosed or not by sellers, prospective buyers are likely to become informed regarding location of the property relative to the ACP’s HCA and evacuation zones or, at a minimum, regarding the presence of the ACP in the study region.

As described in the box above, the compressor station proposed for the Union Hill section of Buckingham County would likely cause its own more severe reduction in the value of nearby properties. We apply the percentage reduction awarded in the Hancock, New York case (25%) to properties that are (as the properties were in that case) within one half mile of the proposed compressor station.

While there remains a paucity of statistical analysis on the effects of high-pressure natural gas transmission lines on property value, there have been many analyses demonstrating the opposite analog—namely, that amenities such as scenic vistas, access to recreational resources, proximity to protected areas, cleaner water, and others convey positive value to real property.<sup>25</sup> There are also studies demonstrating a negative impact on land value of various other types of nuisance that impose noise, light, air, and water pollution, life safety risks, and lesser human health risks on nearby residents (Bixuan Sun, 2013; Bolton & Sick, 1999; Boxall et al., 2005). The bottom line is that people derive greater value from, and are willing to pay more for, properties that are closer to positive amenities and farther from negative influences, including health and safety risks.

### **Claims that Pipelines have no effect on property value may be invalid.**

Both FERC and ACP LLC have cited several studies purporting to show that natural gas pipelines (and in one case a liquid petroleum pipeline) have at most an ambiguous and non-permanent effect on property values. In its Final EIS regarding the Constitution Pipeline, for example, FERC cited two articles concluding, in brief, that effects on property value from the presence of a pipeline can be either positive or negative, and that decreases in values due to a pipeline explosion fade over time (Diskin, Friedman, Peppas, & Peppas, 2011; Hansen, Benson, & Hagen, 2006). In its filing, ACP LLC cites additional studies drawing similar conclusions based on comparison of market and/or assessed prices paid for properties “on” or “near” a pipeline versus those farther away (Allen, Williford & Seale Inc., 2001; Fruits, 2008; Natural Resource Group, 2015b; Palmer, 2008).

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<sup>24</sup> “Sour” gas contains high concentrations of hydrogen sulfide and poses an acute risk to human health.

<sup>25</sup> Phillips (2004) is one such study that includes an extensive review of the literature on the topic.

While the studies differ in methods, they are similar in that each fails to take into account two factors that may void their conclusions entirely. The first is that the studies do not consider that the property value data used do not represent prices arising from transactions in which all buyers have full information about the subject properties. The second is that, for the most part, the definition of nearness to the pipelines may be inappropriate or inadequate for discerning actual effects on property value of that nearness.

Economic theory holds that for an observed market price to be considered an accurate gauge of the value of a good, all parties to the transaction must have full information about the good. If, on the other hand, buyers lack important information about a good, in this case whether a property is near a potential hazard, they cannot bring their health and safety concerns—their risk aversion—to bear on their decision about how much to offer for the property. As a result, buyers' offer prices will be higher than they would be if they had full information.

As Albright (2011) notes in response to the article by Disken, Friedman, Peppas, & Peppas (2011):

The use of the paired-sales analysis makes the assumption of a knowing purchaser, but I believe this analysis is not meaningful unless it can be determined that the purchaser had true, accurate and appropriate information concerning the nature and impact of the gas pipeline on, near or across their property. ... I believe that the authors' failure to confirm that the purchasers in any of the paired sales transactions had full and complete knowledge of the details concerning the gas transmission line totally undercut the authors' work product and the conclusions set forth in the article. (p.5)

Of the remaining studies, only Palmer (2008) gives any indication that any buyers were aware of the presence of a pipeline on or near the subject properties. For Palmer's conclusion that the pipeline has no effect on property value to be valid, however, it must be true that **all** buyers have full information, and this was not the case.

The study by Hansen, Benson, and Hagen (2006) actually reinforces the conclusion that when buyers know about a nearby pipeline, market prices drop. The authors found that property values fell after a deadly 1999 liquid petroleum pipeline explosion in Bellingham, Washington. They also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

We do not think it is appropriate to conclude from this study (as FERC did in the case of the Constitution Pipeline) that natural gas transmission pipelines would have no effect on land prices in today's market. In contrast to Bellingham homebuyers in the months and years after the 1999 explosion, today's homebuyers can query Zillow to see the history of land prices near the pipeline and explore online maps to see what locally undesirable land uses exist near homes they might consider buying. They also have YouTube and repeated opportunities to find and view news stories, citizens' videos, news reports, and other media describing and depicting such explosions and their aftermath. Whether the pre-explosion prices reflected the presence of the pipeline or not, it is hard to imagine

that a more recent event and the evident dangers of living near a fossil fuel pipeline would be forgotten so quickly by today's would-be home buyers.

Online based tools have changed the ways people shop for homes, and we are now in a real world much closer to the competitive economic model that assumes all buyers have full information about the homes they might purchase. Anyone with an eye toward buying property near the proposed ACP corridor would quickly learn that the property is in fact near the corridor, that there is a danger that the property could be adversely affected by still-pending project approval, and that fossil fuel pipelines and related infrastructure have an alarming history of negative health and environmental effects. Accordingly, the price that buyers would offer for a home near the ACP will be lower than the price offered for one farther away or in another community or region entirely.

The second problem with the studies is that while they purport to compare the price of properties near a pipeline to properties not near a pipeline, many or in some cases all of the properties counted as “not near” the pipelines are, in fact, near enough to the subject pipelines that health and safety concerns could influence prices. In both studies written by the Interstate Natural Gas Association of America (INGAA), for example, the authors compare prices for properties directly on pipeline rights-of-way to prices of properties off the right-of-way. However, in almost all cases the geographic scope of the analysis was small enough that most or all of the properties not on the right-of-way are still within the pipelines' respective evacuation zones (Allen, Williford & Seale Inc., 2001; Integra Realty Resources, 2016).<sup>26</sup>

The 2016 INGAA study suffers from the same problems, including the comparison of properties “on” and “off” the six pipelines analyzed when a majority of the “off” properties are within the pipelines evacuation zones. In four of the case studies—those for which a specific distance from pipeline was reported—an average of 72.5% of the “off” properties were actually within the evacuation zone. (We estimated the evacuation zone based information available information about the pipelines' diameter and operating pressure.) For the other two of the pipelines, the study reported a simple “yes” or “no” to indicate whether the property abutted the pipeline in question. For these cases, we assume the author's methods, while flawed, are at least consistent from one case study to the next meaning it is likely at least 50% or more of the comparison properties (the “off” properties) are in fact within the evacuation zone.

If one wants to compare the price of properties with and without a particular feature, one must be sure that some properties have the feature and others do not. It is a case where one actually does need to compare apples to oranges. But if there is no variation in the feature of interest, which in this case would be the presence of a nearby risk to health and safety, then one would expect to find no systematic variation in the price of the properties. By comparing apples to apples when it should be comparing apples to oranges, the INGAA study reaches the forgone and not very interesting conclusion

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<sup>26</sup> This is based on a best estimate of the location of the pipelines derived from descriptions of the pipeline's location provided in the study (only sometimes shown on the neighborhood maps) and an approximation of the evacuation zone based on pipeline diameter and operating pressure (Pipeline Association for Public Awareness, 2007).

that properties that are similar in size, condition, and other features including their location within the evacuation zone of a natural gas pipeline have similar prices.

To varying degrees, the other studies cited by FERC and in ACP LLC's filing suffer from the same problem. Fruits (2008), who analyzes properties within one mile of a pipeline that has a 0.8-mile-wide-evacuation zone (0.4 miles on either side), offers the best chance that a sizable portion of subject properties are in fact "not near" the pipeline from a health and safety standpoint. He finds that distance from the pipeline does not exert a statistically significant influence on the property values, but he does not examine the question of whether properties within the evacuation zone differ in price from comparable properties outside that zone. A slightly different version of Fruits' model, in other words, could possibly detect such a threshold effect. Such an effect would show up, of course, only if the buyers of the properties included in the study had been aware of their new property's proximity to the pipeline.

In short, one cannot conclude from these flawed studies' failure to identify a negative effect of pipelines on property value that no such effect exists. To evaluate the effects of the proposed ACP on property value, FERC and others must therefore look to studies (including those summarized in the previous section) in which buyers' willingness to pay is fully informed about the presence of nearby pipelines and in which the properties bought are truly different in terms of their exposure to pipeline-related risks.

