IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF PENNSYLVANIA

WAYNE LAND AND MINERAL GROUP, LLC *Plaintiff*, v. DELAWARE RIVER BASIN COMMISSION *Defendant*, and DELAWARE RIVERKEEPER NETWORK and MAYA K. VAN ROSSUM, THE DELAWARE RIVERKEEPER *Intervenors-Defendants*	3:16-CV-00897 (JUDGE MARIANI) *electronically filed*

BRIEF OF AMICI CURIAE NATURAL RESOURCES DEFENSE COUNCIL AND CATSKILL MOUNTAINKEEPER

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INTEREST OF AMICI CURIAE

NRDC is a national, nonprofit, nonpartisan environmental advocacy organization with a long history of litigating and advocating for clean water at the state and federal levels, including in New Jersey, Pennsylvania, and New York State. In 1972, NRDC helped enact the federal Clean Water Act, America's bedrock water-protection law. More recently, in 2015, NRDC was a principal advocate for the issuance of the Clean Water Rule, which returned guaranteed protections under the Clean Water Act to hundreds of thousands of miles of streams and tens of millions of acres of wetlands across the country.

NRDC also has deep expertise on the issue of hydraulic fracturing ("fracking"). Among other work, NRDC launched the Community Fracking Defense Project in 2012 to provide communities with policy, legal, and technical tools to protect themselves from the risks of fracking, including groundwater contamination and toxic chemical and wastewater spills.

Catskill Mountainkeeper is a nonprofit grassroots advocacy organization headquartered in Livingston Manor, New York. It is dedicated to protecting and preserving the unique and irreplaceable

Catskill Region of New York State. Catskill Mountainkeeper strives to be the strongest and most effective advocate for the Catskill region. Through a network of concerned citizens, Catskill Mountainkeeper works to protect the ecological integrity of the Catskill region and the quality of life of all those who live there by promoting regional economies and protecting the natural resources essential to healthy communities.

Since its inception, Catskill Mountainkeeper has collaborated with allies to protect the Delaware River Basin. The Catskills are home to the headwaters of the Delaware River, along with the Catskill Delaware reservoir system, which together serve as the drinking water source for New York City.

For the past decade, NRDC and Catskill Mountainkeeper have advocated for a fracking ban in the Delaware River Basin, mobilizing their members and submitting technical comments to the Delaware River Basin Commission's 2018 draft regulations, which, among other things, proposed banning fracking in the River Basin.

INTRODUCTION

This case asks whether an interstate compact formed for the purpose of conserving, managing, and controlling water and related resources in the Delaware River Basin has the authority to protect that basin from the harmful effects of hydraulic fracturing ("fracking"). Fracking is a hazardous industrial process for which water is the primary constituent, and whose waste product, also composed primarily of water, has contaminated waterbodies and drinking water supplies across the country, including in the nearby Susquehanna River Basin.

Defendant Delaware River Basin Commission ("Commission") and Intervenor-Defendants Delaware Riverkeeper Network and Maya K. van Rossum ably explain in their papers how any activity that includes a deliberate and significant use of water resources constitutes a "project" as defined under the Delaware River Basin Compact. Pub. L. 87-328, 75 Stat. 688 ("Compact") § 1.2(g). The Defendants argue that the Commission may therefore properly exercise regulatory authority over such an activity. We agree.

This amicus brief, submitted by two New York-based environmental advocacy organizations with long histories of protecting

water quality in the Delaware River Basin, explains how water and wastewater management areinextricable from the fracking process, and how fracking activities may therefore be subject to regulation by the Commission.

Fracking consumes millions of gallons of water per fracking well, most of which becomes so contaminated after use that it cannot be returned to the waterbody from which it was extracted. Fracking results in millions of gallons of contaminated wastewater—filled with toxic and carcinogenic chemicals—that have contaminated nearby drinking water supplies, rivers, and streams, causing significant environmental degradation and severe illness for nearby residents.

We believe this brief provides an important perspective that is not covered by any other party or amicus in this case.

FACTUAL BACKGROUND

I. The Delaware River Basin

The Delaware River Basin is the catchment area of the United States' longest free-flowing river east of the Mississippi. It is remarkable for its pristine character, geographic scope, and singular utility to the nation's most densely populated region—the Mid-Atlantic.

From the headwaters in the Catskill Mountains to its mouth in the Delaware Bay, the Delaware River spans 330 miles, draws from 216 tributaries, and drains surface water from approximately 13,000 square miles across 42 counties in five U.S. states. This includes 6,465 square miles in Pennsylvania, 2,969 square miles in New Jersey, 2,363 square miles in New York, 968 square miles in Delaware, and 8 square miles in Maryland. North to south, the Basin encompasses five distinct physiographic provinces—Appalachian Plateaus, Valley and Ridge, New England, Piedmont, and Coastal Plain—which range in altitude from over 4,000 feet down to sea level.

II. The Delaware River Basin Commission Is Largely Responsible for One of the Greatest Cleanups in the Nation's History

The Delaware River is recognized as one of the greatest water pollution cleanup success stories in the United States. Gerald Kauffman, Jr., *The Delaware River Revival: Four Centuries of Historic Water Quality Change from Henry Hudson to Benjamin Franklin to JFK,* 77 Pa. Hist. 432, 433 (2010), https://bit.ly/3flqQhT [hereinafter *Kauffman (2010)*]. Once a site of extreme environmental degradation, the Delaware River is now known as an important habitat for hardwood forests and as a sanctuary to rare and endemic species of plants and animals including bears, bald eagles, native trout, and endangered timber rattle snakes. This exceptional transformation, as explained below, is largely due to the formation of the Delaware River Basin Commission and the unprecedented authority it was given over activities in the River Basin.

