Comments on Proposed Regulations

of

The Delaware River Basin Commission

Concerning

High Volume Hydraulic Fracturing to Produce Oil and Gas

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Background

The Delaware River Basin Commission (DRBC) is proposing to amend its *Special Regulations* and its *Administrative Manual Rules of Practice and Procedure* in regard to the extraction of petroleum hydrocarbons using technology known as high volume hydraulic fracturing (HVHF or fracking) that both consumes and contaminates large volumes of water. In addition, changes are proposed regarding the regulation of wetlands and of leachate from solid waste disposal facilities. The Delaware Riverkeeper Network commissioned this commentary as part of its submission pursuant to the DRBC's 30 November 2017 request for comments from the public on the proposed regulations.

The DRBC is an interagency entity formed in 1961 by compact between the States of Delaware, New Jersey, New York, and Pennsylvania (Figure 1)[1] and the federal government to manage water resources jointly in the Delaware River basin (the Basin). The Basin includes all or portions of 42 counties (Figure 2) and all or portions of 838 municipalities.

The DRBC has designated part of its jurisdictional area as Special Protection Waters (Figure 3), and it has established water quality criteria for them. Special Protection Waters drain approximately 4.4 million acres of land and are located within the northern half of the DRBC area. The distribution of Special Protection Water drainage areas in the Basin is as follows (none is in Delaware):

Pennsylvania	=	50%
New York	=	35%
New Jersey	=	15%

Basin water resources are used by more than 15 million people. The quantity of water available in the Basin varies over time, and shortages occur during periods of drought. Water quality varies across the Basin in large part in response to human activities but also as a result of natural environmental factors. The streams and groundwaters of the Basin have a limited capacity to assimilate polluting substances in discharged wastewater while maintaining designated uses as suitable sources of potable water, aquatic life support, and other human purposes. The DRBC traditionally has focused on large-scale activities that affect large quantities of water, rather than the activities of individual householders.

DRBC proposes to amend certain of its regulations at 18 CFR 401 and add a new part 440 in order (1) to prohibit permanently the use of fracking to extract oil and gas within the Basin, (2) to regulate the export of any freshwater from the Basin to be used for fracking elsewhere, (3) to regulate the import of any oil and gas wastewater into the Basin from fracking elsewhere, (4) to change its procedure for authorizing activities affecting wetlands,

[1] Figures are displayed at the end of the text.

and (5) to change its regulations to address specifically the leachate from solid waste disposal facilities rather than the landfills and other facilities themselves. Since 2010 DRBC has maintained a moratorium on fracking for shale gas production within the Basin. There is also a ban on fracking in effect at present in New York State and in several of its municipalities aimed at protecting public health and the environment.

DRBC specifically requested comments on the effects its proposed rules may have on

- Water availability,
- Control and abatement of water pollution,
- Economic development,
- Conservation and protection of drinking water supplies,
- Conservation and protection of aquatic life,
- Conservation and protection of water quality in Special Protection Waters, and
- Protection, maintenance, and improvement of water quality and quantity basinwide.

Schmid & Company professionals have decades of experience applying their expertise in wetlands, stream protection, and environmental impact assessment throughout the Basin and the mid Atlantic region. These comments draw upon experience gained from our diverse project work on behalf of environmental permit applicants, for conservation groups, and in direct support of regulatory agencies at the federal, State, and municipal levels.

Fracking of Hydrocarbon Resources

Geological formations known as the Marcellus Shale and the even deeper Utica Shale underlie the northern 40% of the Delaware River Basin in eastern Pennsylvania and southern New York, typically 7 to 10 thousand feet below the present land surface. They constitute the largest petroleum-producing deposits in the United States. Organic remains slowly accumulated in the beds of shallow seas as these shales were laid down during the Devonian period some 400 million years ago. As the Appalachian Mountains rose in response to colliding tectonic plates, the organic deposits were buried and altered to form hydrocarbons deemed useful today for industrial purposes.

The northern portion of the Marcellus Shale underlies portions of Pennsylvania, Ohio, West Virginia, Virginia, Maryland, and New York (Figure 4). Of the total area of Marcellus Shale reserves, only 5% underlies the DRBC area. Within the Basin, Marcellus Shale is located only in Pennsylvania and New York; none is within New Jersey or Delaware. Most sections of the Basin underlain by Marcellus Shale reserves

are designated Special Protection Waters (Figure 5). In New York, almost all (98%) of the area designated Special Protection Waters is underlain by Marcellus Shale reserves. In Pennsylvania, approximately two-thirds (67%) of the area designated Special Protection Waters is underlain by Marcellus Shale reserves.

Until the present century the petroleum trapped in these “tight” Marcellus and Utica Shale formations was deemed not economically recoverable using traditional vertical wells that had been developed to tap oil and gas held in sandstone and carbonate rocks. During the past decade innovative combinations of drilling and hydraulic fracturing technology have been employed to extract natural gas and other hydrocarbons from these formations in Pennsylvania and other States. Depending on the worldwide market for fossil fuels, industry may seek to exploit the natural gas reserves long trapped beneath the Basin.

Current unconventional technology employs mixtures of water, sand (the most common proppant for holding cracks open), and chemicals injected under high pressure by diesel-powered pumps to break apart shale rocks so that long-trapped natural gas and other hydrocarbons can make their way to the surface through bored wells. Drilling technology now allows the advance of borings that extend thousands of feet deep and thousands of feet horizontally from the drill rig. To be classed by DRBC as HVHF, a well must use more than 300,000 gallons of water during its development. Each unconventional well currently makes use of 4 to 10 million gallons of water each time it is fracked, and the volumes of water needed increase significantly as well bores become longer. The typical 8 to 10-acre well pad may accommodate as many as a dozen wells. Most of that water remains in the underground strata; the rest returns as “produced” wastewater to the surface. Much of the produced water returns during the weeks shortly after the hydraulic pressure is released, but lesser flows continue throughout the life of each well.