### Visual Effects and Viewshed Analysis

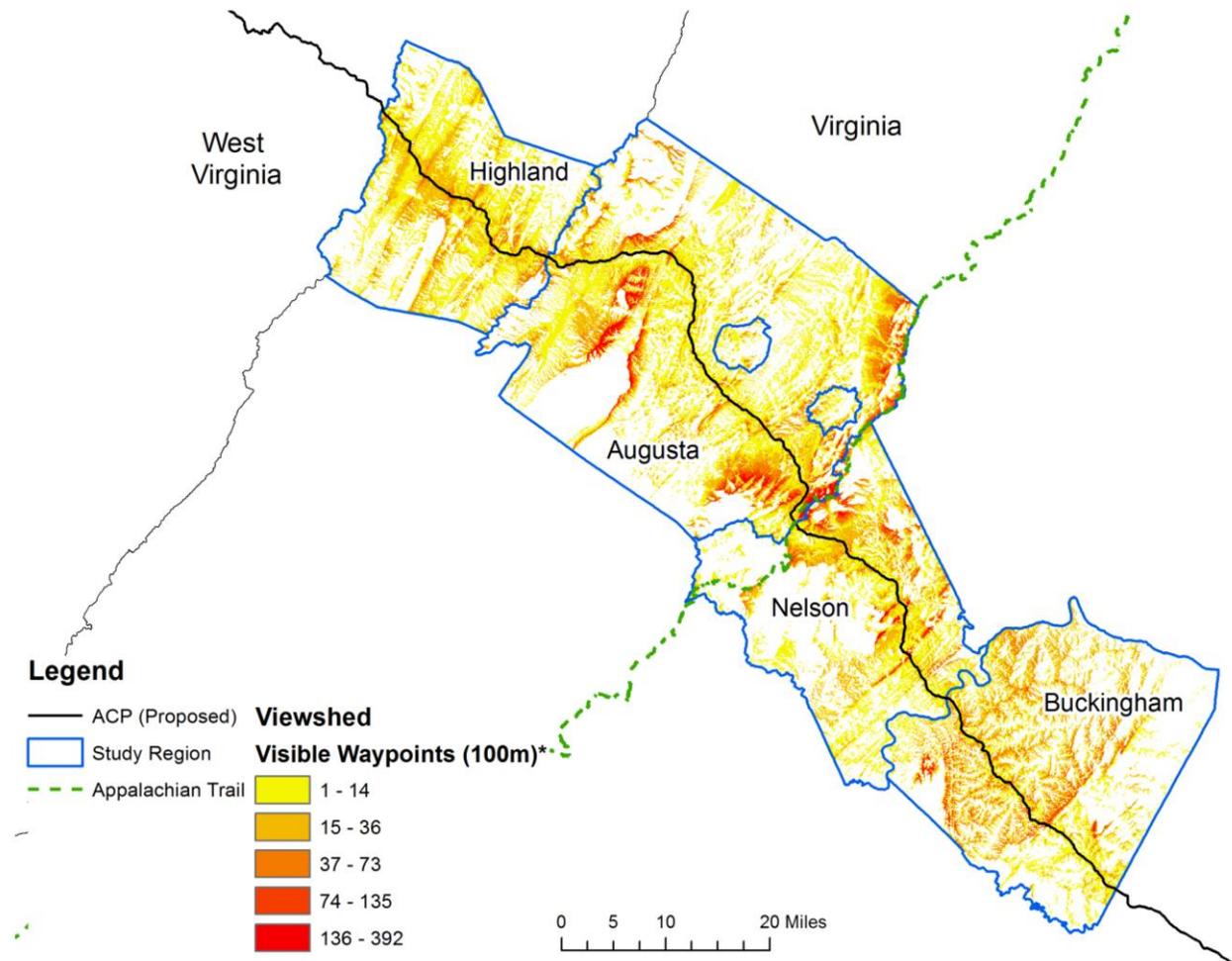
Information about how the visual effects of natural gas transmission pipelines are reflected in property value is scarcer than information related to health and safety effects. On one hand, we know better views increase property value. Conversely, utility corridors from which power lines can be seen decrease property values (by 6.3% in one study) (Bolton & Sick, 1999). This suggests a pipeline corridor reduces property value either by impairing a good view or, if like power lines, by simply being unattractive. It is reasonable to conclude that the proposed ACP would have effects on property value that are mediated through visual effects, but the literature to date does not offer clear guidance on how large or strong the effect may be. We therefore have not included separate estimates of the impact of the ACP on property value in the viewshed. Moreover, we do not wish to double-count a portion of the impact of the ACP on "Aesthetics," which is already included among the ecosystem service value effects.

We do want to know, however, how many properties might suffer a portion of that lost aesthetic value. To keep the estimate conservative, we count only those properties with a higher-than-average likelihood the ACP corridor could be seen from them. To determine this for each parcel, a GIS-based visibility analysis provides an estimate of how many points along the pipeline could potentially be seen from each 30m-by-30m spot in the study region. To keep the computing needs manageable, we analyzed a sample of points placed at 100m intervals along the proposed ACP route.

Because weather, smog, and other conditions limit the distance at which one can see anything in the mountains and valleys of Virginia, we restricted the scope of analysis for any given point on the pipeline

to spots in the study region that lie within a 25-mile radius. As a practical matter, this meant that we analyzed a section of the ACP beginning 25 miles west of the western boundary of Highland County, Virginia and extending to a point 25 miles east of the eastern boundary of Buckingham County.

By tallying the number of points on the pipeline corridor that could be seen from each spot in the study region and then connecting those spots to parcel boundaries, we obtain an estimate of how much of the pipeline could be seen from some spot within a given parcel. In Figure 6, yellow spots on the maps are those where one could see between 1 and 14 points on the pipeline, whereas red spots have a view of up to as many as 392 points along the pipeline. Since each point represents 100 meters of pipeline, there are places in the study region where 39.2 km, or 24.4 miles, of pipeline corridor could be visible.



**FIGURE 6: Visibility Analysis Results**

\*The color indicates the number of waypoints, spaced 100m apart along the proposed route that would be visible from the colored grid cell. Only waypoints within 25 miles are considered. Does not account for obstructions like buildings or trees.

Taking into account those spots on nearly every parcel from which one could not see the ACP corridor, the average of the maximum number of points visible from a parcel is 12. This serves as our threshold for identifying parcels from which the pipeline would be “visible.” Parcels containing no spot (again each spot is a 30m-by-30m square) from which one could see more than 12 pipeline points is

considered to have no view of the pipeline. By this rule, and out of 106,717 parcels in the study region, some 31,117 parcels, or just under one-third, would have a potential view of the pipeline. The total value of these properties is currently \$7.44 billion.

We call this a potential view of the pipeline because we have not taken other visual obstructions, such as trees or buildings into account. In particular, smaller parcels in the more densely developed areas could be at elevations relative to the pipeline that could afford a view of it, but the house next door could block that view. The restriction of our analysis to those parcels that have comparatively many spots from which to potentially see the pipeline mitigates this limitation of our GIS analysis. The reason is simply that smaller urban lots have very few 30-meter-square spots to begin with. A parcel has to be at least 13 spots in size (2.9 acres), with the pipeline visible from every spot, to cross the 12-spot threshold.

## Parcel Values

With the exceptions of the City of Staunton and Highland County, parcel value is obtained from the jurisdictions' public records. We obtained Staunton's parcel boundaries (the GIS file) from the city, but it is not possible to download or create a file with the assessed value that corresponds to each parcel. For Highland County, we obtained the parcel boundaries from the Commonwealth of Virginia's web-based map service, but those parcels lack any identifying information, such as an address or key code by which parcels could be connected to property value obtained separately from the County.

For both Staunton and Highland County, we adopted a second-best approach to enable some spatial analysis of property value impacts. We extracted the median house value for block groups in those two jurisdictions from the American Community Survey (ACS) (2014). After adjusting the ACS's figures for inflation, we attached those values to each parcel, according to which block group the parcel occupies.<sup>27</sup>

Each of the remaining jurisdictions have some parcels with missing value data or parcels where a match in the jurisdictions' separate assessment records could not be found. This will lead to some underestimation of any land value effects, since the value of these parcels is set to zero.

Two other features of the parcel data required adjustments prior to performing any land value impact calculations. First, the Buckingham County data had instances in which two or more individual tracts in different parts of the County are listed on a single tax record with a single property value. The consequence is that the value of all of the land connected to such multi-tract tax records would be swept up with the value of just those tracts actually crossed by the proposed ROW, in the evacuation zone, or near the compressor station. To avoid overstating impacts, we split the multi-tract parcels into separate tax records and assigned each tract its own value based on its size and the per-acre value of the original multi-tract parcel.

The second remaining issue deals with public land that is unlikely to be sold and therefore does not

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<sup>27</sup> Because many parcels overlap block group boundaries, each parcel is assigned to a block according to whether its centroid, or geometric center, lies within the block group.

possess any market value. To ensure these properties would not inflate overall property value effects, we used the “Protected Areas Database” from the National Gap Analysis Program to identify fee-owned conservation properties, such as portions of the George Washington National Forest and state, county, and municipal parks (Conservation Biology Institute, 2012). Once identified, we set the value of all such properties equal to zero.

With all of these adjustments made, there remains the comparatively straightforward matter of identifying parcels of six types for which one could expect some effect of the ACP on the value. In order of increasing distance from the pipeline itself, these are:

1. Parcels crossed by the right-of-way  
(508 parcels, with total value (before ACP) of \$277.5 million)
2. Parcels crossed by the construction corridor  
(553 parcels, with total value (before ACP) of \$281.8 million)
3. Parcels at least partially within the High Consequence Area (HCA)  
(1,799 parcels, with total value (before ACP) of \$539.7 million)
4. Parcels at least partially within the Evacuation Zone  
(5,553 parcels, with total value (before ACP) of \$1.13 billion)
5. Parcels with their geographic center (centroid) within one half mile of the compressor station  
(87 parcels, with total value (before ACP) of \$4.9 million)
6. Parcels from which the pipeline would be visible (as defined above)  
(31,117 parcels, with total value (before ACP) of \$7.44 billion)

Note that there is overlap among these zones. All ROW parcels are within the construction, HCA, and evacuation zones, and 13 are near the compressor station, for example. To avoid double counting we apply only one land value effect to any given parcel. We assume that the health and safety concerns associated with the compressor station dominate the effects of the ROW and of the evacuation zone, and so we exclude the compressor zone parcels from estimates of the impact of those zones and estimate a separate effect of the compressor station. Similarly, ROW parcels are assumed to suffer no further reduction in value due to their location within the evacuation zone.

We ignore the construction corridor for this analysis. Even though the additional 32 parcels and \$4.3 million in value (relative to parcels in the ROW) are not trivial, we do not have a basis for estimating a change in value that is separate from or in addition to the change due to the parcels’ proximity to the ROW or their location within the evacuation zone.

Furthermore, we treat parcels in the HCA and in the evacuation zone the same way and apply a single land value change to all parcels in the evacuation zone. Arguably, there should be a larger effect on parcels in the HCA than those only in the evacuation zone. Living with the possibility that one would need to evacuate one’s home at any time day or night would, one would expect, have a smaller effect on property value than living with the possibility that one would not survive a “high consequence” event and, therefore, not have the chance to evacuate at all. We do not have data or previous study results that allow us to draw such a distinction, so instead we apply the lower evacuation zone effect to all HCA and evacuation zone parcels.

To summarize, Table 9 repeats a portion of Table 2, but with the property value effects discussed above in place of check marks.

