



## COMMENT ON CHESAPEAKE DOCKET

July 10, 2009  
Carol Collier, Executive Director  
Commissioners  
Delaware River Basin Commission  
West Trenton, New Jersey

Re: Docket No. D-2009-20-1, Chesapeake Appalachia, LLC

Dear Executive Director Collier and Commissioners,

Delaware Riverkeeper Network recommends that the Commission postpone action on Docket No. D-2009-20-1, Chesapeake Appalachia, LLC ("the Docket") at this time. It is premature to approve a water withdrawal from the West Branch for natural gas drilling activities. The Commission should complete key planning and management initiatives and should require complete information from applicants before granting any approvals for water withdrawal from the Basin, particularly in the upper tributaries of the Delaware River.

### Special Protection Waters Regulations

The DRBC's Executive Director Determination stated that natural gas development was expected to have the potential to substantially impact the water resources of the Delaware River Basin's Special Protection Waters (SPW), which includes the West Branch of the Delaware River, and that the Commission would review and condition approvals based on avoiding the degradation of these exceptional waters. The draft Docket's "On Site Findings" discusses SPW requirements. Yet there are ongoing studies and new analyses that would accompany the development of rulemaking to amend the Water Code for natural gas extraction and development that need to be completed in order to accurately assess the impacts of this Docket and future gas-related dockets. Such assessment is necessary in order to plan and design natural gas projects so that degradation of the resources of Special Protection Waters can be prevented. Action should not be taken in the absence of such critical information.

### Flow Management Issues

The Commission is in the process of developing the Flexible Flow Management Plan (FFMP) for the Delaware River<sup>[1]</sup>. New Amendments to the Commission's Water Code are being developed after

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previously proposed amendments (published December 2007) were withdrawn in December 2008, amidst much public controversy; complaints about the poor performance of the FFMP regime in regard to fish protection by the PA Fish and Boat Commission were key in having the proposed plan withdrawn[2]. The new rulemaking process is ongoing; several studies and analyses are being conducted by Commission committees, subcommittees and staff. Until that process is completed, no approvals for water withdrawals or gas development and extraction projects should be granted. There has been much data and scientific study on the upper tributaries of the River, but the information needed to finalize the FFMP is not complete. Complete information is needed to inform decisions regarding any further allocation of water, especially for a consumptive use, such as this Docket represents.

In the interim while the FFMP studies are being developed, the Supreme Court Decree Parties (States of New York, Pennsylvania, New Jersey, Delaware and City of New York) put in place a management plan for releases from the New York City reservoirs. Most recently, the Decree Parties announced changes to the FFMP[3] in June for the period June 1, 2009 to May 31, 2010. The changes were aimed at improving downstream habitat by additional release of cold water. The West Branch of the Delaware will receive an additional 100 cubic feet per second (cfs) from Cannonsville to improve trout habitat during the summer months. Barring drought conditions, this will translate into 300-325 cfs of cold water released at Cannonsville to reduce thermal stress on fish in the West Branch and in the upper reaches of the main stem for most of this season. An "Extraordinary Needs Bank" was also established to hold water for other needs that may arise. Also New York City was allowed more flexibility in reservoir operations to try to reduce the rapid fluctuations of releases which can cause havoc on downstream aquatic life. State fishery experts and technical review of the effects of the FFMP over the past season led to the changes.

Even with these recent changes, the FFMP is still considered flawed by many because it assumes that New York City is diverting its full allocation of 800 mgd when the average annual diversion is closer to 500 mgd. Fish conservationists argue that if the actual diversion is used to set the release program there would be more water that could be released to benefit the fishery downstream of Cannonsville (on the West Branch) and Pepacton (on the East Branch) Reservoirs[4]. And on July 8, Peter Kolesar lodged an email complaint with the DRBC about "ramping", the sudden drop in reservoir releases from Cannonsville. He submitted a USGS graph showing the precipitous drop from over 1000 cfs to about 300 cfs overnight; such sudden changes in flow are harmful to life in the West Branch[5].