The water necessary for fracking is obtained from surface sources or occasionally from wells in groundwater aquifers that are shallow relative to the target shale deposits. Near-surface aquifers are linked with surface waters, from which they can receive both replenishment and pollutants. The quantities of water required for fracking are large enough that they can deplete local streams and groundwater aquifers, especially during periods of drought. Such quantities of water require hundreds of large trucks for transport, and in some cases are moved by pipelines laid above or below ground. The wastewater produced at well pads contains high concentrations of harmful chemicals that are technically difficult and costly to separate from the water itself.

Explosives and frackwater pressure open existing cracks and create new fractures in the rock layers surrounding each well bore. Much of the fracking fluid binds to the rocks underground. Drillers store nearby in ponds or containers the produced water that returns to the surface after hydraulic pressure is released and reuse it to frack multiple wells; the

remainder is transported long distances to deep injection wells where it is intended to be isolated permanently, far below potable groundwater aquifers. Relatively little produced water is treated for release to surface streams and rivers. Hence the use of water for fracking is deemed by DRBC to be a “consumptive” use. More than 90% of frackwater would be lost to natural recycling within the Basin. This contrasts sharply with most other industrial and municipal uses of water within the Basin, more than 90% of which volume returns to the Basin’s water cycle after human use and treatment to remove pollutants.

Chemicals typically are added to frackwater to reduce friction and prevent bacterial growth. About 1,000 kinds of substances have been added to the water as drillers seek to optimize their recovery of energy-producing hydrocarbons. The mixes of added chemicals, together with various salts plus organic and naturally occurring radioactive compounds extracted from the shale by the frackwater, render produced water toxic to people, animals, and plants in the event that it is released or spilled into the environment. Frackwater must be transported primarily by truck to and from well sites, where it is stored temporarily in open basins or closed containers. Containment capacity must be provided at each well pad yielding gas to store the continually produced wastewater after drilling stops. Fractured rock layers near well bores can intercept natural faults or abandoned wells through which the pressurized fluid can escape unintentionally. Escaped or leaking frackwater contaminates groundwater aquifers and the land surface as it flows by gravity into wetlands and streams. Unscrupulous operators may spread frackwater on roads as concentrated brine intended to reduce dust or to melt snow and ice. Several hundred tons of mineral salts are produced in the brine from an individual HVHF well.

The dramatic results of unintended leaks from unconventional gas wells have received wide publicity when invisible and odorless methane (natural gas) renders the tap water from home wells flammable. So have catastrophic explosions of high-pressure pipelines transporting natural gas and other hydrocarbons from wells to users. Other leaked or spilled contaminants can impart undesirable color or odor or taste or poisons to drinking water. Some of the contaminants present in frackwater do not break down readily into benign compounds; salts are not removed by normal publicly owned sewage treatment systems. Other pollutants can be transformed in the environment into low, difficult-to-detect, but still toxic concentrations of compounds linked to genetic mutations and cancers. Routine drinking water treatment can yield unhealthy concentrations of brominated hydrocarbons that originated in frackwater in public water supplies downstream from wastewater treatment plants. Hence produced frackwater can pose serious but hard-to-manage risks, either transient or permanent, to public health and to the environment. Yet information regarding the proprietary mix of chemicals injected at each well and produced by dissolution of in-ground substances is seldom collected or disclosed to the public, making human health symptoms difficult to diagnose and treat by health professionals.

Some of the produced frackwater pollutants that affect water quality already are found in the environment as a result of natural conditions and/or legacy human activities that formerly extracted oil and coal. The locations of many thousands of abandoned wells are unknown in Pennsylvania. Existing data on old wells are incomplete, and drillers may miss such features when planning new wells. Background concentrations of pollutants are not required to be documented in nearby wells and streams prior to HVHF well installation. Spills and leaks are not always reported, and required agency inspections may provide inadequate and infrequent oversight. As a January 2018 white paper from PADEP addressing proposed reforms of its permitting stated,

> DEP's oil and gas staff complement has been decreased from 226 employees to 190 employees. Well permit review staff have been reduced by 43% in the Southwest District Office, and by 15% in the Northwest District Office. These reductions have unquestionably impacted the timeliness of permit review, and the department's ability to oversee its responsibilities. (http://files.dep.state.pa.us/LicensingPermitsCertification/PermitDecisionGuaranteePortalFiles/Permitting_Reform_01262018.pdf)

PADEP has asked the Governor and General Assembly to increase permit application fees to help increase regulatory staff in its Oil and Gas Program.

Leakage from new well casings is common; over time the failure of cement casing can affect large numbers of frack well bores, allowing the uncontrolled escape of methane and other pollutants into aquifers and the surface environment (Ingraffea *et al*. 2014). In consequence, about 10,000 complaints of stream and well pollution in lands where gas and oil drilling and fracking are underway have been filed with State regulators in Pennsylvania over the past decade in response to encounters with the consequences of pollution from some 11,000 new oil and gas wells (all drilled outside the Basin). But documenting the sources responsible for specific episodes of water contamination often proves difficult. Meanwhile, opportunities for public participation in decisionmaking about fracking are limited, and shortages of information have generated widespread concern among residents of oil and gas fields where HVHF is utilized.

Drawing upon the growing scientific literature, DRBC staff summarized the dangers associated with shale gas production using fracking in their notice of proposed rulemaking (http://www.nj.gov/drbc/meetings/proposed/notice_hydraulic-fracturing.html). There is no need to repeat that well organized information here. Schmid & Company staff concur that the proposed permanent ban on fracking in the Basin is warranted for the reasons set forth by DRBC in that document in order to protect the waters of the Basin, human health, and the environment. Keeping unconventional oil and gas operations out of the Basin will eliminate a potentially major consumer and polluter of water. It also will bar from the Basin a poorly understood source of human health problems associated with unconventional well

pads and the vehicular traffic and diesel generators associated with them as HVHF industrial uses spread into residential landscapes (Currie, Greenstone & Meckel 2017).