**TABLE 9: Summary of Marginal Property Value Effects**

Values / Effects	Right-of-Way (Low, Medium, & High effects)	High Consequence Area	Evacuation Zone	Compressor Station Zone	Pipeline Viewshed
Land / Property Value	-4.2% <sup>a</sup> -10.5% <sup>b</sup> -13.0% <sup>c</sup>	-3.8% <sup>d</sup>		-25% <sup>e</sup>	Impact included with Ecosystem Services

Notes:

- a. Kielisch, Realtor survey in which 56% of respondents expected an effect of between -5% and -10% ( $0.56 \times -7.5\% = -4.2\%$ ).
- b. Kielisch, buyer survey in which half of buyers still in the market would reduce their offer on a property with a pipeline by 21% ( $0.50 \times -0.21 = -10.5\%$ ).
- c. Kielisch, appraisal/impact studies showing an average loss of between -12% and -14% (-13% is the midpoint)
- d. Boxall, study in which overlap with an emergency planning zone drives, on average, a 3.8% reduction in price. We apply this reduction ONLY to those parcels in the evacuation zone that are not also in the ROW or within one half mile of the compressor station.
- e. Based on examples from the town of Hancock, New York.

### Estimated Land Value Effects

Following the procedures outlined in the previous section, our conservative estimate for costs of the proposed ACP would include between \$55.8 million and \$80.2 million in diminished property value. Some of the most intense effects will be felt by the owners of 508 parcels in the path of the right-of-way, who collectively would lose between \$11.7 million and \$36.1 million in property value. There are 87 parcels in the compressor station zone, and their owners would together experience a drop of \$1.2 million in property value. Some 5,553 additional parcels lie outside the ROW and compressor station zones but are within or touching the evacuation zone. These parcels’ owners would lose an estimated \$43.0 million. (See Table 10). A far greater number of parcels, 31,117, would experience a loss in value due to diminished quality of the view from their properties.

**TABLE 10: Summary of Land Value Effects, by Zone and County**

County	Effects in Right-of-Way			Effects in Evacuation Zone
	Realtor Survey (4.2%)	Buyer Survey (10.5%) <sup>a</sup>	Impact Studies (13.0%)	Boxall Study (3.8%)
Augusta	-5,201,628	-13,004,069	-16,100,276	-28,380,818
Buckingham	-993,700	-2,484,249	-3,075,737	-2,884,845
Highland	-360,981	-902,453	-1,117,323	-2,094,518
Nelson	-5,082,259	-12,705,646	-15,730,800	-9,596,010
<b>Study Region Total</b>	<b>-\$11,654,492</b>	<b>-\$29,136,230</b>	<b>-\$36,073,427</b>	<b>-\$42,956,191</b>

TABLE 10: Continued

	Effects Near Compressor Hancock, NY Finding (25%)	Total of ROW, Compressor Station, and Evacuation Zone Effects		
		Low	Medium	High
Augusta	n/a	-33,582,445	-41,384,887	-44,481,094
Buckingham	-1,214,140	-5,092,685	-6,583,234	-7,174,722
Highland	n/a	-2,455,500	-2,996,972	-3,211,841
Nelson	n/a	-14,678,268	-22,301,656	-25,326,810
<b>Study Region Total</b>	<b>-\$1,214,140</b>	<b>-\$55,808,898</b>	<b>-\$73,266,748</b>	<b>-\$80,194,467</b>

Based on median property tax rates in each county, these one-time reductions in property value would result in reductions in property tax revenue of between \$281,000 and \$408,000 per year (see Table 11). To keep their budgets balanced in the face of this decline in revenue, the counties would need to increase tax rates, cut back on services, or both. The loss in revenue would be compounded by the likelihood that the need for local public services, such as road maintenance, water quality monitoring, law enforcement, and emergency preparedness/emergency response could increase. The ACP, in other words, could drive up expenses while driving down the counties’ most reliable revenue stream.<sup>28</sup>

TABLE 11: Effects on Local Property Tax Revenue

	Median Tax Rate (% of Value) <sup>a</sup>	Lost Property Tax Revenue		
		Low	Medium	High
Augusta County	0.47%	-157,837	-194,509	-209,061
Buckingham	0.56%	-28,519	-36,866	-40,178
Highland	0.46%	-11,295	-13,786	-14,774
Nelson	0.57%	-83,666	-127,119	-144,363
<b>Study Region Total</b>		<b>-\$281,318</b>	<b>-\$372,281</b>	<b>-\$408,377</b>

a. Source: Property Taxes By State (Virginia Counties and Independent Cities) (propertytax101.org, 2015)

In addition to factors that make our estimates of the effects on property value itself conservative,<sup>29</sup> there is one other factor that makes the estimates of effects on property taxes lower than what one would expect if the ACP is permitted. Namely, nearly a quarter of the properties in the ROW are currently undeveloped but still assessed at a value that assumes a single house site. Buckingham County has 70 such properties, Nelson has 7, and Augusta has 46.<sup>30</sup> The total assessed value of these

<sup>28</sup> We recognize that ACP anticipates making tax payments, but because those payments are tied to net income from the operation of the pipeline, they may fluctuate from year to year or disappear entirely if pipeline operations become unprofitable.

<sup>29</sup> These factors include using the lower expected price reduction from the buyer survey and applying the same price reduction to the entire evacuation zone (including the HCA).

<sup>30</sup> There are no such properties in Highland County, where the County does not assume any development value until development is imminent. In Buckingham County all unimproved properties are assessed as if they include at least one

properties is \$15.1 million. Depending on where and how the ROW crosses these properties, it is likely that some will lose their potential usefulness for future residential or other development. In those cases, the assessed value (which by law reflects market value) will fall, and tax revenue generated by future development will never materialize.

## EFFECTS ON ECONOMIC DEVELOPMENT

Across the study region, county-level economic development plans recognize the importance of a high quality of life, a clean environment, and scenic and recreational amenities to the economic future of people and communities. Augusta County's Economic Development Strategic Plan, for example, stresses "Respect for Heritage and Environment: Promote a quality of life that embraces our heritage, preserves the environment and effectively manages the resources we have been given" (Glover & Castle, 2015). In Highland County, the Economic Development Authority states its mission is to "promote sustainable economic development in order to achieve a desirable quality of life for the citizens of Highland County," and it aims to complete that by "preserving our rural heritage and natural beauty, supporting existing businesses, promoting new investment and igniting entrepreneurship" (Billingsley et al., 2015).

The ACP would undermine the progress toward these visions if the loss of scenic and recreational amenities, the perception and the reality of physical danger, and environmental and property damage were to discourage people from visiting, relocating to, or staying in the study region. Workers, businesses, and retirees who might otherwise choose to locate along the ACP's proposed route will instead pick locations retaining their rural character, productive and healthy landscapes, and promise for a higher quality of life.

This is already occurring in the region. With the possibility of the ACP looming, business plans have stalled and the real estate market has slowed (Adler, 2015; R. Smith, 2015a, 2015b). Study region residents are also concerned the ACP could have broad, negative impacts on the economy. Of those

### Forgone Economic Development: Eco-Village

In April of 2014 a father and son purchased two parcels near Bold Rock Cidery in Nelson County in order to begin developing a "stunning boutique eco-resort focused on the natural beauty of the Rockfish Valley and the delightful Virginia-Made craft beers, wines, ciders, foods, and handmade goods."

Designed to be a top destination on the East Coast, the developers predict \$35 million in investment costs to create this vision. They began developing a plan in April of last year and have already hired a world-class landscape design firm. The eco-resort would provide 50 full-time and 50 or more part-time jobs as well as \$15-30 million in annual taxable revenue for Nelson County.

This project, which will be "a pure celebration of Virginia", will be entirely derailed by the ACP, which would cut "right through the heart of this project and destroy any opportunity to develop this land in a meaningful way." This project represents just one of many "small business owners investing in their own ideas and opportunities to serve the exploding tourism market and our local economy."

- Richard Averitt  
Developer of Spruce Creek Resort  
and Market

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house site. Nelson County assumes that all unimproved properties of 10 acres or smaller include a single house site. Augusta County applies the single house site assumption to unimproved properties of between 0.5 and 20 acres in size.

who mentioned the economy in written comments to the Federal Energy Regulatory Commission during the scoping phase of its environmental review, 91.4% expressed a belief that the ACP would have a negative effect. Of those who mentioned agriculture, 98.6% thought the effect would be negative, and 99.5% of those who addressed tourism said the effect would be negative.

These fears are consistent with research results from this region and around the country demonstrating that quality of life is often of primary importance when people choose places to visit, live, or do business. As Niemi and Whitelaw state, “as in the rest of the Nation, natural-resource amenities exert an influence on the location, structure, and rate of economic growth in the southern Appalachians. This influence occurs through the so-called people-first-then-jobs mechanism, in which households move to (or stay in) an area because they want to live there, thereby triggering the development of businesses seeking to take advantage of the households’ labor supply and consumptive demand” (1999, p. 54). They note that decisions affecting the supply of amenities “have ripple effects throughout local and regional economies” (p. 54).

Along similar lines, Johnson and Rasker (1995) found that quality of life is important to business owners deciding where to locate a new facility or enterprise and whether to stay in a location already chosen. This is not surprising. Business owners value safety, scenery, recreational opportunities, and quality of life factors as much as residents, vacationers, and retirees.

It is difficult to predict just how large an effect the ACP would have on decisions about visiting the study region, or locating, or staying there. Even so, based on information provided by business owners to FERC and as part of this research, we can consider reasonable scenarios for how the ACP might affect key portions of the region’s overall economy.

As noted above, the study region’s residents believe the ACP will harm the travel and tourism industry. Wintergreen Resort, located in Nelson and Augusta Counties, expects a 40% drop in business relative to a planned expansion (Theiss, 2015). The nearby Fenton Inn projects it “will be losing at least 10% of projected

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***Natural and Scenic Resources [Goals]***

***– Recognize that the natural environment is an important facet of our quality of life and efforts should be made to support and enhance that environment.***

***– Protect the county’s scenic resources as essential to the county’s rural character, economic strength and quality of life.***

*- Nelson County Comprehensive Plan*

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income for [the life of the pipeline]” and that insurance and other costs will further impact its bottom line (Fenton & Fenton, 2015). In one widely reported case, a planned resort in Nelson County will never be built if the ACP is constructed—effectively a 100% loss for a business that would supply 50 full-time and 50 part-time jobs (Averitt, 2015). Finally, Yogaville in Buckingham County surveyed current and former guests regarding how a pipeline near its campus could affect future demand for its programs and found some 95% of those surveyed responded they would visit less often if the pipeline were constructed.