A. Before the Delaware River Basin Commission, the Delaware River Basin was a Site of Extreme Environmental Degradation

The cleanup of the river, which began in the 1960s with the formation of the Delaware River Basin Commission, has helped to establish the River Basin as one of the most important fisheries in the nation. *Id.* at 445 – 48. Today, the tidal estuary portion of the river is home to nearly 50 species of fish and a thriving fishing industry. *Id.* at 433. But in the early 1960s, when the Commission was formed, staggering levels of pollution in the River Basin threatened fish populations—the American shad in particular—and the commercial fishing industry as a whole. *Id.*

Figure 1. Bridgeport Canal in 1928. Source: Philadelphia Water Dept., Dept. of Public Works, https://bit.ly/2L1snvx.

Once abundant in fish and other wildlife, centuries of contamination from industrial dumping and sewage had amassed record levels of pollution in the Basin by the mid-twentieth century. *Kauffman (2010)*, *supra,* at 435 – 45. Industrial activity along the Delaware proliferated during the nineteenth and twentieth centuries. *Id.* at 438 – 39. Factories, coal mines, and businesses dumped chemicals and other waste into the river at increasingly high rates. *Id.* at 439. As late as 1951, nearly every large city along the Delaware and

its tributaries lacked sewage treatment facilities and thus dumped raw, untreated sewage into the river. *Id.* at 442 – 43.

Aquatic life suffered from the adverse effects of the Delaware's growing contamination. By the turn of the twentieth century, sturgeon and shad populations, faced with over-harvesting and the rapid deterioration in water quality, declined dramatically. *Id.* at 439 – 40. And by the second World War, shad had all but disappeared in the region. *Id.* at 443. By then, the Delaware was considered a "dead river," one of the most polluted rivers in the world. *Id.* at 442 – 43.

Established in 1961, over a decade before the creation of the U.S. Environmental Protection Agency and the Clean Water Act, the Commission was formed to coordinate the overlapping water management concerns of the four states: New York, New Jersey, Pennsylvania, and Delaware. *New Jersey v. New York*, 347 U.S. 995 (1954). It remains the only federal/state basin compact with authority in all areas of water supply, water quality, flood mitigation, and watershed management. Gerald Kauffman, *Governance, Policy, and Economics of Intergovernmental River Basin Management*, 29 Water Resource Mgmt. 5689, 5709 (2015), https://bit.ly/2SFOdZV.

Regulations imposed by the Commission, which included a wastewater treatment program and strict waste load allocations, put the Basin on a path to recovery. By 1988, the water quality of the Delaware Estuary was found to be better than it had been at any time in the previous century. *Kauffman (2010)*, *supra,* at 449. By the 1990s, fish species such as striped bass and shad began to spawn again, returning to the Basin, and over 90 percent of the Delaware Estuary met the fishable and swimmable goals set forth in the 1972 Federal Clean Water Act. *Id.* at 450. It was in large part because of the Commission's expansive authority that this dramatic restoration was possible.

B. The Delaware River Basin Today—the Social, Economic, and Environmental Importance of the River Basin

Today, the Delaware River Basin is a bucolic landscape that serves as crucial habitat for countless species of flora and fauna, a source of drinking water for millions of people, an important source of recreation for fishermen, boaters, tubers, naturalists, and swimmers, and a significant contributor to the local economy.

The Delaware is now one of the most important fisheries in the east. The river has seen a 100-mile expansion of spawning grounds, resulting in the resurgence of species whose populations were once depleted, including the striped bass, endangered short-nosed sturgeon, and American shad, which supports a multi-million-dollar fishing market each year. Pa. Dept. of Conserv. and Nat. Res., Bureau of State Parks, Watershed Education Program, *Delaware River Basin Facts* 3, 4 (2010), https://bit.ly/2YFwci6. The River Basin also provides an unmatched blend of habitats for smallmouth bass, trout, and one of the healthiest American eel populations in the country. Spawning horseshoe crabs gather in the Delaware Estuary every spring in the greatest numbers in the world. *Id.* at 4.

And the dwarf wedgemussel—once found in Atlantic coastal drainages from New Brunswick, Canada to North Carolina, but now extinct in all of Canada and listed as endangered in the United States—still persists in the Upper Delaware basin, with over 14,000 individuals relying on the Basin's clean water for survival. Heather Galbraith, et al., *Population Demographics for the Federally Endangered Dwarf*

Wedgemussel, 7 J. of Fish & Wildlife Management 377 (2016), https://bit.ly/2xQlBWy.

Figure 2. The revitalized Delaware Water Gap today. Source: SachinDaluja, Flickr (2009), https://flic.kr/p/6jWxAw

Altogether, approximately 16 million people (5 percent of the total U.S. population) rely on the Delaware River Basin for clean drinking water. Gerald Kauffman & Andrew Homsey, *Economic Value of Marcellus Shale Gas in the Delaware Basin*, 2 J. of Envtl. Solutions for Oil, Gas, & Mining 33, 36 (2016). This figure includes 8 million individuals who reside within the Basin, along with 7 million residents of New York City and Philadelphia. *Id*. at 2.

New York City gets nearly half of its water from three large reservoirs located on the tributaries to the Delaware. U.S. Govt. Accountability Office, *Interstate Compacts: An Overview of the Structure and Governance of Environment and Natural Resource Compacts* 38 (2007), https://bit.ly/2yljg6t. Due to the high quality of drinking water from the Delaware River Basin, New York City is one of only five large cities in the country with a surface drinking water supply that does not need to filter its water prior to consumption, a measure that saves the City $10 billion per year. N.Y. City Dept. of Env. Prot., *Final Impact Assessment Report: Impact Assessment of Natural Gas Production in the New York City Water Supply Watershed* 51 (2009), *available at* https://bit.ly/2LiwJys. [hereinafter *NYC Assessment*].