Based on drilling elsewhere in Pennsylvania, many shale gas HVHF wells may be sited in upstream headwaters distant from major rivers. Prohibition of fracking is an efficient means of protecting water quality directly in the 40% of Basin land underlain by Marcellus and Utica Shales. In most of those shale-gas lands (which overall are about 85% forested; http://www.nj.gov/drbc/library/documents/bush_CDRWforum102214.pdf), the streams have been designated Special Protection Waters by DRBC. Streams in the Schuylkill River subbasin and other waters discharging into the tidal Delaware River below Trenton have not been designated as Special Protection Waters by DRBC.

Six of the seven concerns listed above obviously are benefited by a permanent ban on fracking and require no discussion here. The seventh DRBC concern---economic development---also is virtually certain to be benefited. Fracking poses very real risks at present to human health and to the environment in the Basin in consequence of 1) primitive available technology for gas extraction and waste treatment, 2) the minimal inventory of potentially affected resources currently required by DRBC and other agencies for permitting, 3) the scarcity of qualified personnel reviewing permits and inspecting operations on the ground and low probability of increased regulatory budgets, 4) the uncertain and fluctuating economic demand for natural gas that has long characterized the boom-and-bust oil and gas industry that has produced focus on quick production and profit with slight concern for long-term consequences, and 5) the ever-growing certainty that most known reserves of fossil fuels worldwide must be kept permanently unburned and below ground to forestall massive climate disruption (McGlade & Ekins 2015). These concerns exist over and above the localized resource damages from fracking that threaten vital water resources, recreation, tourism, and other sustainable economic activities within the Basin. The sacrifice of long-term economic and environmental values within the Basin's tiny proportion of the shale gas resource land on behalf of short-term benefits from HVHF gas flowing primarily to large energy corporations would not be prudent. Were the shale gas ever needed by future generations of people, it could be extracted by them, potentially with far less damaging consequences as a result of technological advances unknown at present.

Hence this report concentrates on the export of fresh water associated with HVHF gas production from and import of produced frackwater into the Basin, which the DRBC proposes to regulate. Based on experience elsewhere in Pennsylvania during the past decade, the drilling industry would be expected to seek approval for water withdrawals from and discharges of treated wastewater to streams situated high in the watershed along headwaters relatively close to drilling pads. The use of wells drilled specifically for extraction of groundwater for shale fracking or for disposal of wastewater by injection has not been common in Pennsylvania. Injection wells for frackwater disposal elsewhere have

led to earthquakes. We have concerns that DRBC authorization of import and export of waters used in unconventional oil and gas production may prove unwise as well as inconsistent, and we recommend that import and export of frackwaters---like fracking wells themselves---also should be banned permanently in the Basin. These activities pose many of the same likely impacts on water resources as drilling and fracking operations, with even less opportunity for economic benefits to Basin residents.

The Regulation of Fracking

The DRBC currently relies, and proposes in the future to rely, primarily upon State and federal regulators who implement the programs of other agencies to protect the public and the environment from the impacts of exporting freshwater to and importing produced wastewater from HVHF gas wells constructed outside the Basin. DRBC seeks to minimize regulatory duplication through coordination of its permit review and approvals with other agencies and via administrative agreements with the States. Historically, DRBC has focused chiefly on water quantity management and secondarily on water quality preservation. The information uniquely solicited by its current permit application forms primarily concerns water quantity.

At present DRBC has established no limit on the total volume of water that can be exported from or of wastewater that can be imported into the Basin. Instead, its permits (granted primarily to public utilities) to export an average of more than 100,000 gallons per day (based on a 30-day average) of fresh water from the Basin for any purposes other than oil and gas production ordinarily---after permit review---are deemed to have no substantial effect on the Basin's resources. Smaller withdrawals are not required to undergo DRBC review or obtain permits at all, unless specifically so notified. A lower minimum threshold for groundwater withdrawal review is set at 10,000 gallons per day in the Southeastern Pennsylvania Groundwater Protected Area consisting of parts of five counties, where shortages have been most problematic. DRBC seeks to impose restrictions on water withdrawal during periods of drought, and it assigns lower priority to industrial than to domestic water uses.

The withdrawal of any quantity of surface water or groundwater within the Basin for the purposes of HVHF, however, is proposed to require a full permit review. DRBC hopes somehow to "discourage" approval of such permits. The quantities of water extracted from the Basin at various locations for HVHF use are likely to be much more variable over time than the extraction of water by public utilities for potable water supplies. There are no currently approved DRBC permits for this purpose.

Because the capacity of the Basin's waters to accept treated wastewater also is considered limited, DRBC reviews permit applications to import more than 50,000 gallons

per day (30-day average) of most wastewaters into (or to export such wastewaters out of) the Basin. The lower import permit threshold for typical wastewater discharges reaching Special Protection Waters is 10,000 gallons per day. The importation or treatment of produced frackwater in any quantity into the Basin, however, is proposed not to be allowed except after DRBC permit approval. Fracking wastes are considered to be different from other wastewaters currently discharged into the Basin. There are no currently approved DRBC permits for this purpose.

The proposed regulations would continue to allow the future export or import of water associated with HVHF if and when permits are requested by the industry. Future discharge of HVHF wastes anywhere within the Basin would be allowed only after treatment in a centralized waste treatment (CWT) facility. DRBC apparently would require a permit for all such transfers regardless of volume, as well as requiring approval of each CWT itself. Centralized waste treatment is an industrial category subject to specific US Environmental Protection Agency regulations for treatment technology. DRBC expects that the continuing imposition of its permit review would "discourage" proposals to transfer out-of-basin oil and gas wastewaters to CWTs discharging into Special Protection Waters, consistent with longstanding DRBC policy regarding direct discharges (Water Quality Regulations 3.10.3.A.2.c.[1]). Most CWTs for frackwaters would be expected to discharge directly into streams in accordance with a National Pollutant Discharge Elimination System permit, because USEPA has now banned the discharge of treated frackwaters into publicly owned treatment works. Each applicant would have to demonstrate an absence of out-of-basin alternatives (including the no-project alternative), as well as detail the impacts of each alternative on and benefits to the Basin. Applications for all frackwater import also would have to include a treatability analysis by a licensed engineer showing that the discharge by the intended CWT will meet all applicable standards plus achieve no exceedance of background concentrations in ordinary receiving waters and no measureable change (except toward natural conditions) in Special Protection Waters, as calculated by DRBC.