While more systematic research could provide refined estimates of the impact of natural gas transmission pipelines on recreation and tourism spending, one plausible scenario is that the impact is at least as high as the minimum of these business owners' reported expectations. That is, if the ACP were to cause a 10% drop in recreation and tourism spending from the 2014 baseline, the ACP could mean \$41.3 million less in travel expenditures each year. Those missing revenues would otherwise support roughly \$7.5 million in payroll, \$1.3 million in local tax revenue, \$1.8 million in state tax revenue, and 387 jobs in the four-county region's recreation and tourism industry each year.<sup>31</sup> In the short run, these changes multiply through the broader economy as recreation and tourism businesses buy less from local suppliers and fewer employees spend their paychecks in the local economy. As with the reduction in local property taxes, lost tax revenue from a reduction in visitation and visitor spending would squeeze local governments trying to meet existing public service needs as well as those additional demands presented by the ACP.

Along similar lines, retirement income is an important economic engine that could be adversely affected by the ACP. In county-level statistics from the US Department of Commerce, retirement income shows up in investment income and as age-related transfer payments, including Social Security and Medicare payments. In the study region, investment income grew by 1.5% per year from 2000 through 2014, and age-related transfer payments grew by 5.4% per year. During roughly the same time period (through 2013), the number of residents age 65 and older grew by 27.3% (2.1% per year), and this age cohort now represents 17.6% of the total population.<sup>2</sup>

It is difficult to precisely quantify the effect of the ACP on retirement income, but given the strong expression of concern from residents about changes in quality of life, safety, and other factors influencing retirees' location decisions, it is important to consider that some change is likely. Here, we consider what just a *10% slowing of the rate of increase* might entail. Such a scenario entails an annual decrease in investment income and age-related transfer payments of approximately \$6.6 million. That loss would ripple through the economy as the missing income is not spent on groceries, health care, and other services such as restaurant meals, home and auto repairs, etc.

The same phenomenon also applies to people starting new businesses or moving existing businesses to communities in the study region. This may be particularly true of sole proprietorships and other small businesses who are most able to choose where to locate. As noted, sole proprietors account for a large and growing share of jobs in the region. If proprietors' enthusiasm for starting businesses in the study region were dampened to the same degree as retirees' enthusiasm for moving there, the 10% reduction in the rate of growth would mean 41 fewer jobs and \$1.6 million less in personal income.

For "bottom line" reasons (e.g., cost of insurance) or due to owners' own personal concerns, businesses in addition to sole proprietorships might choose locations where the pipeline is not an issue. If so, further opportunities for local job and income growth will be missed.

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<sup>31</sup> Raw data on travel expenditures is from the Virginia Tourism Corporation (2015). This reduction in economic activity would be in addition to the lost recreation benefits (that is, the value to the visitors themselves over and above their expenditures on recreational activity) that are included with ecosystem service costs above.

These are simple scenarios and the actual magnitude of these impacts of the ACP will not be known unless and until the pipeline is built. Even so, and especially because the pipeline is promoted by supporters as bringing some jobs and other economic benefits to the region, it is important to consider the potential for loss.

## CONCLUSIONS

The full costs of the proposed Atlantic Coast Pipeline in our four-county study area and beyond are wide-ranging. They include one-time costs like reductions in property value and lost ecosystem services during pipeline construction, which we estimate to be between \$72.7 and \$141.2 million. Plus there are ongoing costs like lost property tax revenue, diminished ecosystem service value, and dampened economic growth that would recur year after year for the life of the pipeline. These annual costs range from an estimated \$54.8 to \$67.8 million per year. Most of these costs would be borne by residents, businesses, and institutions in Highland, Augusta, Nelson, and Buckingham Counties.

By contrast, the ACP's one local benefit is much smaller. It is an estimated average tax payment of \$3.2 million per year (for the four-counties) through 2025 (Natural Resource Group, 2015b, pp. 5–31). Other ACP-promoted benefits, such as jobs from the ACP's construction and operation and those stemming from lower energy costs, would accrue primarily in other places (Atlantic Coast Pipeline, LLC, n.d.).<sup>32</sup>

The decision to approve or not approve the ACP does not hinge on a simple comparison of estimated benefits and estimated costs. The scope and magnitude of the costs outlined here, however, reflect and are an important component of the full environmental effects that must be considered in making that decision. Impacts on human well-being, including but not limited to those that can be expressed in dollars-and-cents must be taken into account by the Federal Energy Regulatory Commission and others weighing the societal value of the Atlantic Coast Pipeline.

If these considerations and FERC's overall review, under the National Environmental Policy Act, result in selection of the "no-action" alternative and the Atlantic Coast Pipeline is never built, most of the costs outlined in this report will be avoided. It is *most*, but not *all* costs because there has already been the cost of delaying implementation of business plans, the cost of houses languishing on the market, and the cost to individuals of the stress, time, and energy diverted to concern about the pipeline rather than what would normally (and more productively) fill their lives.

Another possible scenario is that the FERC, considering the impacts of the ACP *as currently proposed* on ecosystem services, property values, and economic development, would conduct a thorough analysis of all possible alternatives. Those alternatives may include using existing gas transmission infrastructure (with or without capacity upgrades), routing new gas transmission lines along existing utility and transportation rights-of-way, and/or scaling down permitted new pipeline capacity to match regional gas transmission needs (as opposed to permitting pipelines on a company-by-company basis). In this case, estimates of these impacts should inform the choice of a preferred alternative that minimizes environmental damage and, thereby, minimizes the economic costs to individuals, businesses, and the public at large.

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<sup>32</sup> Due to issues with the methods and assumptions used in the ACP-sponsored studies, the benefit estimates they present may be inflated. See Stanton, et al. (2015), and Phillips (2015b) for a review.

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## APPENDIX A:

### CANDIDATE PER-ACRE VALUES FOR LAND-USE AND ECOSYSTEM SERVICE COMBINATIONS

As explained under “Effects on Ecosystem Service Value,” the benefit transfer method applies estimates of ecosystem service value from existing studies of “source areas” to the “study area,” which in this case is the proposed ACP corridor. This application is done on a land-use-by-land-use basis. So, for example, values of various ecosystem services associated with forests in the source area are applied to forests in the study area. The table below lists all of the values from source area studies areas considered for our calculations.

Land Use	Ecosystem Service	Minimum \$/Acre/year	Maximum \$/Acre/year	Source Study
Cropland	Aesthetic	35.01	89.23	(Bergstrom, Dillman, & Stoll, 1985)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Biological Control	14.38	204.95	(Cleveland et al., 2006)
	Erosion	27.31	72.55	(Pimentel et al., 2003) *
	Food	33.25	33.25	(Lex & Groover, 2015)
	Pollination	10.14	10.14	(Brenner Guillermo, 2007) *
	Pollination	13.89	13.89	(Robinson, Nowogrodzki, & Morse, 1989)
	Pollination	47.43	1,987.97	(Winfree, Gross, & Kremen, 2011)
	Recreation	18.77	18.77	(Brenner Guillermo, 2007) *
	Recreation	2.16	5.02	(Knoche & Lupi, 2007)
	Soil Fertility	7.28	7.28	(Pimentel, 1998) *
	Soil Fertility	115.23	115.23	(Pimentel et al., 2003)
	Waste	132.26	132.26	(Perrot-Maître & Davis, 2001) *
Grasslands	Aesthetic	102.38	116.61	(Ready, Berger, & Blomquist, 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015) *
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Pasture	Aesthetic	102.38	116.61	(Ready et al., 1997)
	Biological Control	15.21	15.21	(Brenner Guillermo, 2007) *
	Climate	3.55	3.55	(Brenner Guillermo, 2007) *
	Erosion	17.48	17.48	(Barrow, 1991) *
	Erosion	68.28	68.28	(Sala & Paruelo, 1997) *
	Food	15.50	15.50	(Lex & Groover, 2015)
	Pollination	16.23	16.23	(Brenner Guillermo, 2007) *
	Soil Fertility	3.55	3.55	(Brenner Guillermo, 2007) *

Land Use	Ecosystem Service	Minimum \$/Acre/year	Maximum \$/Acre/year	Source Study
Pasture, cont'd	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	5.88	64.40	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Water Flows	2.54	2.54	(Brenner Guillermo, 2007) *
Shrub/Scrub	Air Quality	37.26	37.26	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Climate	7.27	7.27	(Croitoru, 2007) *
	Erosion	22.75	22.75	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Pollination	1.41	7.10	(Robert Costanza, Wilson, et al., 2006)
	Recreation	3.95	3.95	(Haener & Adamowicz, 2000)
	Waste	46.35	46.35	(Croitoru, 2007) *
	Waste	0.10	324.35	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
Forest	Aesthetic	4,439.71	18,141.99	(Nowak, Crane, Dwyer, & others, 2002)
	Air Quality	372.57	372.57	(Ministerie van Landbouw & Natuur en Voedselkwaliteit, 2006) *
	Biological Control	8.91	8.91	(Wilson, 2005) *
	Biological Control	2.54	2.54	(Brenner Guillermo, 2007) *
	Climate	67.45	67.45	(Brenner Guillermo, 2007) *
	Climate	56.89	56.89	(Robert Costanza, d'Arge, et al., 2006)
	Erosion	61.87	61.87	(Brenner Guillermo, 2007) *
	Erosion	3.09	36.09	(Zhou, Al-Kaisi, & Helmers, 2009)
	Extreme Events	797.66	797.66	(Weber, 2007)
	Food	0.13	0.13	(Wilson, 2005) *
	Pollination	202.87	202.87	(Brenner Guillermo, 2007) *
	Raw Materials	24.53	24.53	(Wilson, 2005) *
	Raw Materials	166.82	166.82	(Weber, 2007)
	Recreation	152.66	152.66	(Brenner Guillermo, 2007) *
	Recreation	1.29	4.55	(Cruz & Benedicto, 2009) *
	Recreation	1.56	1.56	(Kniivila, Ovaskainen, & Saastamoinen, 2002) *
	Recreation	37.13	45.50	(Prince & Ahmed, 1989)
	Recreation	2.79	503.97	(Shafer, Carline, Guldin, & Cordell, 1993)
	Soil Fertility	6.09	6.09	(Brenner Guillermo, 2007) *
	Soil Fertility	19.97	19.97	(Weber, 2007)
	Waste	55.28	55.28	(Brenner Guillermo, 2007) *
	Waste	8.66	8.66	(Cruz & Benedicto, 2009) *
	Waste	265.79	266.89	(Lui, 2006)
	Water	204.39	204.39	(Brenner Guillermo, 2007) *
	Water	47.39	47.39	(Cruz & Benedicto, 2009) *
	Water	1,292.23	1,292.23	(Weber, 2007)
	Water Flows	230.01	230.01	(Mates, 2007)
Water Flows	797.66	797.66	(Weber, 2007)	