The River Basin also holds tremendous ecological and economic value. A clean and protected River Basin contributes to the regional economy by supporting approximately 600,000 jobs, accounting for more than $12 billion in annual wages, in the coastal, ecotourism, recreation, and water industries. Gerald Kauffman, *Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania* T.E1, T.E3 (2011), https://bit.ly/3b9E0Ly [hereinafter

Kauffman (2011)].[1] Factoring in ecosystems services, the Basin's annual contribution to regional and local economies totals at least $16 billion—nearly five times the potential annual value of the natural gas industry in the watershed (a mere $3.3 billion). *Id.*

Since 1965, Congress has repeatedly recognized the Delaware River Basin's unique value to the country, designating hundreds of miles of river and tributary as protected areas. Gerald Kauffman, Partnership for the Delaware Estuary, Inc., *Economic Value of the Delaware Estuary Watershed Comprehensive Report* 12 (2011), https://bit.ly/2xD9Enb.

In 2020, the national environmental group American Rivers named the Delaware River the "2020 River of the Year"—a testament to the Delaware River Watershed's continuing ecological significance to the country. In presenting the award, American Rivers noted, "the Delaware shows how a healthy river can be an engine for thriving communities and strong local economies." American Rivers, *Delaware*

[1] These figures exclude jobs and wages generated from wastewater utilities.

River: 2020 River of the Year, https://bit.ly/2SCsp1q (last visited May 5, 2020).

ARGUMENT

In its complaint, Wayne Land and Mineral Group minimizes the centrality of water use in fracking and related activities in an attempt to exempt their proposed activity from regulation. But its efforts distort the reality of the fracking process: that water is the main component of fracking fluid and fracking wastewater. When a well is hydraulically fractured, a mixture primarily composed of millions of gallons of water—between 98 and 99.5 percent of the entire fracking solution—is injected underground at very high pressures to crack open rock layers and release the oil or gas trapped inside. *NYC Assessment*, *supra,* at 51.

Arguing that water use is peripheral to fracking is akin to claiming that water "just happens" to be used in the operation of dams. There simply is no fracking without substantial water use. As such, any fracking well pads and structures built appurtenant to fracking activity necessarily include facilities "for the conservation, utilization, control, and management of water resources." Compact § 1.2(g). From the drilling rig to well casings to frac tanks to water storage to

wastewater storage, fracking facilities all feature water as their primary constituent.

As explained in the remainder of this brief, the withdrawal, injection, leakage, and disposal of water could dramatically harm the valuable water resources of the Delaware River Basin—an outcome that the Commission was explicitly formed to prevent.

I. Fracking Fluid and Wastewater Could Harm Human Health and the Environment

Fracking fluid and wastewater—of which Wayne Land and Mineral Group concedes it will use, produce, and store millions of gallons (Def.'s Concise S. of Material Facts, ECF No. 169-3 ¶ 10)—can be harmful to human health and the environment. Fracking generates massive amounts of fracking fluid and wastewater that threaten the health of drinking water supplies, rivers, streams, and groundwater. These threats to water quality are present well beyond the footprint of the fracking well. The transportation, treatment, and disposal of fracking wastewater, even without fracking wells nearby, can degrade source water quality, impair long-term watershed health, and expose watershed residents to chronic levels of toxic chemicals. Because the Commission was charged with "encourag[ing] and provid[ing] for the

planning, conservation, utilization, development, management and control of the water resources of the [B]asin," Compact § 1.3(e), it follows that the Commission has the authority to regulate fracking activities.

A. Fracking Fluid and Wastewater Production

The fracking process involves pumping fracking fluid, a mixture of water and other additives, into a fracking well in order to free methane trapped in the rock. The fracking process generates two types of wastewater: (a) "flowback," or the fracturing fluid injected into a gas well that returns to the surface during or closely after the time of drilling; and (b) "produced water," or all wastewater emerging from the well after completion of drilling operations, much of which is brine contained within the shale formation. NRDC, *In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater* 1 (2012), https://on.nrdc.org/2W6XQSn.

The ingredients used in fracking fluid consist primarily of water, along with chemicals used to modify the water's characteristics (e.g., to reduce friction or corrosion) and sand or other agents that hold open the fractures in a shale formation as gas is extracted. Judith S. Schreiber,

Synopsis of Public Health and Environmental Risks Associated with Fracking Wastewater 2 (2018), *available at* https://on.nrdc.org/2yMnkwf.

A wide variety of chemicals are known to be used in fracking fluid. And while the relative concentration of these chemicals is small, just a small concentration is sufficient to harm the health of waterbodies. Assuming about 4 million gallons of water are used per fracking well, about 80 to 300 tons of chemicals are used per well. *NYC Assessment*, *supra*, at 6.

Of the fracking fluid that is used at a fracking well, approximately 10 to 50 percent or more of it returns to the surface. *Id.* This water is then stored on the property until it is trucked offsite for treatment and disposal—approximately 600 to 865 truck trips per fracking well are used for the transport of water and wastewater alone. *Id.* at 33. If fracking is permitted in the Basin, over 18 million gallons of wastewater would be stored, transported, and potentially treated in the Basin over a 20-year period. *Kauffman (2011)*, *supra,* Executive Summary at 19.

B. Fracking Fluid and Wastewater Are Harmful to Human Health

Multiple studies have found that those who live closer to fracking wells are at greater risk of experiencing serious health problems. EPA, *Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States* 9-6 (2016), *available at* https://www.epa.gov/hfstudy [hereinafter *EPA (2016)*]. For example, epidemiological studies have found that pregnant mothers who live near natural gas wells give birth to infants with increased incidence of congenital heart defects, neural tube malformations, and lower birth weights compared to infants from mothers living farther from wells. *Id.* at 9-6 – 9-7.