It is not clear why DRBC is proposing to allow, yet discourage, the export of fresh water to and import of frackwater generated by out-of-basin HVHF activities, while banning those activities within the Basin itself. The term "discourage" is not defined in the DRBC regulations, which are silent as to how the term might be applied. Perhaps DRBC deems the proposed fees at 18 CFR 401.43 constitute sufficient discouragement. No specific criteria that must be met to overcome discouragement are set forth in the DRBC proposal.

DRBC regulations already require submission of State approvals of proposed large freshwater withdrawal and wastewater discharge activities as part of its permit applications. Thus it is appropriate to examine the information required in DRBC applications. Traditionally DRBC has regulated water export from the Basin in large quantities on a relatively permanent basis by municipal users. The hydraulic fracturing of a

well requires millions of gallons of water during a period of about one week, followed by flowback of hundreds of thousands of gallons of polluted water over a relatively short period. After that occurs a much reduced flowback of produced water throughout the life of the well. After a period of years the entire fracking process may be repeated to stimulate the ever dwindling flow of shale gas. The quantities of water used can be significant in small streams near the headwaters at the edges of the Basin and locally wherever groundwater resources are scarce. Over time a given withdrawal point on a stream or other body of surface water can be used to supply many wells on nearby pads, and a CWT capable of treating frackwater can generate variable flows of wastewater discharged into a stream. Thus the impacts from withdrawal of water and discharge of treated waste can vary depending on site conditions. Depending on the timing of gas well development, simultaneous fracking activities can occur in localized areas of abundant production ("sweet spots"). This could concentrate water import and export into relatively short, intense periods of time and into localized clusters of water resources.

There is little information concerning the potential impacts of such withdrawal and/or discharge in specific Basin watersheds, and permit applications at present do not require documentation of baseline conditions against which any resulting changes could be compared. Permit conditions imposed by DRBC do not require biological monitoring of impacts from approved facilities. DRBC apparently would have to close this regulatory gap, but has not explained how it plans to do so.

Withdrawal of Fresh Water for Fracking

DRBC has not explained how it intends to implement the requirements of its *Water Code* and *Water Quality Regulations* when authorizing stream water withdrawal for HVHF uses. In particular, it does not indicate how it will assure compliance with its adopted biocriteria. Those biocriteria appear not to be addressed by other agencies. DRBC has offered no detailed regulations or technical guidance specifying how such assessments will be made and reported in order to fill the current regulatory gap.[2]

Fresh water for transport to HVHF activities outside the Basin could be purchased from municipal suppliers using surface or groundwater sources, if they have excess approved capacity, apparently without specific DRBC approval. It is not clear whether DRBC notification would be required for such HVHF-related purchases, and the ultimately

[2] Other segments of the fossil fuel industry already are required to inventory baseline conditions and monitor impacts on macroinvertebrates and other existing conditions in streams at risk of biological degradation by loss of flow or discharge of pollutants. PADEP, for example, has adopted requirements for inventory and assessment of macroinvertebrates as part of its comprehensive stream monitoring in permit applications for coal mining activities [*see* 25 *Pennsylvania Code* §89.35; PADEP Bituminous Underground Mining Permit Application Module 8, Form 5600-PM-BMP0324, last revised July 2013; and PADEP Technical Guidance Document 563-2000-655].

adopted language should make this clear to all parties. Fresh water also could be withdrawn from specifically drilled wells following DRBC permit approval. To date water for fracking in Pennsylvania has been obtained primarily from surface sources rather than from groundwater.

Import of Produced Wastewater

USEPA prohibits the unregulated discharge of pollutants to surface waters of the United States from the onshore oil and gas industry. The discharge of wastewaters that contain pollutants is authorized by permits issued in accordance with the misleadingly named National Pollutant Discharge *Elimination* System administered primarily by the States. DRBC coordinates its discharge approvals with NPDES requirements and permits. Now DRBC proposes to authorize, yet also somehow to "discourage," future discharges of treated HVHF wastewater generated by oil and gas activities operating outside the Basin into waters within the Basin by requiring them to use approved CWTs.

DRBC and other agencies have established maximum concentrations of several specific pollutants allowable in wastewaters discharged from CWTs and into Special Protection Waters and other surface waters. DRBC regulations state that the most stringent applicable effluent limitations apply. Despite many years of study, USEPA has not established federal standards for treatment of fracking wastewater at CWTs. USEPA has prohibited the processing of frackwater at publicly owned wastewater treatment works (POTWs). Apparently DRBC has no plans to do so. Not all specific chemicals or combinations of chemicals that appear in frackwater have been assigned effluent limitations by any agency.

DRBC proposed regulations do not require baseline biological inventory or stream monitoring in receiving waters during wastewater discharge operations, as appears especially warranted at minimum in the Basin's Special Protection watersheds if future discharges of treated water were to be permitted for frackwater wastes generated outside the Basin. Such baseline inventory and biological monitoring by permittees is warranted to insure that the DRBC biocriteria for Special Protection Waters are being maintained. Such data should be collected and reported by applicants, used to assess habitat features and potential impacts of changing the flow regime on the species and habitats present, submitted electronically, and made available for timely review by the affected public during the review period for permit applications. The monitoring data also should be reviewed and publicly reported annually by DRBC staff to substantiate industry compliance with DRBC requirements for water resource protection. As noted above, biological monitoring already is required for potentially polluting discharges in other segments of the fossil fuel industry.

It is not clear whether each driller proposing to dispose any truckload of frackwater, wherever generated, anywhere within the Basin must apply to DRBC for a permit, although each CWT seeking to accept and treat frackwater apparently would have to do so. If every individual truckload of HVHF waste entering the Basin is going to require a separate permit from DRBC, a great deal of paperwork may be generated, and DRBC must specify precisely what information will be needed in such applications.