These recent events regarding the FFMP illustrate the level of involvement and the technical complexities of flow management in the Delaware River, particularly the Upper Delaware main stem and the upper tributaries. Of course, the three New York City reservoirs in the upper River supply 8 million city dwellers with water, which dominates Delaware River management goals. Layered into the rubric of Upper Delaware flow management is the required minimum flow target at Montague that New York City is required to maintain through reservoir releases to protect the Delaware River downstream, including deflecting salt intrusion at Philadelphia/Camden and maintaining water supply quality for the 7 million downstream people who rely on the Delaware River for water. Substantial public involvement, government studies, technical analyses and re-analyses go into every cubic foot per second that is released to the River's streams by New York City. With this reality as a backdrop, it is clear that the removal and complete depletion of 1 million gallons per day by Chesapeake through this Docket is potentially very significant for the "managed" part of this tributary (the section of the West Branch below Cannonsville Reservoir) and adds more competition for the clean cold waters of the Upper Delaware River.

Further, this withdrawal coupled with future applications for water withdrawals and/or natural gas drilling sites in the subwatershed present an even larger question in terms of total impact of this removal of water from the Basin. Yet the environmental, social/cultural, political and economic issues that are considered in the matrix of sustainability are not being considered. In fact, the approval of this Docket forecloses the ability to provide a level playing field for water withdrawal applicants going forward as it secures the 1 mgd consumptive loss as a condition for ten years. It begs the question: how will this Docket and all future water withdrawals affect the FFMP's success at meeting water supply and ecological needs? Painstaking efforts are being made by the public, scientists, and the government to manage the flow of the River and its tributaries to serve water supply and conservation needs. Will water for natural gas development trump these efforts or make meeting present goals and uses more difficult, costly, or impossible? One also has to ask, whose water is being allocated? New York City is making reservoir releases under an Agreement forged by the Supreme Court Decree Parties. Is Chesapeake taking some of New York's released waters that are supposed to be augmenting flow for fish in the West Branch and upper main stem? Will other withdrawals eat into the efficacy of the FFMP's reservoir releases? And at whose expense?

There has been no public discussion of these issues. Before approval is granted, there should be an analysis of how this Docket will interplay with the FFMP and the ecology of the West Branch and the main stem. A plan should be developed that provides a calculation of how much total water can be removed from this subwatershed without degrading SPW resources. Also, location of withdrawals, rate and timing of withdrawal, pass-by flow requirements, nonpoint source pollution control plans and other aspects of Dockets can be informed by an analysis of flow regime needs. This is essential to prevent water resource depletion.

#### Chesapeake Build-out Analysis

The Commission should require a build-out analysis of Chesapeake's planned natural gas drilling activities in the Basin before the Docket is approved. All wells that will use the water withdrawn should be reviewed and considered by the Commission at the same time as the water withdrawal is considered. The segmenting of the wells from the water withdrawal Docket removes information from consideration such as: How much water will ultimately be used by how many wells? Where will they be located? What will be the net export of wastewater after well development? What will the spacing be between wells? What is the ultimate change in land cover that needs to be addressed by nonpoint source pollution control planning? What are the potential water quality impacts on the West Branch such as temperature, flow regime (hydrology), dilution of pollutants, and pollutant loading?

The 10 year permit cycle could be used as a planning horizon for the short term. This build-out analysis will help the Commission plan for Chesapeake's natural gas activities so that degradation of water resources can be avoided. Without understanding the full scope of the planned gas well development, the impacts can't be accurately assessed.

Some vital information is obviously missing from the Docket. For instance, how many wells will be served by the 1 million gallon per day withdrawal? There is no explanation in the application or Draft Docket of how the need for this quantity of water was justified by Chesapeake to the Commission. Will this provide all the water needed for gas well development on all of Chesapeake's lease holdings in the Delaware River Basin? If not, what amount is needed?

The segmentation of the well permits from the water withdrawal and the lack of a comprehensive analysis by Chesapeake also undermines the Commission's ability to comply with SPW requirements. For example, the Area/Wells Served section of the draft Docket (A.3.) does not properly address the service area that is supposed to be defined in a water withdrawal application in the drainage area of SPW. One of the reasons the Area Served is to be defined is because a Non-Point Source Pollution Control Plan (NPSPCP) is to be submitted for the project service area located within the drainage area of SPW (Water Code Article 3.10.3.A.2.e.1) and 2)). The Draft Docket only requires a NPSPCP for the area where the facilities for the water withdrawal project is to be constructed ("Cutrone Site"). This is not correct. Section 1) referenced above makes it clear that the service area for a withdrawal is the area to be served by that withdrawal, not just the withdrawal site. Section 2) further reinforces this by requiring that when a project is expanded, the system can only serve an area regulated by a Non-Point Source Pollution Control Plan approved by the Commission.