Similar results have been found in the Marcellus Shale, the natural gas reserve that underlies the Delaware River Basin. In the parts of the Marcellus where fracking is permitted, those who live close to natural gas wells are more likely to self-report health problems, especially upper respiratory and dermal symptoms, chronic rhinosinusitis, migraine headache, and fatigue. *Id.*

If fracking were permitted in the Basin, roughly 45,000 people could live within one mile of the projected well pad locations. Steven

Habicht, et al., *The Potential Environmental Impact from Fracking in the Delaware River Basin* iv (2015), https://bit.ly/2xdtQvH. The majority of these people (over 30,000) would reside in Wayne County, Pennsylvania, *id.,* where Wayne Land and Mineral Group's property is located (Def.'s Concise S. of Material Facts, ECF. No. 169-3 ¶ 1). If fracking were permitted, nearly 60 percent of the county's population could be vulnerable to adverse health effects caused by fracking. Habicht, et al., *supra*, at iv.

And while the components of fracking wastewater vary from well to well, chemical additives commonly used in fracking have been associated with adverse health effects. More than 75 percent of the chemicals used in fracking are associated with adverse effects on the skin, eyes, respiratory and gastrointestinal systems, about 40 percent could have effects on the brain/nervous system, immune and cardiovascular systems, the kidneys and endocrine system, and 25 percent are associated with cancer and mutations. T. Colborn, et al., *Natural Gas Operations from a Public Health Perspective*, 17 Hum. & Ecological Risk Assessment 1039, 1039 (2011), https://bit.ly/2A6xJn4. Even very low doses of certain chemicals in drinking water, particularly

known or suspected carcinogens and endocrine-disrupting compounds, can be dangerous to human health. *NYC Assessment*, *supra*, at 36.

Here, the potential leakage of fracking fluid and wastewater presents elevated risks, since, as Wayne Land and Mineral Group acknowledges, groundwater at the property would serve as the primary drinking water source for workers on the property. (Def.'s Concise S. of Material Facts, ECF. No. 169-3 ¶ 6.) Wayne Land and Mineral Group also concedes that "surface casings" must extend through these freshwater aquifers and that neighbors to the property also rely on groundwater for their primary drinking water source. *Id.*

i. Fracking Fluid and Wastewater Composition

Because fracking companies can conceal the composition of their fracking fluid, the exact chemical composition of fracking fluid and wastewater that would be treated in the Basin is unknown. While Wayne Land and Mineral Group has not disclosed what chemicals it will use in its fracking fluid (Def.'s Concise S. of Material Facts, ECF. No. 169-3 ¶ 11), it concedes that chemicals will certainly be used in fracking fluid as part of the water mixture, *id.* at ¶ 10, and that fracking wastewater will be collected, separated, and managed on the

property for twenty to fifty years (Def.'s Mot. Partial Summ. J., ECF No. 169 ¶¶ 25 – 26).

Even if the chemical composition were known, there is "very limited" compound-specific toxicity data for many of the over 1,000 chemicals present in fracking wastewater. *NYC Assessment, supra,* at 36. To date, no one has compiled a comprehensive inventory of all the components of fracking wastewater and their associated health risks. This dearth of information makes it difficult to know for certain what effect fracking wastewater will have on human health and the environment.[2] Matthew McFeeley, *NRDC Issue Brief: State Hydraulic Fracturing Disclosure Rules and Enforcement: A Comparison* (2012), https://on.nrdc.org/2YhmpyN.

Generally speaking, the major constituents of concern that are present in wastewater are; (a) salt, including metals; (b) organic hydrocarbons (sometimes referred to as "oil and grease"); (c) inorganic

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[2] As of March 2017, Pennsylvania requires fracking operators to complete and submit a list of chemicals used during the fracking process on the website, FracFocus.org. However, operators are allowed to withhold these chemicals from public disclosure if they consider a chemical or the concentration of a chemical to be a trade secret. 58 Pa.C.S.A. § 3222.1.

and organic additives; and (d) naturally occurring radioactive material. NRDC, *In Fracking's Wake, supra,* at 21 (2012). These pollutants can be dangerous when they are released into the environment and when people are exposed to them. Some contaminants (e.g., benzene, toluene, ethylbenzene, and xylenes) are toxic to humans and aquatic life, radioactive, or corrosive. *Id.* at 6.

The following section provides just a small sample of the known components of fracking waste (including flowback) and their associated health risks:

Acetone. In several studies, workers exposed to very high levels of acetone via inhalation complained of headache, lightheadedness, unsteadiness and confusion. Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, *Toxicological Profile For Acetone* (1994), https://bit.ly/2xZtNUr.

Benzene. Eating foods or drinking liquids containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, coma, and death. Agency for

Toxic Substances and Disease Registry, *Toxicological Profile for Benzene* (2007), https://bit.ly/2Y5nt8w.

Cyanide. Cyanides are perhaps best known for their use in gas-chamber executions and as a war gas. *Id.* at 2. Cyanides enter the air, water, and soil from both natural processes and industrial activities. Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Cyanide* 1 (2006), https://bit.ly/3eTxmw3. Many are powerful and rapid-acting poisons, affecting the nervous system and capable of causing death at high concentrations. *Id.*

Total Trihalomethanes (TTHMs): Bromoform, Chloroform, Dichlorobromomethane and Dibromochloromethane. EPA classifies bromoform as a probable human carcinogen and dibromochloromethane as a possible human carcinogen. EPA, *Fact Sheet: Bromoform* (2016), https://bit.ly/2yNJcqX. Swallowing or breathing large amounts of bromoform can slow normal brain activities, resulting in sleepiness or sedation. Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Bromoform and Dibromochloromethane* (2005), https://bit.ly/2KAZtT4.

Phenols. Ingestion of liquid containing elevated levels of phenol can cause serious gastrointestinal damage and even death. Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Phenol* (2008), https://bit.ly/2yGVdyv.

Radium. While radium is naturally present in the environment, it is usually present at very low levels. The Marcellus Shale is known to have high uranium content, which decays into radium at levels that can exceed 10,000 picocuries per liter (pCi/L) (a measure of radiation) in the concentrated brine. Schreiber, *supra*, at 12 – 13. As a result, fracking waste is radioactive. At more elevated levels, radiation has been shown to cause adverse health effects such as anemia, cataracts, fractured teeth, cancer and death.