Land Use	Ecosystem Service	Minimum \$/Acre/year	Maximum \$/Acre/year	Source Study
Water	Recreation	446.31	446.31	(Brenner Guillermo, 2007) *
	Recreation	155.36	914.10	(Cordell & Bergstrom, 1993)
	Recreation	304.18	437.19	(Mullen & Menz, 1985)
	Recreation	148.68	148.68	(Postel & Carpenter, 1977)
	Waste	10.72	10.72	(Gibbons, 1986) *
	Water	512.74	512.74	(Brenner Guillermo, 2007) *
	Water	22.98	22.98	(Gibbons, 1986) *
Wetland	Aesthetic	38.46	38.46	(Amacher & Brazee, 1989) *
	Air Quality	75.50	98.02	(Jenkins, Murray, Kramer, & Faulkner, 2010)
	Climate	1.84	1.84	(Wilson, 2005) *
	Climate	157.73	157.73	(Brenner Guillermo, 2007) *
	Extreme Events	228.06	369.85	(Wilson, 2005) *
	Extreme Events	110.06	4,583.26	(Brenner Guillermo, 2007) *
	Extreme Events	304.18	304.18	(Robert Costanza, Farber, & Maxwell, 1989)
	Extreme Events	278.77	278.77	(Robert Costanza & Farley, 2007)
	Extreme Events	1,645.59	7,513.98	(Leschine, Wellman, & Green, 1997)
	Raw Materials	50.16	50.16	(Everard, Great Britain, & Environment Agency, 2009)
	Recreation	80.71	80.71	(Bergstrom, Stoll, Titre, & Wright, 1990)
	Recreation	1,716.76	1,761.89	(Brenner Guillermo, 2007) *
	Recreation	109.30	429.97	(Robert Costanza et al., 1989)
	Recreation	1,041.04	1,041.04	(Creel & Loomis, 1992)
	Recreation	88.06	994.50	(Gren & Söderqvist, 1994) *
	Recreation	71.11	71.11	(Gren, Groth, & Sylven, 1995) *
	Recreation	208.01	208.01	(Kreutzwiser, 1981)
	Recreation	209.51	209.51	(Lant & Roberts, 1990) *
	Recreation	648.57	4,203.82	(Whitehead, 1990)
	Waste	141.56	141.56	(Wilson, 2005) *
	Waste	67.02	67.02	(Breux, Farber, & Day, 1995)
	Waste	1,050.34	1,050.34	(Brenner Guillermo, 2007) *
	Waste	170.05	170.05	(Gren & Söderqvist, 1994) *
	Waste	35.20	35.20	(Gren et al., 1995) *
	Waste	551.02	551.02	(Jenkins et al., 2010)
	Waste	209.51	209.51	(Lant & Roberts, 1990) *
	Waste	5,027.28	5,027.28	(Meyerhoff & Dehnhardt, 2004) *
	Waste	10,881.15	10,881.15	(Lui, 2006)
	Water	1,934.84	2,407.52	(Brenner Guillermo, 2007) *
	Water	622.77	622.77	(Creel & Loomis, 1992)
	Water	18.19	18.19	(Folke & Kaberger, 1991) *
	Water Flows	3,741.87	3,741.87	(Brenner Guillermo, 2007) *
Water Flows	3,920.69	3,920.69	(Leschine et al., 1997)	
Water Flows	4,329.70	4,329.70	(UK Environment Agency, 1999)	

Land Use	Ecosystem Service	Minimum \$/Acre/year	Maximum \$/Acre/year	Source Study
Urban Open Space	Aesthetic	1,006.06	1,322.31	(Qiu, Prato, & Boehrn, 2006)
	Air Quality	32.46	32.46	(G. McPherson, Scott, & Simpson, 1998)
	Air Quality	192.35	192.35	(G. E. McPherson, 1992)
	Climate	1,134.38	1,134.38	(G. E. McPherson, 1992)
	Extreme Events	315.52	597.01	(Streiner & Loomis, 1995)
	Water Flows	8.32	8.32	(G. E. McPherson, 1992)
	Water Flows	138.22	187.58	(The Trust for Public Land, 2010)
Urban Other	Climate	420.95	420.95	(Brenner Guillermo, 2007) *
	Recreation	2,670.74	2,670.74	(Brenner Guillermo, 2007) *
	Water Flows	7.61	7.61	(Brenner Guillermo, 2007)

All values are adjusted for inflation to 2014 dollars.

\* Indicates source is from the TEEB database.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 13, Key-Log Economics, Four Summaries of Economic Harm (PennEast Pipeline Project, the Mountain Valley Pipeline Project, the Millennium Eastern System Upgrade Project and the Atlantic Coast Pipeline Project).**

## At a Glance:

### The Atlantic Coast Pipeline in Western and Central Virginia ~ Highland, Augusta, Nelson, & Buckingham Counties ~

- Miles of Pipeline: 125.5
- Acres in the construction corridor and permanent right-of-way (ROW): 1,901 and 1,140
- Most impacted land cover types (ROW only): forest (795 acres) and pasture (247 acres)
- Parcels touched by ROW: 521
- Parcels in the 1.4-mile-wide evacuation zone: 6,148
- Parcels within one half mile of the compressor station: 87
- Residents and housing units in the evacuation zone: 15,128 people and 8,762 homes
- Parcels from which the pipeline would be visible: 31,117, or 29% of all parcels in the four-county study region
- Baseline property value at risk (and expected one-time cost due to the ACP):
  - In the ROW: \$277.1 million (\$11.6 to \$36.0 million)
  - In the evacuation zone: \$1.13 billion (\$43.0 million)
  - Near the compressor station: \$4.9 million (\$1.2 million)
  - In the viewshed: \$7.44 billion (to avoid double counting with lost aesthetic value under ecosystem services, this impact is not separately estimated)
- Total property value lost: \$55.8 to \$80.2 million
- Resulting loss in property tax revenue (annual): \$281,300 to \$408,400
- Lost ecosystem service value, such as for water and air purification, recreational benefits, and others:
  - Over the two-year construction period: between \$16.9 and \$61.0 million (a one-time cost)
  - Annually for the life of the ACP: between \$4.9 and \$17.8 million
- Lost economic development opportunities due to the erosion of these Counties' comparative advantages as attractive places to visit, reside, and do business. Under the scenarios described below, these could include:
  - Annual loss of recreation tourism expenditures of \$41.3 million that supports 387 jobs and \$7.4 million in payroll and generates \$1.8 million in state and \$1.3 million in local taxes
  - Annual loss of personal income of \$6.6 million due to slower growth in the number of retirees
  - Annual loss of personal income of \$1.6 million due to slower growth in sole proprietorships
- One-time costs (property value and ecosystem services during construction) would total between \$72.7 and \$141.2 million
- Annual costs (all other costs above) would range from \$54.8 to \$67.8 million

## At a Glance:

### The Mountain Valley Pipeline in Virginia and West Virginia *Craig, Franklin, Giles, Montgomery, and Roanoke Counties in Virginia and Greenbrier, Monroe, and Summers Counties in West Virginia*

- Miles of pipeline: 143
- Acres
  - In the construction corridor and temporary roads and workspaces: 2449
  - In the permanent right-of-way (ROW): 861
  - In permanent access roads and other facilities: 76
- Most impacted land cover types (ROW only): forest (664 acres) and pasture (142 acres)
- Parcels touched by ROW: 716
- Parcels in the 1.4-mile-wide evacuation zone: 8,221
- Residents and housing units in the evacuation zone: 20,389 people and 9,700 homes
- Parcels from which the pipeline would be visible: 78,553 or 31% of all parcels in the six counties for which detailed parcel data are available
- Baseline (no pipeline) property value at risk (and expected one-time cost due to the MVP):
  - In the ROW: \$125.9 million (\$5.3 to \$16.4 million)
  - In the evacuation zone: \$972.6 million (\$37.0 million)
  - In the viewshed: \$16.8 billion (to avoid double counting with lost aesthetic value under ecosystem services, this impact is not separately estimated)
- Total property value lost (a one-time cost): \$42.2 to \$53.3 million
- Resulting loss in property tax revenue (annual): \$243,500 to \$308,400
- Lost ecosystem service value, such as for water and air purification, recreational benefits, and others:
  - Over the two-year construction period (a one-time cost): between \$22.9 and \$82.2 million
  - In the ROW (annual): between \$4.1 and \$14.8 million
- Lost economic development opportunities due to the erosion of these counties' comparative advantages as attractive places to visit, reside, and do business. Under the scenarios described below, these could include:
  - Annual loss of recreation tourism expenditures of \$96.8 million that supports 1,073 jobs and \$24.3 million in payroll and generates \$4.8 million in state and \$2.6 million in local taxes
  - Annual loss of personal income of \$15.6 million due to slower growth in the number of retirees
  - Annual loss of personal income of \$2.1 million due to slower growth in sole proprietorships
- Total of estimated costs:
  - One-time costs (lost property value and lost ecosystem service value during construction) would total between \$65.1 to \$135.5 million
  - Annual costs (costs that recur year after year) would range from \$119.1 to \$130.8 million
    - Present discounted value of all future annual costs (discounted at 1.5%): \$7.9 to \$8.7 billion
  - One-time costs plus the discounted value of all future annual costs: \$8.0 to \$8.9 billion