Landfill Leachate

Given the DRBC's focus on water resource protection, it is not unreasonable that it clarify its regulations at proposed 18 *CFR* 401.35(b)(14) to focus its concerns with landfill leachate, as opposed to other aspects of landfill regulation. Compact States have their own regulations governing the siting and operation of landfills.

Wetland Regulation

Wetlands are among the most threatened ecosystems on our planet. They are degraded and converted to human uses more rapidly than any other ecosystem, and the status of freshwater species is deteriorating faster than for other species. Since wetlands are essentially characterized by hydrologic conditions, changes in water volumes and timing of flows are major threats, as are discharges of various pollutants (Verones *et al*. 2013, Zedler 2005). Withdrawals of surface waters or groundwaters, and discharges of wastewaters have the potential for negatively impacting wetlands throughout the Basin. Given its focus on water quantity and quality, DRBC probably could oversee proposed changes in hydrology to wetlands within the Basin, especially including wetland drainage, more effectively than other agencies that focus on the placement of structures and fill material into wetlands and other regulated surface waters.

DRBC typically restricts its review of projects affecting wetlands to those projects affecting more than 25 acres of wetlands. It deems projects affecting less than 25 acres of wetlands normally as not having a substantial effect on the water resources of the Basin [18 *CFR* 401.35(a)(15)]. It is not clear that a 25-acre minimum threshold for wetland review is appropriate, especially if DRBC considers it essential to review water withdrawals and discharges of any size within the Basin when those activities are related to oil and gas development. Other agencies may not be able to review the impacts of proposed water withdrawals from and discharges into wetlands as thoroughly as DRBC staff.

The proposed change at 18 *CFR* 401.35(a)(15) would make clear that DRBC will review proposed impacts on wetlands involving less than 25 acres, but only when no State or federal agency already has done so. This could be an opportunity to partially fill a regulatory gap, but it is not clear how such a provision would be

implemented. There are no detailed maps of regulated wetlands in the Basin. Existing National Wetland Inventory maps show the general location of wetlands recognizable from aerial photographs, but omit many forested wetlands, which are characteristic in the Special Protection watersheds of the Basin, and which offer special habitat values over and above other kinds of wetlands in this biome (Schmid & Co., Inc. 2014). DRBC has no capability of identifying small wetlands subject to impact that are not known already to other agencies. Similarly, published maps available from the United States Geological Survey and from the online National Hydrography database omit many headwater streams. Apparently DRBC expects to rely upon the affected public to identify small wetlands and streams at risk from its water-related permits that applicants and other agencies have overlooked. How it might condition its permits to protect such resources is not clear.

DRBC should issue detailed regulations and/or technical guidance for implementing its intended wetland review requirement. DRBC should require that applicants prepare detailed onsite field surveys and standard written documentation of the nature and extent of wetlands and other surface water conditions on any property to be disturbed by any proposed construction within the Basin associated with the regulated withdrawal of water or disposal of wastewater, and review all such information that has been compiled already for, and approved by, another State or federal agency.

Authorship

This report was prepared by James A. Schmid with the assistance of Stephen P. Kunz. Dr. Schmid is a biogeographer and plant ecologist with 45 years of applied environmental consulting experience in the mid Atlantic States. Mr. Kunz is a Senior Ecologist at Schmid & Company with 40 years experience in environmental consulting. Both Dr. Schmid and Mr. Kunz are certified as Senior Ecologists by the Ecological Society of America, as Professional Wetland Scientists by the Society of Wetland Scientists, and as Wetland Delineators by the Army Corps of Engineers.

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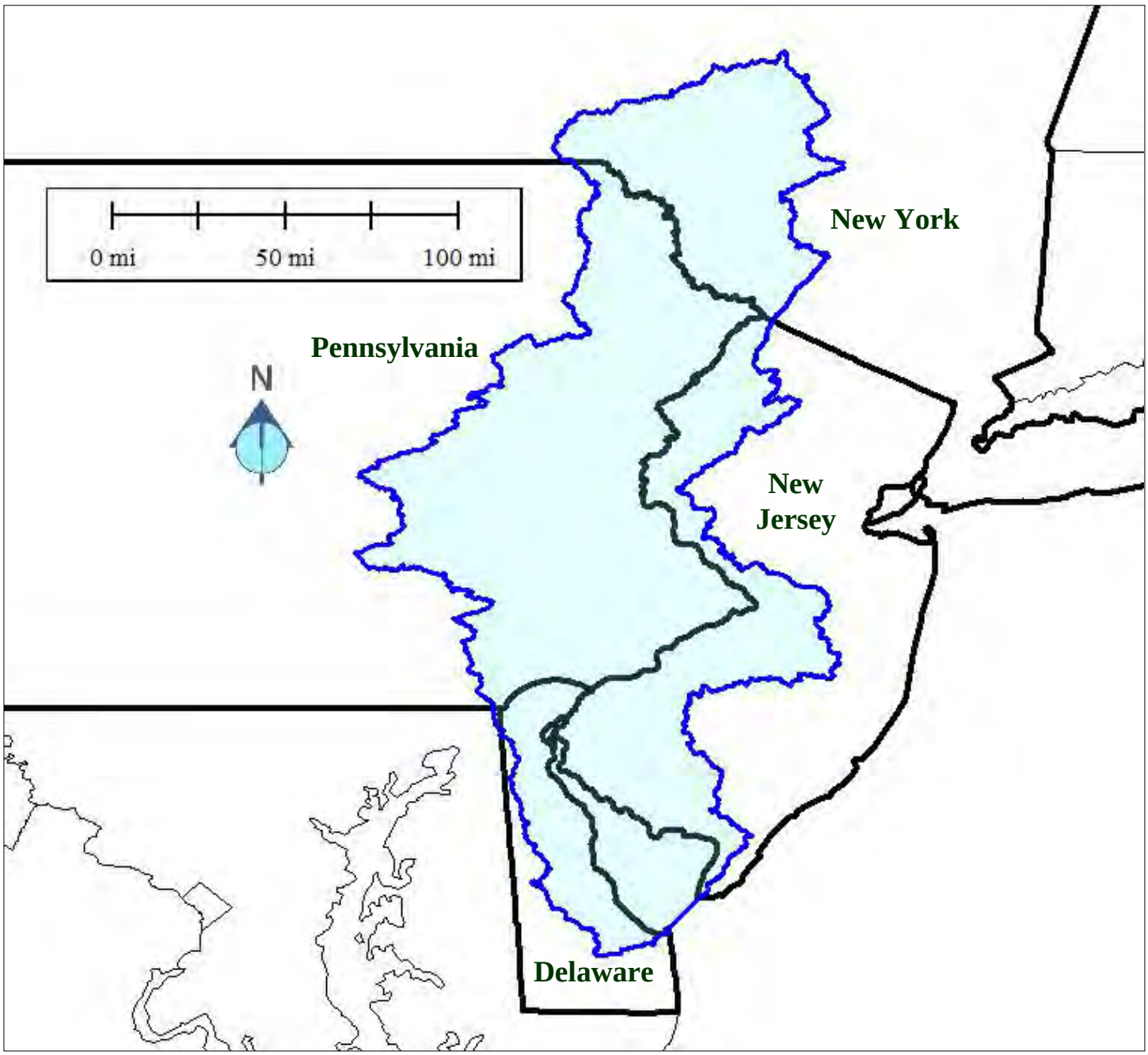