Toluene. Toluene may have an effect on the nervous system (brain and nerves) after exposure; these effects may include headache, dizziness, or unconsciousness. Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Toluene* (2017), https://bit.ly/3cNqezu. Some effects such as incoordination, cognitive impairment, and vision and hearing loss may become permanent with repeated exposure, especially at high concentrations. *Id.*

Xylenes. There are three forms of xylene, and they have very similar effects on health. Short-term exposure to high levels of xylenes can cause irritation of the skin, eyes, nose, and throat; difficulty breathing; impaired function of the lungs; delayed response to visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys. Agency for Toxic Substances and Disease Registry, *Toxicological Profile for Xylene* (2007), https://bit.ly/2Y4yCXl.

C. Fracking Wastewater Is Harmful to the Environment

In addition to adverse effects on human and animal health described above, fracking wastewater has also been found to harm the environment. Certain chemicals found in fracking wastewater, such as ammonia, can damage ecosystem health by depleting oxygen or causing algal blooms, or can interact with disinfectants at drinking water plants to form cancer-causing chemicals. NRDC, *In Fracking's Wake*, *supra,* at 6. Some others can affect the beneficial use of the water downstream (e.g., sulfate, which can make drinking water taste bad), and still others can disrupt ecosystems (e.g., chloride, which alters fish reproduction). *Id.*

Exposure to fracking wastewater generally impairs the quantity and quality of aquatic, wetland, and terrestrial habitats and the biota that they support. N.Y. State Dept. of Health, *A Public Health Review of High Volume Hydraulic Fracturing for Shale Gas Development* (2014), https://on.ny.gov/2KAzV8A. It increases the death rate of terrestrial plants and lowers streambed microbial diversity. Kelly O. Maloney, et al., *Unconventional Oil and Gas Spills: Materials, Volumes, and Risks to Surface Waters in Four States of the U.S.*, 581-582 Sci. of the Total Env't 369 (2017). Spills or intentional discharges of fracking waste into streams have adversely affected the ecology and aquatic biodiversity and populations of mussels, *id.*, and sensitive fish species like brook trout. Concerned Health Professionals of N.Y. & Physicians for Social Responsibility, *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction), Fifth Edition* 225 (2018), https://bit.ly/2VGfFIQ.

Fracking wastewater has also been found to hurt farms, causing deaths, neurological disorders, aborted pregnancies, and stillbirths in animals that have come in contact with fracking wastewater.

Concerned Health Professionals of New York & Physicians for Social Responsibility, *supra,* 225.

Discharges of total dissolved solids (TDS), sulfates, and chlorides into the receiving surface water are the primary cause of harm to aquatic species, as they can increase salinity and can rebond with other more toxic metals, increasing the toxicity of the receiving waters. Pa. Dept. of Env. Prot., P*ermitting Strategy for High Total Dissolved Solids (TDS) Wastewater Discharges* (2009), https://bit.ly/2KCpLUE. Brine and fracking wastewater have high concentrations of total dissolved solids. *Id.* The discharge of total dissolved solids leads to decreases in existing freshwater organisms in the receiving waters, and increases in brackish water organisms, indicating a shift in biotic communities. *Id.*

Moreover, salts, metals and organics—core components of most fracking wastewater—are all known to induce oxidative stress in fish, V. I. Lushchak, *Environmentally Induced Oxidative Stress in Aquatic Animals,* 101 Aquat. Toxicol. 13 (2011), which can lead to damage to the fatty tissue, DNA, and proteins in the fish, causing cancer, heart disease, and other fatal health problems. Waterborne metals, organic toxicants, and elevated salts can also lead to changes in fish gill

morphology. Blewett, et al. *The Effect of Hydraulic Flowback and Produced Water On Gill Morphology, Oxidative Stress and Antioxidant Response in Rainbow Trout (Oncorhynchus Mykiss)*, 7 Sci. Rep. 2 (2017), https://go.nature.com/2VVcsUU.

D. Wherever There is Fracking, There are Spills

Fracking fluid and wastewater have spilled into surface waterbodies at every stage of the fracking process—including during transportation of the fracking fluid to the well site, storage and handling of the fluid at drill sites, and afterward, when fracking wastewater is being trucked from well pads for treatment and disposal. N.Y. State Dept. of Env. Conserv., *Final Supplemental Generic Environmental Impact Statement of Regulatory Program for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* 6-14–15, 51 (2015), *available at* https://goo.gl/EzY83S [hereinafter *SGEIS*]. Spills or releases can result from tank ruptures, piping failures, equipment or surface impoundment failures, overfills, vandalism, accidents (including vehicle collisions), ground fires, drilling and production equipment defects, or improper operations. From there,

spilled, leaked, or released fluids can move beyond the fracking zone to groundwater, streams, reservoirs, and water supplies. *Id.* at 6-15.