### At a Glance:

The PennEast Pipeline in Pennsylvania and New Jersey  
*Bucks, Carbon, Luzerne, and Northampton Counties in PA and  
Hunterdon and Mercer Counties in NJ*

- **Miles of pipeline:** 118
- **Impacted acres (area converted temporarily or permanently from its existing use or cover):**
  - In the permanent right-of-way (ROW): 717.3
  - In the construction zone (the construction corridor, new temporary roads, pipeyards, and temporary aboveground infrastructure): 1,852.7
  - In new permanent access roads and aboveground infrastructure: 55.8
  - The most heavily affected land cover types: forest (386.8 acres) and cropland (147.0 acres) (ROW only)
- **Parcels:**
  - In the ROW: 730
  - In the 1.2-mile-wide evacuation zone: 18,097
  - Within half a mile of the compressor station: 40
- **Residents and housing units in the evacuation zone:** 54,579 people, 23,293 homes
- **Lost ecosystem service value, such as for water and air purification, aesthetics, and recreation:**
  - Over the one-year construction period (a one-time cost): \$6.3 to \$22.1 million
  - In the ROW and in other permanent infrastructure (annual): \$2.6 to \$9.8 million
- **Property value:**
  - Baseline—that is, in a “no pipeline” scenario—property value at risk (and the expected one-time cost due to the pipeline in the following parentheses):
    - In the ROW: \$200.5 million (\$8.4 to \$26.1 million)
    - In the 1.2-mile-wide evacuation zone: \$3.9 billion (\$149.9 million)
    - Within half a mile of the compressor station: \$5.6 million (\$1.4 million)
  - Total property value lost (a one-time cost): \$159.7 to \$177.3 million
  - Resulting loss in property tax revenue (annual): \$2.7 to \$3.0 million
- **The social cost of carbon:**
  - The project would contribute to an equivalent of 21.3 million metric tons of carbon dioxide a year. Using a 5% discount rate, the social cost of carbon ranges from \$291.9 to \$608.1 million per year between 2019 and 2048. Using a 2.5% discount rate for the same time period, the social cost of carbon ranges between \$1.5 and \$2.3 billion per year.
- **Other impacts for consideration:**
  - Visual impacts:
    - The ROW for the pipeline and laterals can potentially be seen from approximately 35% of the study region. At least 1 km (0.62 miles) of pipeline ROW is visible from roughly 20% of the study region. (While these visual impacts have financial implications, we do not estimate these strictly in property value terms. Instead, the economic cost of impaired views for homeowners, as well as losses experienced by recreational visitors, and others would be captured as part of the “lost ecosystem service value”)
  - Economic activity that depends on the region’s scenic, recreational, and quality-of-life: (We consider scenarios in which visitor spending declines by 10% from current levels, and the rate of growth in retirement and proprietor’s income slows by 10%)
    - Annual loss of recreation tourism expenditures of \$448.0 million that would otherwise support 4,090 jobs and generate \$38.8 million in state and local tax receipts
    - Annual loss of personal income of \$55.6 million due to slower growth in the number of retirees
    - Annual loss of personal income of \$16.3 million due to slower growth in sole proprietorships
- **Total estimated costs:**
  - One-time costs (lost property value plus lost ecosystem service value during construction) would total between \$166.0 and \$199.4 million
  - Annual costs (costs that recur year after year) would range from \$5.3 to \$12.8 million PLUS the social cost of carbon, which varies by year, and ranges between \$291.9 million and \$2.3 billion per year
    - Present discounted value of all future annual costs (including the social cost of carbon): \$13.1 to \$56.4 billion
  - One-time costs plus the discounted value of all future annual costs: \$13.3 to \$56.6 billion

## At a Glance:

### The Eastern System Upgrade in New York Delaware, Orange, and Sullivan Counties

- **Miles of pipeline loop:** 7.8
- **Additional aboveground facilities:** Highland CS, new compressor at the Hancock CS; new pig launcher/receiver, alternate interconnect, and modifications to 3 metering stations
- **Impacted acres:**
  - In the permanent right-of-way (ROW): 26.0
  - In the construction zone: 156.9
  - At the existing Hancock Compressor Station in Delaware County during construction and operation: 9.05, 5.5
  - At the new Highland Compressor Station in Sullivan County during construction and operation: 14.31, 5.4
- **Parcels in the portion of the loop not co-located with the existing Millennium Pipeline:**
  - In the ROW: 5
  - In the 1.2-mile-wide evacuation zone: 196
  - Within half a mile of the compressor stations: 32 for the Hancock CS and 11 for the Highland CS
- **Residents and housing units in the pipeline evacuation zone:** 1,092 people, 470 homes
- **Property value:**
  - Baseline—that is, in a “no ESU” scenario—property value at risk (with the expected one-time cost due to the ESU in parentheses):
    - In the ROW: \$186,050 (\$7,814 to \$24,187)
    - In the 0.9-mile-wide evacuation zone: \$19.8 million (\$753,700)
    - Within half a mile of the compressor stations: \$2.1 million (\$519,900) for the Hancock CS and \$2.9 million (\$715,500) for the Highland CS
  - Total property value lost (a one-time cost): \$2.0 million
  - Resulting loss in property tax revenue (annual): \$36,005 to \$36,298
- **The social cost of carbon (equivalent):**
  - An annual cost that varies year to year, the project would contribute to an equivalent of 3.9 million metric tons of carbon dioxide a year. Using a 5% discount rate, the social cost of carbon ranges from \$50.1 to \$115.0 million per year between 2019 and 2048. Using a 2.5% discount rate for the same time period, the social cost of carbon ranges between \$256.5 and \$420.1 million per year.
- **Other impacts for consideration:**

Economic activity that depends on the region’s scenic, recreational, and quality of life: We consider a hypothetical scenario in which visitor spending declines by 5% from current levels, and the rate of growth in retirement and proprietor’s income slows by 5%)

  - Annual loss of recreation tourism expenditures of \$47.2 million that would otherwise support 745 jobs and generate \$3.1 million in local taxes and \$2.6 million in state taxes
  - Annual loss of personal income of \$6.3 million due to slower growth in the number of retirees
  - Annual loss of personal income of \$1.2 million due to slower growth in sole proprietorships
  - The total of these losses is \$82.5 million per year
- **Total estimated costs:**
  - One-time costs (property value lost during construction) would total to \$2.0 million
  - Annual costs (costs that recur year after year) would range from \$36,005 to \$36,298 PLUS the social cost of carbon, which also varies year by year, and ranges between \$50.1 and \$420.1 million
  - One-time costs plus the discounted value of all future annual costs: \$4.7 to \$18.8 billion

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 14**, *Mountain Valley Pipeline DEIS at 3-1*, Docket No. CP 16-10.



**Federal Energy Regulatory Commission**  
 Office of Energy Projects  
 888 First Street, NE, Washington, DC 20426

**FERC/DEIS-D0272**

**September 2016**

# **Mountain Valley Project and Equitrans Expansion Project**

## *Draft Environmental Impact Statement*



**Mountain Valley Pipeline, LLC and Equitrans, LP**  
 FERC Docket Nos.: CP16-10-000 and CP16-13-000

**Cooperating Agencies:**



U.S. Forest Service



U.S. Army Corps of Engineers



U.S. Bureau of Land Management



U.S. Environmental Protection Agency



Pipeline Hazardous Materials Safety Administration



West Virginia Department of Environmental Protection



West Virginia Division of Natural Resources

FEDERAL ENERGY REGULATORY COMMISSION  
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

In Reply Refer To:  
OEP/DG2E/Gas 3  
Mountain Valley Pipeline LLC  
Docket No. CP16-10-000  
Equitrans LP  
Docket No. CP16-13-000

**TO THE PARTY ADDRESSED:**

The staff of the Federal Energy Regulatory Commission (FERC or Commission) has prepared a draft environmental impact statement (EIS) for the projects proposed by Mountain Valley Pipeline LLC (Mountain Valley) and Equitrans LP (Equitrans) in the above-referenced dockets. Mountain Valley requests authorization to construct and operate certain interstate natural gas facilities in West Virginia and Virginia, known as the Mountain Valley Project (MVP) in Docket Number CP16-10-000, designed to transport about 2 billion cubic feet per day (Bcf/d) of natural gas from production areas in the Appalachian Basin to markets in the Mid-Atlantic and Southeastern United States. Equitrans requests authorization to construct and operate certain natural gas facilities in Pennsylvania and West Virginia, known as the Equitrans Expansion Project (EEP) in Docket No. CP16-13-000, designed to transport about 0.4 Bcf/d of natural gas north-south on its system, to improve system flexibility and reliability, and serve markets in the Northeast, Mid-Atlantic, and Southeast, through interconnections with various other interstate systems, including the proposed MVP. Because the MVP and EEP are interrelated and connected actions, we are analyzing them both together in this single comprehensive EIS.

The draft EIS assesses the potential environmental effects of the construction and operation of the MVP and EEP in accordance with the requirements of the National Environmental Policy Act (NEPA). The FERC staff concludes that approval of the MVP and EEP would have some adverse environmental impacts; however, these impacts would be reduced with the implementation Mountain Valley's and Equitrans' proposed mitigation measures, and the additional measures recommended by the FERC staff in this EIS.