FIGURE 1. Location of the Delaware River Basin (blue) in Pennsylvania, New York, New Jersey, and Delaware.

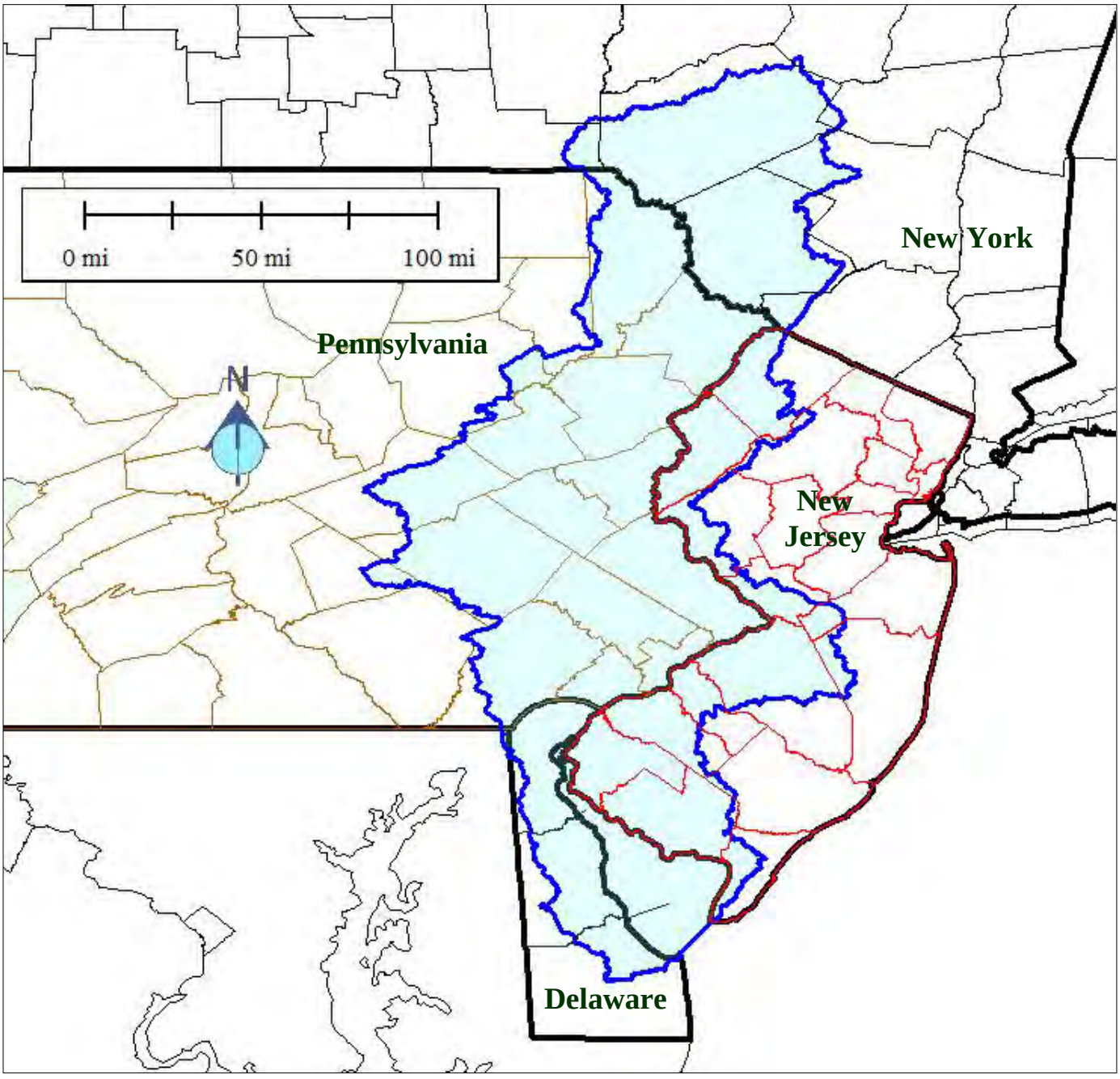

FIGURE 2. Location of the Delaware River Basin (blue) in Pennsylvania, New York, New Jersey, and Delaware, with counties outlined.