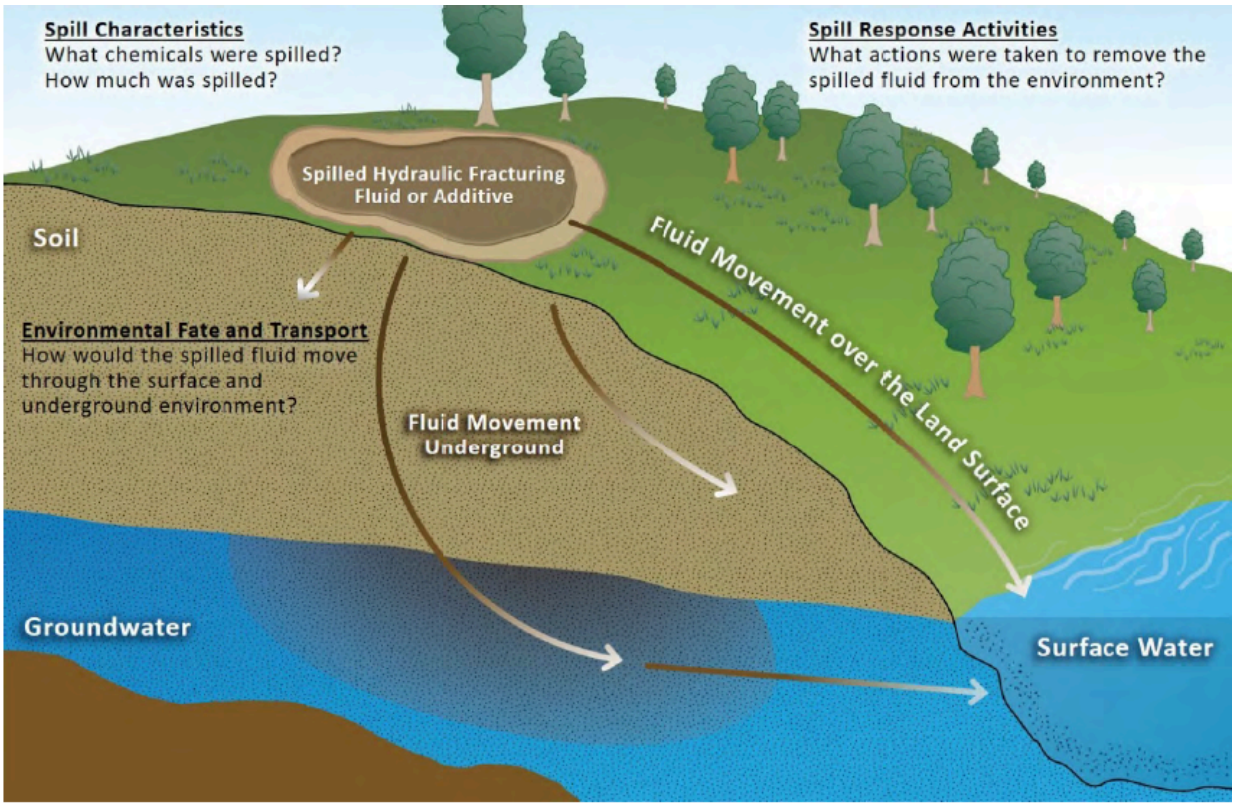

Figure 3. How fracking spills can reach groundwater and surface waterbodies. Source: EPA (2016), Fig. ES-5.

Water used in the fracking process is typically taken from surface waterbodies and trucked to the drill site, where it is then mixed with chemicals, sand or resin, and injected into the ground. *NYC Assessment*, *supra*, at ES-1. Once fracking fluid is injected into the ground, underground pathways, such as the production well itself and newly-created fractures, can serve as vectors for fracking fluid to reach underground drinking water resources. *EPA (2016)*, *supra,* at ES-26.

After the fracking wastewater returns, the produced water is generally stored on-site until it is trucked off-site for treatment or disposal, risking spills all along the storage, transfer, and transportation route. NRDC, *In Fracking's Wake*, *supra*, at 6, 58.

The opportunities for spills are not theoretical. In Pennsylvania, one-fifth of all wells were given at least one non-administrative notice of violation. Susan Brantley, et al., *Water Resource Impacts During Unconventional Shale Gas Development: The Pennsylvania Experience*, 126 Int'l J. of Coal Geology 140, 140 (2014), *available at* https://bit.ly/2KGdUFq. Spills and leaks account for many of the environmental violations cited in connection with shale gas development by the Pennsylvania Department of Environmental Protection. *See, e.g.*, N.Y. State Water Resources Institute, *Spills and Leaks Associated with Shale Gas Development* 4 (2011), https://bit.ly/3cNnRNb. According to EPA, between 2006 and 2011, there were eighty-seven reported spills of fracking wastewater in Pennsylvania alone. *EPA (2016)*, *supra,* at t. 2. The number of reported spills is likely an underestimate, as this only includes spills that were lawfully reported—there are an unknown number of cases

where spills went unreported, or where fracking wastewater was intentionally mishandled. *See, e.g., Com. v. Shipman*, No. 1169 WDA 2012 (Pa. Super. Ct. June 5, 2013) (defendant illegally dumped thousands of gallons of wastewater in different areas in Allegheny, Lawrence, Greene, Fayette, Washington and Westmoreland counties in Pennsylvania over a period of seven years).

In 2009, over the span of less than one week, more than 8,000 gallons of hydraulic fracturing fluid were inadvertently spilled at one gas well in Dimock, Pennsylvania, seeping into nearby waterbodies and drinking water supplies. The Pennsylvania Department of Environmental Protection concluded that 18 water wells located within a 9 square mile area had been contaminated as a result of nearby fracking. *EPA (2016), supra,* at Text Box 6-2. The fracking fluid included a liquid gel known as "LGC-35," which can lead to skin cancer and may cause headaches, dizziness, and other central nervous system effects. Abrahm Lustgarten, *Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish*, ProPublica, Sept. 21, 2009, https://bit.ly/2YM1Dra. The spills killed fish, *id.,* caused skin rashes, severe nausea and headaches among residents; and sickened livestock

and family pets, Kate Sinding, *Cabot Sanctioned Big Time for Dimock Disaster*, NRDC Expert Blog, Apr. 20, 2010, https://on.nrdc.org/3b6vwoz.

Such spills have also harmed aquatic life. According to the Pennsylvania Department of Environmental Protection, for example, one wastewater leak contaminated a nearby a stream, killing more than 150 fish. *EPA (2016)*, *supra*, at 9-7.

In 2009, after conducting a thorough assessment of the environmental impacts of fracking, New York City concluded that "acute spill scenarios are realistic and should be expected." *NYC Assessment*, *supra*, at 37. And strict regulations are not enough to prevent these spills, New York City determined: "Even with appropriate BMPs and regulations . . . mechanical failures, human errors, and accidents are inevitable." *Id.* After this assessment, New York City determined that fracking was "incompatible" with its reservoir system, and that it would pose "unacceptable risks" to the city's drinking water supply. N.Y. City, *Comments on Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program* 1 (2009), *available at* https://bit.ly/35WzEGZ.