The United States (U.S.) Department of Agriculture Forest Service (FS), U.S. Army Corps of Engineers (COE), U.S. Environmental Protection Agency, U.S. Department of the Interior Bureau of Land Management (BLM), U.S. Department of Transportation, West Virginia Department of Environmental Protection; and West Virginia Division of Natural Resources participated as cooperating agencies in the preparation of the EIS. Cooperating agencies have jurisdiction by law or special expertise with respect to resources potentially affected by the proposals and participate in the NEPA analysis. The BLM, COE, and FS may adopt and use the EIS when they consider the issuance of a Right-of-Way Grant to Mountain Valley for the portion of the MVP that would cross federal lands. Further, the FS may use the EIS when it considers amendments to its Land and Resource Management Plan for the Jefferson National Forest to allow the MVP to cross the Forest. Although the cooperating agencies provided input to the conclusions and recommendations presented in the draft EIS, the agencies will present their own

conclusions and recommendations in their respective permit authorizations and Records of Decision for the projects.

The draft EIS addresses the potential environmental effects of the construction and operation of the proposed facilities. For the MVP those facilities include:

- about 301 miles of new 42-inch-diameter pipeline extending from the new Mobley Interconnect in Wetzel County, West Virginia to the existing Transcontinental Gas Pipe Line Company LLC (Transco) Station 165 in Pittsylvania County, Virginia;
- 3 new compressor stations (Bradshaw, Harris, Stallworth) in West Virginia totaling about 171,600 horsepower (hp);
- 4 new meter and regulation stations and interconnections (Mobley, Sherwood, WB, and Transco);
- 2 new taps (Webster and Roanoke);
- 5 pig<sup>1</sup> launchers and receivers; and
- 36 mainline block valves.

For the EEP those facilities include:

- about 8 miles total of new various diameter pipelines in six segments;
- new Redhook Compressor Station, in Greene County, Pennsylvania, with 31,300 hp of compression;
- 4 new taps (Mobley, H-148, H-302, H-306) and 1 new interconnection (Webster);
- 4 pig launchers and receivers; and
- decommissioning and abandonment of the existing 4,800 hp Pratt Compressor Station in Greene County, Pennsylvania

The FERC staff mailed copies of the draft EIS to federal, state, and local government representatives and agencies; elected officials; regional environmental groups and non-governmental organizations; potentially interested Native Americans and Indian tribes; affected landowners; local newspapers and libraries; parties to this proceeding; and members of the public who submitted comments about the projects. Paper copy versions of this draft EIS were mailed to those specifically requesting them; all others received a compact-disc version. In addition, the draft EIS is available for public viewing on the FERC's website ([www.ferc.gov](http://www.ferc.gov)).<sup>2</sup> A limited number of copies are available for distribution and public inspection at:

Federal Energy Regulatory Commission  
Public Reference Room  
888 First Street NE, Room 2A  
Washington, DC 20426  
(202) 502-8371

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<sup>1</sup> A "pig" is a device used to clean or inspect the interior of a pipeline.

<sup>2</sup> Go to "Documents & Filings," click on "eLibrary," use "General Search" and put in the Docket numbers (CP16-10 or CP16-13) and date of issuance (09/16/16).

Any person wishing to comment on the draft EIS may do so. To ensure consideration of your comments on the proposal in the final EIS, it is important that the Commission receive your comments on or before **December 22, 2016**.

For your convenience, there are four methods you can use to submit your comments to the Commission. The Commission will provide equal consideration to all comments received, whether filed in written form or provided verbally. The Commission encourages electronic filing of comments and has expert staff available to assist you at (202) 502-8258 or [efiling@ferc.gov](mailto:efiling@ferc.gov). Please carefully follow these instructions so that your comments are properly recorded.

- 1) You can file your comments electronically using the [eComment](#) feature on the Commission's website ([www.ferc.gov](http://www.ferc.gov)) under the link to [Documents and Filings](#). This is an easy method for submitting brief, text-only comments on a project;
- 2) You can file your comments electronically by using the [eFiling](#) feature on the Commission's website ([www.ferc.gov](http://www.ferc.gov)) under the link to [Documents and Filings](#). With eFiling, you can provide comments in a variety of formats by attaching them as a file with your submission. New eFiling users must first create an account by clicking on "[eRegister](#)." If you are filing a comment on a particular project, please select "Comment on a Filing" as the filing type; or
- 3) You can file a paper copy of your comments by mailing them to the following address. Be sure to reference the project docket number (CP16-10-000 or CP16-13-000) with your submission::

Kimberly D. Bose, Secretary  
Federal Energy Regulatory Commission  
888 First Street NE, Room 1A  
Washington, DC 20426

- 4) In lieu of sending written or electronic comments, the Commission invites you to attend one of the public comment session its staff will conduct in the project area to receive oral comments on the draft EIS. The dates, time, and locations of the public comment sessions will be released with the Notice of Availability for the draft EIS to be issued by the FERC on September 16, 2016, and mailed to our environmental list.

Any person seeking to become a party to the proceeding must file a motion to intervene pursuant to Rule 214 of the Commission's Rules of Practice and Procedures (18 CFR Part 385.214).<sup>3</sup> Only intervenors have the right to seek rehearing of the Commission's decision. The Commission grants affected landowners and others with environmental concerns intervenor status upon showing good cause by stating that they have a clear and direct interest in this proceeding which no other party can adequately represent. **Simply filing environmental**

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<sup>3</sup> See the previous discussion on the methods for filing comments.

**comments will not give you intervenor status, but you do not need intervenor status to have your comments considered.**

### **Questions**

Additional information about the projects is available from the Commission's Office of External Affairs, at **(866) 208-FERC**, or on the FERC website ([www.ferc.gov](http://www.ferc.gov)) using the eLibrary link. For assistance, please contact FERC Online Support at [FercOnlineSupport@ferc.gov](mailto:FercOnlineSupport@ferc.gov) or toll free at (866) 208-3676; for TTY, contact (202) 502-8659. The eLibrary link also provides access to the texts of formal documents issued by the Commission, such as orders, notices, and rulemakings.

In addition, the Commission offers a free service called eSubscription that allows you to keep track of all formal issuances and submittals in specific dockets. This can reduce the amount of time you spend researching proceedings by automatically providing you with notification of these filings, document summaries, and direct links to the documents. Go to [www.ferc.gov/docs-filing/esubscription.asp](http://www.ferc.gov/docs-filing/esubscription.asp).

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## 3.0 ALTERNATIVES

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### Introduction

In this section, we evaluate a range of reasonable alternatives, as required by NEPA (at 40 CFR 1502.14) and Commission policy. We also discuss other alternatives that were eliminated from detailed review because they were not reasonable or practicable. The alternatives may have been presented by the Applicants, cooperating and other governmental resource agencies, affected landowners, the public, and staff. The range of alternative we evaluated include the no action alternative, system alternatives, pipeline route alternatives, route variations, and compressor station equipment alternatives.

The purpose of this evaluation is to determine whether an alternative would be preferable to the proposed action. We generally consider an alternative to be preferable to a proposed action using three evaluation criteria, as discussed in greater detail below. These criteria include:

- the alternative meets the stated purpose of the project;
  - i.e., for the MVP, to alleviate some of the constraints on transporting natural gas production by adding infrastructure to transport lower-priced natural gas from the Appalachian Basin to industrial users and power generators in the Mid-Atlantic and Southeastern United States, as well as to LDCs;
  - i.e., for the EEP, to provide additional volumes of firm capacity of natural gas to be transported north-south on Equitrans' existing system. The creation of expansion capacity on Equitrans' system would allow shippers to transport natural gas produced in the Appalachian Basin to markets in the Northeast, Mid-Atlantic, and Southeastern United States, mainly through an interconnection with the MVP. The EEP would also interconnect with the existing systems of Texas Eastern; Dominion; and Columbia. End-users could include LDCs, industry, and electric power generators;
- is technically and economically feasible and practical; and
- offers a significant environmental advantage over a proposed action.

Each of the cooperating agencies with obligations under NEPA can use this alternatives analysis as part of their decision making process. Individual agencies would ensure consistency with their own administrative procedures prior to accepting the conclusions in this EIS.

### Public Comments

We received 240 comments for the MVP and 3 comments for the EEP, respectively, requesting that we evaluate alternatives. In response to these comments, we requested that the Applicants provide additional environmental information to enable us to compare alternatives to the proposed action. Our analysis of the Applicants' data and assessment of the alternatives can be found below. In some cases, during pre-filing and following filing of the applications, in response to stakeholder, agency, and staff comments, and their own assessments, the Applicants revised their proposals.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 15**, Key-Log  
Economics, Memo on effects of pipelines on property  
values, March 11, 2015.



*Research and strategy for the land community.*

To: Interested Parties  
From: Sonia Wang and Spencer Phillips, Ph.D.  
Date: 3/11/2015  
Subject: Review of INGAA Foundation Report, "Pipeline Impact to Property Value and Property Insurability"

---

The Interstate Natural Gas Association of America (INGAA) Foundation, Inc., has released another report on the impacts of pipelines on property values and property insurability.<sup>1</sup> Like a previous report using the same methods, the report claims that pipelines have no measurable impact on property values of homes of any type, regardless of the age or size of the transmission line. The report quantitatively analyzes two pipelines in Ohio, plus one each in Virginia, New Jersey, Pennsylvania, and Mississippi.

Like its similar 2001 study,<sup>2</sup> this new study has many flaws in methods and uses the same, incorrect assumptions.<sup>3</sup> The authors attempt to compare prices for properties "adjacent to" a pipeline with the price of properties "off" the pipeline. The trouble in each of their case studies, however, is that the definition of "adjacent to" ignores the potential impact of health and safety risks that may be depressing property values for a majority (and in some cases, all) of the properties considered. Specifically, and for most of the properties, the authors fail to account for the fact that many of the "off" properties analyzed are in fact included in the evacuation zone of the pipeline, which would mean the study is not truly distinguishing between properties potentially affected by the pipeline and those beyond the danger zone.