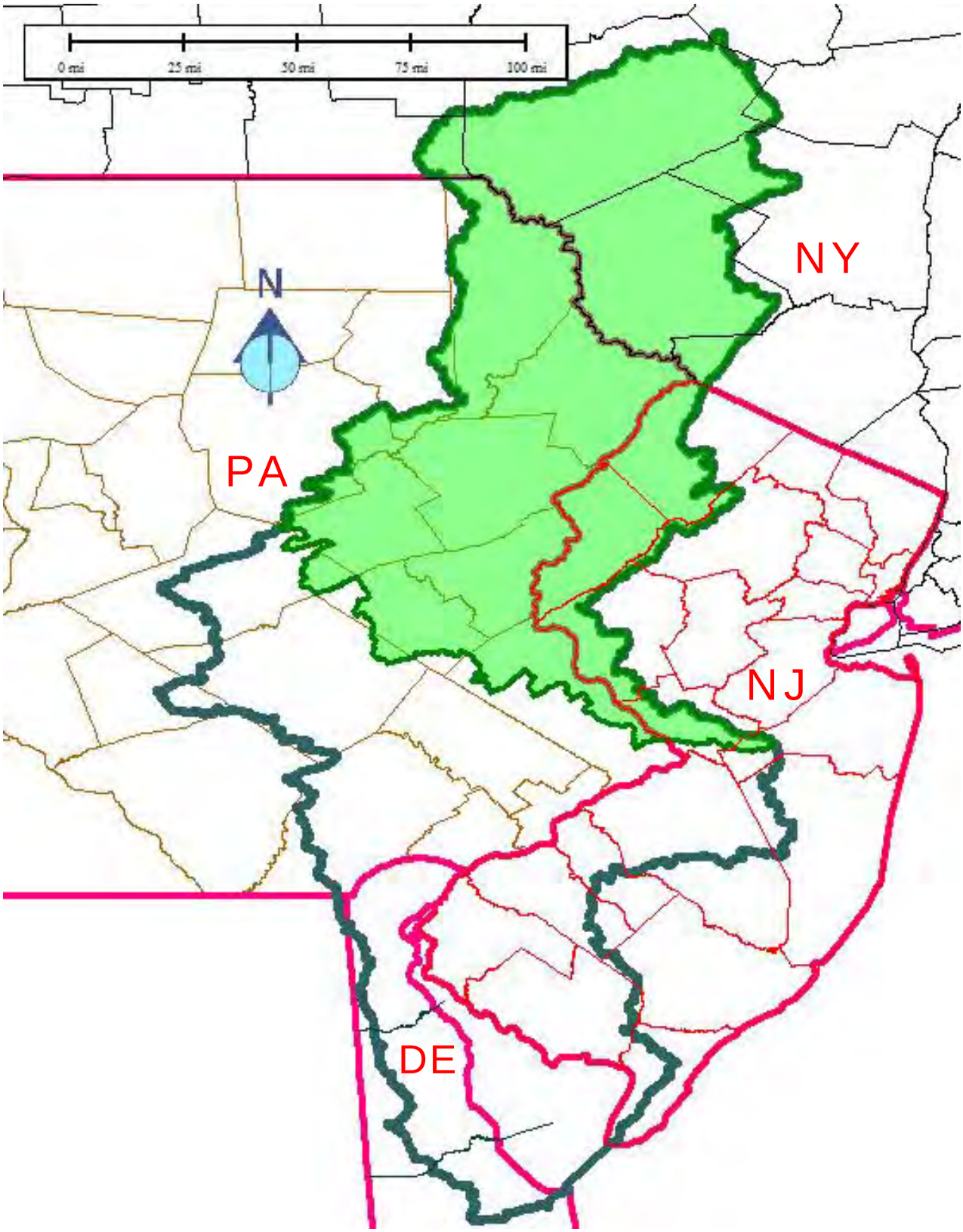

FIGURE 3. Identification of the Special Protection Waters area (green) within the jurisdiction of the DRBC (heavy outline) and member states (red). Counties also are shown. Approximately 50% of the DRBC Special Protection Waters are in PA, 35% are in NY, and 15% are in NJ.