II. The Consumptive Use of Water from the Basin Could Impair Both Quantity and Quality of Water Resources in the Delaware River Basin

Fracking is a highly water-intensive process that requires between three and eight million gallons of water per well in the Marcellus region. B. Wright, et al., *Impact Assessment of Natural Gas Production in the NYC Water Supply Watershed* 5 (2010). And unlike other activities in the Delaware River Basin, such as domestic and commercial water use, where 90 percent of water is returned to the Basin, fracking results in 70 to 90 percent of the water used being permanently removed from the water cycle.[3] (Def.'s Mot. Partial Summ. J., ECF No. 169 ¶ 23.) In the neighboring Susquehanna River Basin, water use is even more consumptive—approximately 96 percent of the water withdrawn by the gas industry is not returned to its source. J.

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[3] A portion of water that does not return to the surface remains underground at the fracking site, where it can contaminate groundwater. *EPA (2016)*, *supra*, at 6-3, 6-21, 6-29. Water that does return to the surface is typically stored temporarily on-site in pits or tanks, and then recycled as fracking fluid, disposed of (e.g., shipped offsite and permanently discarded in underground storage tanks), or treated (where it may return to the water cycle after treatment). *See generally* NRDC, *In Fracking's Wake*, *supra*. All of these uses present their own potential for surface and groundwater contamination. *Id.*

Richenderfer, et al., *Water Use Associated with Natural Gas Shale Development: An Assessment of Activities Managed by the Susquehanna River Basin Commission July 2008 through December 2013*, 38 (2016).

If fracking were permitted in the Basin, 18,000 horizontal wells could be drilled in the Basin on 2,200 well pads on 2,000 acres. Kauffman and Homsey, *supra,* at 19. This could require between 26.6 and 66.6 million gallons of water per day, the vast majority of which could not be returned to the Basin. This is more water than the consumptive water used by all current industrial activities in the Basin. DRBC, *Basin Water Use*, https://bit.ly/2VS9tMQ (last modified Dec. 3, 2019). Wastewater treatment capacity would be needed for 18 billion gallons of wastewater over 20 years.[4]

Water stress, a scenario in which the water resources in a region or country are insufficient for its needs, could occur in the River Basin at the points of water withdrawal, particularly if they occur during

[4] Assuming hydraulic fracturing requires 5 mgdmillion gallons per day per well and 20 percent is flowback water (1 mgd). Kauffman and Homsey, *supra,* at 19.

seasonal low-flow periods. *EPA (2016)*, *supra*, at 4-37. Water stress could harm the resources of the River Basin in three primary ways.

First, a dip in freshwater supply in the Delaware River would reduce the waterway's ability to dilute and assimilate pollutants. Notice of Rule and Public Hearing, Administrative Manual and Special Regulations Regarding Natural Gas Development Activities; Additional Clarifying Amendments, 83 Fed. Reg. 1586 (proposed Jan. 12, 2018). When water enters a waterway through tributaries, it naturally helps to dilute point sources of pollution (e.g., a sewage outfall). A decline in the ability of a waterway to dilute pollutants would make it harder for waterbodies to meet water quality standards. Nolton Johnson, et al., *Environmental Considerations for Evaluating Interbasin Water Transfers in Georgia* 2 (2007), https://b.gatech.edu/353wznK.

Second, unregulated consumptive use of water could create low-flow conditions, which have been linked to increased water temperature, decreased dissolved oxygen and decreased biodiversity—all of which harms aquatic habitats. Robert J. Rolls, et al., *Mechanistic Effects Of Low-Flow Hydrology On Riverine Ecosystems: Ecological Principles And Consequences Of Alteration*, 31 Freshwater Sci. 1163,

1170 (2012). Additionally, low-flow conditions reduce the capacity of a waterway to transport silt and fine sediment, leading to sedimentation and smothering benthic habitat, effects that are discussed in more detail later in the brief. *Id*. at 1167.

Low-flow conditions also lead to decreased insect biomass due to reduced habitat, which can in turn harm fish communities and other species that rely on insects for food. Annika Walters & David Post, *How Low Can You Go? Impacts of A Low Flow Disturbance On Aquatic Insect Communities*, 21 Ecological Applications 163, 172 (2011).

Third, removing freshwater for fracking could threaten regional drinking water security. Removing water from the Basin could decrease the amount of water available for drinking, especially during seasonal droughts. Additionally, groundwater withdrawals could deplete freshwater aquifers, threatening streams and wetlands throughout the watershed. *NYC Assessment*, *supra*, at 33. Across the country, from Pennsylvania to Texas to New Mexico, streams and drinking water supplies have been pumped dry to provide water for drilling. Environment America, *Fracking by the Numbers* 11, 12 (2013), *available at* https://bit.ly/3dxjy9e.

According to the Delaware River Basin Water Code, "the waters of the Delaware River Basin are limited in quantity and the basin is frequently subject to drought warnings and drought declarations due to limited water supply storage and streamflow during dry periods. Therefore, it shall be the policy of the Commission to discourage the exportation of water from the Delaware River Basin." Delaware River Basin Water Code, DELAWARE RIVER BASIN COMMISSION, § 2.30.2. https://bit.ly/3cNJNHU.

Given the highly variable and limited freshwater supply in the Basin, and the intent to create the Commission as a body to manage water quality and water quantity together (*see* Def.'s Br. In Support of Mot. Partial Summ. J., ECF No. 175, at 18 – 27), it follows that the Commission has the authority to regulate this extractive activity.