- For the Texas Gas Transmission in Ohio, based on the lowest estimated pressure (PSI) for a 26" pipeline, 25 of the 31 (81%) "off" properties are actually located in the evacuation zone (615.5 feet).<sup>4,5</sup>

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<sup>1</sup>Integra Realty Resources. 2016. "Pipeline Impact to Property Value and Property Insurability." 2016.01. Interstate Natural Gas Association of America (INGAA) Foundation, Inc. <http://www.ingaa.org/PropertyValues.aspx>.

<sup>2</sup> Allen, Williford & Seale Inc. 2001. "Natural Gas Pipeline Impact Study." F-2001-02. Interstate Natural Gas Association of America (INGAA) Foundation, Inc.

<sup>3</sup> The flaws in the 2001 study are described in Phillips, Bottorff and Wang, 2016, Economic Costs of the Atlantic Coast Pipeline: Effects on Property Value, Ecosystem Services, and Economic Development in Western and Central Virginia, Charlottesville, VA: Key-Log Economics available at [keylogeconomics.com](http://keylogeconomics.com).

<sup>4</sup> In most cases, we were able to estimate the evacuation zone based on the diameter and operating pressure given for the pipeline. The Pipeline Association for Public Awareness provides a lookup table with these evacuation zones. For pipelines that fall between the sizes or pressures given, we interpolated the evacuation zone from the available information. (See Appendix C of "Pipeline Emergency Response Guidelines," Pipeline Association for Public Awareness, 2007, [www.pipelineawareness.org](http://www.pipelineawareness.org).)

<sup>5</sup> For this pipeline, we used the lowest estimated pressure because the exact PSI was not noted in the study or available from other sources. This estimate is the most conservative and it is likely the evacuation is actually larger, meaning even more of the "off" properties listed are, in effect, near the pipeline.

- For the REX-EAST pipeline in Ohio, based on a max operating PSI of 1480 for a 42" pipeline, 5 of the 9 (56%) "off" properties are actually located in the EVAC zone (3683.8 feet).
- For the Transcontinental Gas Pipeline in New Jersey, based on the max operating PSI of 1480 for a 42" pipeline, ALL "off" properties are actually located in the EVAC zone (3683.8 ft).
- For the Gulf South Transmission Pipeline in Mississippi, based on the lowest estimated operating PSI of 100 for a 30" pipeline, 9 out of the 17 (53%) "off" properties are actually located in the EVAC zone (684 ft).<sup>4</sup>
- For the Transco (Williams) Pipeline in Virginia and the Williams Natural Gas Pipelines in Pennsylvania, the authors do not report the distance away from the pipeline, rather there is just a yes or no regarding whether or not the property is abutting the right of way. Assuming the authors methods, while flawed, are at least consistent from one case study to the next within the paper, it is likely that 50% or more of the comparison properties (those not abutting the right-of way) are in fact within the evacuation zone and, therefore, are not materially different from those abutting the right-of-way from the perspective of health and safety effects on property value.

In summary, while any econometric evaluation of differences in market prices requires comparing observed prices of things that are different in some way, the INGAA study is merely reporting that there is little difference in the price of things that are not materially different. The authors should be comparing apples to oranges, but instead they compare oranges to oranges.

In addition, the INGAA study suffers from a more serious flaw in that the authors do not state whether or not the purchasers of any of the properties analyzed were aware of the properties' proximity to a pipeline. If a market price is to be taken as a signal of economic value, then the price must arise from a transaction in which both buyers and sellers have full information about the property being sold. But proximity to natural gas pipelines is not typically something that sellers and realtors are required to disclose. If buyers in the study were unaware that they were buying a property near a natural gas pipeline, then one cannot legitimately conclude that their offer prices reflect the effect of the presence or absence of a pipeline on property value.

As a result of these flaws, it is impossible to conclude from INGAA's study that a property value effect does not exist. Other, more appropriate/robust studies, like the study by Hansen, Benson, and Hagen (2006)<sup>6</sup> actually reinforce the conclusion that when buyers do know about a nearby pipeline, market prices drop. These authors found that property values fell after a deadly 1999 liquid petroleum pipeline explosion in Bellingham, Washington. They also found that the negative effect on prices diminished over time. This makes perfect sense if, as is likely, information about the explosion dissipated once the explosion and its aftermath left the evening news and the physical damage from the explosion had been repaired.

Similarly, Kielisch (2015) concludes that when buyers are aware that a property is near a pipeline, their willingness to buy the property and their average offer prices drop significantly.<sup>7</sup> In his systematic

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<sup>6</sup> Hansen, Julia L., Earl D. Benson, and Daniel A. Hagen. 2006. "Environmental Hazards and Residential Property Values: Evidence from a Major Pipeline Event." *Land Economics* 82 (4): 529–41.

<sup>7</sup> Kielisch, Kurt. 2015. "Study on the Impact of Natural Gas Transmission Pipelines." Forensic Appraisal Group, Ltd.

review of studies were buyers, Realtors, or appraisers were aware of properties' proximity to natural gas pipelines, He found, in brief, that

- 68% of Realtors believe the presence of a pipeline would decrease residential property value, with 56% of Realtors estimating a decrease in value between 5% and 10%.
- 70% of Realtors believe a pipeline would cause an increase in the time it takes to sell a home.
- 62.2% of buyers in a different study stated that they would no longer buy a property with/on a pipeline ROW at any price. Of the remainder, half (18.9%) stated that they would still buy the property, but only at a price 21% below what would otherwise be the market price. The other 18.9% said the pipeline would have no effect on the price they would offer. Not incidentally, the survey participants were informed that the risks of "accidental explosions, terrorist threats, tampering, and the inability to detect leaks" were "extremely rare" (2015, p. 7).

This translates into a reduction in expected value of 10.5% for those who proceed to buy the home. If you consider that the 62% of buyers who drop out are effectively reducing their offer prices by 100%, the expected reduction in offer price for all potential buyers 66.2%.

- Based on five "impact studies" in which appraisals of smaller properties with and without pipelines were compared, "the average impact [on value] due to the presence of a gas transmission pipeline is -11.6%" (p. 11).

Clearly when one considers property transactions in which one's eyes are open to the presence or or proximity to a pipeline, market prices fall because the properties are less attractive and valuable to their would-be or actual new owners.

In conclusion, the recent INGAA study does not provide conceptually or empirically valid results regarding the effect of natural gas pipelines on property value. Citizens local government officials and FERC should be looking to the best available information from studies such as those referenced here.

People's Dossier: FERC's Abuses of Power and Law  
→ Deficient EIS Analyses

**Deficient EIS Analysis Attachment 16**, Letter from Pipeline Awareness Southern Oregon to Maya van Rossum, the Delaware Riverkeeper, February 4, 2016.



February 4, 2016

Ms. Maya K. van Rossum  
Delaware Riverkeeper Network  
925 Canal Street, Suite 3701  
Bristol, PA 19007

Re: Delaware Riverkeeper Network Request for a review of FERC by the Government  
Accountability Office

Dear Ms. Van Rossum:

I commend your championship of these longstanding issues with the Federal Energy Regulatory Commission. Please include Pipeline Awareness Southern Oregon in Delaware Riverkeeper's request for a review of FERC by the Government Accountability Office. It is important to note that Oregon Senator Ron Wyden also sits on the Senate Committee on Energy and Natural Resources; as a supporter of LNG terminals and methane pipelines in the Pacific Northwest, it is unclear as to whether Senator Wyden might support this appeal. I hope so.

Oregonians are currently besieged by several high profile and strongly opposed LNG export terminals and methane pipeline projects. The issues you outline in your correspondence reflect the experiences of many Oregonians opposed to and affected by the Jordan Cove LNG Energy Export Project and the Pacific Connector Fracked Methane Gas Pipeline and the Oregon LNG proposal. Jordan Cove and the Pacific Connector are proposed in Southern Oregon and the Oregon LNG project is proposed in the Northwest corner of the State.

Oregon LNG, the Jordan Cove LNG Export project and the Pacific Connector Fracked Gas Pipeline, will be disastrous for the environment, economy and people of Oregon. The environmental review of these projects by FERC has failed to fully examine and adequately recognize the severe environmental consequences of these projects. Requests of FERC to address issues such as the impacts of wildland fires, public and fire safety are routinely ignored and shelved.

For example, the deception based mitigation measures proposed to balance the impact of the Pacific Connector methane pipeline crossing more than 400 rivers, streams and creeks, along with the damage to Oregon forests, [including late successional reserves] threats to endangered wildlife and Oregon's scenic beauty make any approval, for any reason, insupportable. Yet, FERC has regarded this extensive 232-mile long construction project and its long-term consequences to Oregon's pristine natural environment as having a

*minimal* impact. Approval will be a blow to anyone who depends on the natural environment in Oregon in impacted areas for a livelihood, or is genuinely concerned about the risks to the welfare of future generations posed by climate change.

In regard to the Pacific Connector Gas Pipeline, approximately 630 private landowners will be unprotected against eminent domain by these private, for-profit corporations if a certificate of public convenience and necessity is issued. Jordan Cove is owned by Veresen, Inc., a private for-profit Canadian corporation which also co-owns the Pacific Connector Methane pipeline. Many of these landowners have been held hostage to the FERC permitting process for more than ten years as project applicants have switched from import projects to export projects and even now at the conclusion of the FERC environmental process have **no** sales contracts in place.

The NEPA violations surrounding these projects are simply too numerous to list; however, it appears FERC has a deeply ingrained culture of disregarding and disrespecting other review and permitting processes as a matter of course. How can it be that FERC is financed and funded by the very industry they are charged to oversee and regulate? This feels wrong. For example, FERC offers training seminars, delivered by FERC staff and industry consultants to help applicants successfully navigate the FERC process from project concept to post-construction monitoring. Yet the average citizen is expected to maneuver the maze of federal and state regulations associated with these very complex processes on their own, unaided. The very structure of FERC is illegitimately imbalanced in favor of the fossil fuel industry at the expense of individual citizens in the United States. Simply put, the deck is stacked and the system rigged against anyone outside of the fossil fuel and energy industry.

Thank you for allowing Oregon to participate in your call to action and for all of the work you do to protect our natural resources.

Sincerely,

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