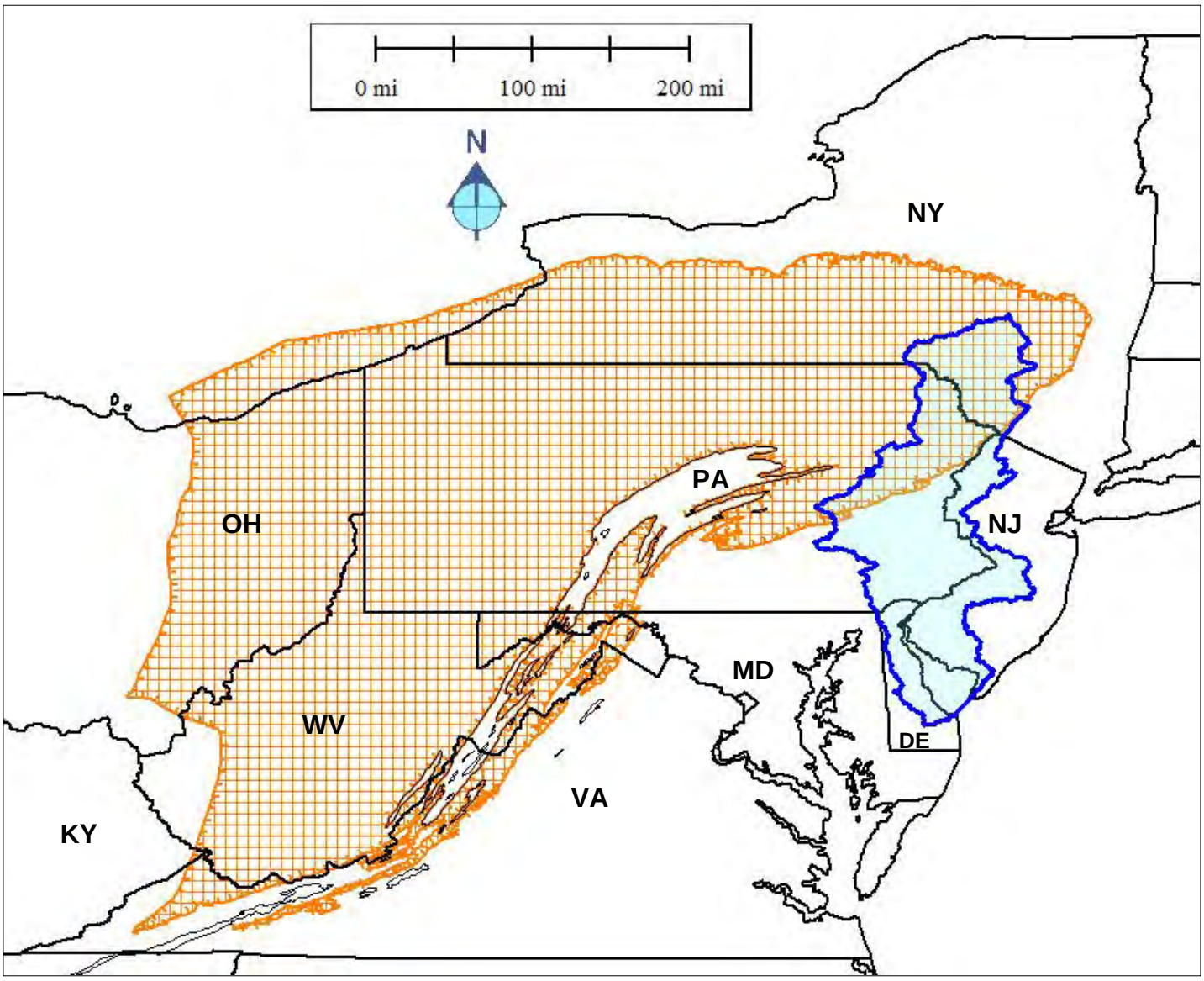

FIGURE 4. Location of area within the northeastern United States underlain by Marcellus Shale reserves (orange crosshatch). Delaware River Basin is in blue. Only 5% of the Marcellus Shale is within the Delaware River Basin, and it is found only within Pennsylvania and New York.

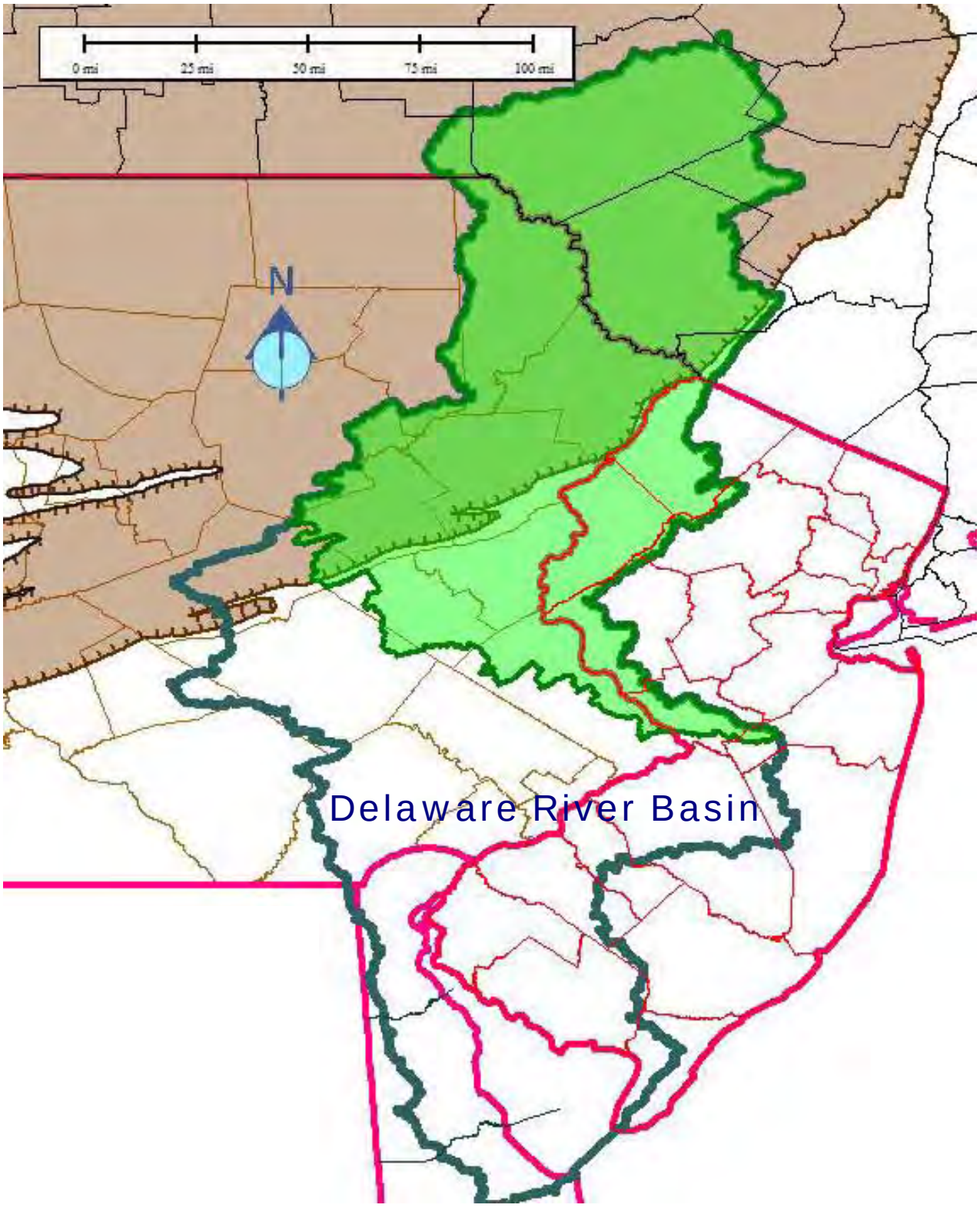

FIGURE 5. Location of Marcellus Shale reserves (brown) in relation to the Special Protection Waters section (green) of the Delaware River Basin (heavy outline). State boundaries are in red. Counties also are shown.