III. Fracking Would Significantly Alter Land Use in the River Basin, Harming Nearby Water Quality

Perhaps the most widespread effect fracking would have in the River Basin would result from changes in land use. Specifically, the green-lighting of fracking in the Basin would lead to the conversion of forested ecosystems into roads, wells, and pipelines for extracting and exporting fracked gas—this could increase both stormwater runoff (i.e., water that 'runs off' the land instead of seeping into the soil) and soil erosion, which together can exacerbate the turbidity and sedimentation in nearby waterbodies, undermining the waterbodies' uses as suitable habitat or spawning area for fish and other aquatic species. *SGEIS*, *supra,* at 51. Under the Compact, changes to land use that have substantial effects on water resources are also subject to regulation by the Commission. *See* Compact § 1.2(e).

While Wayne Land and Mineral Group's individual projects may displace five to seven acres of land, the cumulative effect of permitting fracking in the Basin could result in 2,000 acres of land subject to fracking development. Kauffman and Homsey, *supra,* at 19.

A. Importance of Forests to Nearby Water Quality

Figure 4. Photograph of two hydraulic fracturing well sites and a service road in Springville Township, Pennsylvania. Source: EPA (2016), Fig. 3-9, Photo credit: Image@J Henry Fair

Fracking activity is especially harmful when it takes place in forests, which must be cleared for the well pad and other fracking-related infrastructure. It is well-established that forest cover is closely linked with nearby water quality—they filter contaminants, regulate stream temperatures, and limit flow after a storm. Delphine Brogna et al., *Linking Forest Cover to Water Quality*, 9 Water 176 (2017), *available at* https://goo.gl/dwzc6i. In addition to heightened turbidity,

reductions in forest cover provoke increases in nitrogen, phosphorus, sodium, chlorides, and sulfates in water. *Id*.

The Delaware's drainages and surrounding environs encompass a substantial oak-hickory forest, northern mixed hardwoods, and isolated spruce-fir zones that include bog and fen habitats. Opening the River Basin to fracking could lead to a 1 to 2 percent loss of total forest land in fracking areas, and between 5 and 10 percent loss of core forest—ecologically valuable forest that is surrounded by more forest. Habicht, et al., *supra*, at 17.

In the River Basin, land cover conversions could increase erosion rates up to 150 percent during well pad construction. Habicht, et al., *supra,* at iv.

Figure 5. Well site with equipment (and pits in the background) in preparation for hydraulic fracturing in Troy, Pennsylvania. Source: SGEIS, supra*, at 5-90.*

B. Impacts of Land Use Changes on Aquatic Organisms

As water quality deteriorates, aquatic species, such as plants, fish, mollusks, crustaceans, and insects, may suffer both in the short- and long-term. J. M. Castro et al., *Risk-Based Approach to Designing and Reviewing Pipeline Stream Crossings to Minimize Impacts to Aquatic Habitats and Species*, 31 River. Res. & Application 767, 767 (2015), available at https://goo.gl/5gtBgx. Aquatic species have evolved to thrive in habitats with particular characteristics and require narrow

ranges of water temperatures, certain natural features for feeding and spawning, and particular levels of turbidity. Changes to any of these characteristics can significantly harm populations of fish, plants, and other organisms that rely on these characteristics for survival.

For example, healthy streams typically have gravel bottoms and cobble bars free of mud and sediment. These serve as spawning areas for fish and provide benthic invertebrates like mussels and crustaceans space for attachment, protection, feeding, and oxygen consumption. Lucie Levesque & Monique Dube, *Review of the Effects of In-Stream Pipeline Crossing Construction on Aquatic Ecosystem*s, 132 Envtl. Monitoring & Assessment 395, 400 (2007), *available at* https://goo.gl/N2soGd. When sediment settles, as it does when erosion from construction settles into a stream or riverbed, it smothers fish eggs, destroys the primary habitat for many benthic invertebrates, and deprives fish of a key food source (i.e., invertebrates). *Id.* at 400 – 02.

Increased sedimentation and turbidity can also lead to warmer waters. K. P. Paaijmans, et al., *The Effect of Water Turbidity on the Near-Surface Water Temperature of Larval Habitats of the Malaria Mosquito* Anopheles Gambiae, 52 Int'l J. of Biometeorology 747, 747

(2008). Warmer waters can damage habitat for aquatic animals, rendering their habitats unlivable. U.S. Fish and Wildlife Service, *Habitat Suitability Information: Rainbow Trout* 4 (1984), *available at* https://goo.gl/7FMk6u. As water warms, the level of dissolved oxygen decreases, depriving fish of oxygen they need to breathe. *Id.* at 6. Furthermore, sedimentation tends to eliminate the presence of riffles—shallow, fast-moving sections of streams that fish rely on for propagation. *Id.* at 4. With fewer riffles, fish are left with fewer areas to breed.

CONCLUSION

Fracking activity, if permitted to take place in the Delaware River Basin, would remove millions of gallons of water from the watershed, and could lead to dangerous impairment of water quality in the River Basin, harming local wildlife and making local residents sick.

For over 50 years, the Delaware River Basin Commission has been the body responsible for ensuring industrial activity does not jeopardize the water resources of the Basin—it would be a significant defeat for the watershed if the Commission was no longer permitted to play this important role.

For the reasons set forth in this brief and the briefs of the Delaware River Basin Commission and Delaware Riverkeeper Network and Maya K. van Rossum, we support Defendants' request for summary judgment, and ask that the Court declare that Wayne Land and Mineral Group's planned activities constitute a "project" within the meaning of the Compact.

Dated: May 11, 2020

Respectfully submitted,

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CERTIFICATION OF WORD COUNT

I certify that this brief complies with the word count limit described in Fed. R. App. P. 29(a)(5) as limited by the Court's Order dated April 15, 2020 (ECF No. 174). This brief includes 7,074 words as calculated with the word counting feature on Microsoft Word, exclusive of the cover page, tables, and the signature block.

Dated: May 11, 2020 *<u>/s/ Kimberly Ong</u>*

CERTIFICATE OF SERVICE

I hereby certify that I have on this 11th day of May 2020 electronically filed the Brief of Amici Curiae Natural Resources Defense Council and Catskill Mountainkeeper using the CM/ECF system, which will send notification of such filing via electronic service to the following:

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