Until the location and plans for all wells where the water is to be used are identified and permitted, the Area Served cannot be correctly defined and acceptable NPSPC plans developed. Setbacks distances, separation distances, spacing of structures, type of materials to be used, BMPs to be employed cannot be specifically developed until all well sites are located and site plans produced. And until a build-out analysis for Chesapeake operations within the Delaware River Basin is produced, the full impact of the use of the water will not be known (and unknown negative impacts cannot be reasonably avoided).

#### Absence of a Non-Point Source Pollution Control Plan

An additional problem is that the Draft Docket does not even meet the requirements of the development of a Non-Point Source Pollution Control Plan for the facilities that will be constructed at the Cutrone site, which is in violation of Water Code Article 3.10.3.A.2.e.1) and 2). Chesapeake did not submit a site specific Non-Point Source Pollution Control Plan for the water withdrawal site and facilities at the Cutrone Site. Chesapeake submitted a general boilerplate plan that did not meet DRBC requirements; therefore the Chesapeake application is incomplete.

However, the Draft Docket proposes to allow Chesapeake to submit the Non-Point Source Pollution Control Plan for the Cutrone Site after approval as long as they submit it to the DRBC and secure Executive Director Approval before construction or water withdrawal. This removes the Non-Point Source Pollution Control Plan from public review through the public comment and Hearing process that has been instituted for this application. Such a proposed course of action is completely inappropriate and is another reason why the approval of this Draft Permit should be postponed. Pollution from runoff at this location constitutes a significant threat to the water quality of the West Branch, classified by PADEP as a Cold Water Fishery, Migratory Fish<sup>[6]</sup> and by PA Fish and Boat Commission as a "Naturally reproducing trout stream, May 15, 2009"<sup>[7]</sup>.

The West Branch of the Delaware River is very sensitive to nonpoint source pollution due to fish habitat needs and the water uses to be protected as per its classification, which include water supplies, maintenance and propagation of resident game fish and other aquatic life, maintenance and propagation of trout, wildlife and recreation<sup>[8]</sup>.

To illustrate the sensitivity of the stream, the story of the upper section of the West Branch is instructive. The upper section of the West Branch (UWBDR), above the Cannonsville Reservoir, begins in the town of Jefferson, Schoharie County, NY and flows 43 miles to Cannonsville. This part of the stream is fed by naturally cold headwaters that are home to wild brook trout as well as naturally reproducing brown trout. The main stem of the UWBDR runs through agricultural land and forest upstream of the impoundment and was listed on New York State's 303(d) list in 1998 due to phosphorus loads. Since the UWBDR feeds New York City's Cannonsville Reservoir, cleaning up the phosphorus problem was a high priority for the State. NYSDEC completed a TMDL for phosphorus, approved by EPA in 2000. An aggressive restoration program was implemented and the stream was cleaned up to standards through the work of many agencies, councils, watershed associations, municipalities, academic institutions, environmental coalitions, and New York City. In 2004 New York State removed the UWBDR from the 303(d) list<sup>[9]</sup>. The water quality of the West Branch's upper reach, Cannonsville Reservoir and the lower reach of the West Branch have been improved in terms of nonpoint source pollution.

This success story shows how a stream can become polluted from nonpoint source pollution and how much effort and cost must be invested to successfully address the diffuse sources of that pollution. The upper West Branch has already been compromised and brought back and we should learn from that experience that prevention of nonpoint source pollution makes sense and should be a top priority when changed land use occurs. This is why the Commission's Water Code requires a NPSPCP. And it is why this plan should not be left out of the Public Hearing and approval process, not set aside to a later date and less public course of action.

### Basinwide Analysis

Considering that the industry forecasts that Marcellus Shale could be the largest producer of natural gas in the nation and considering that the most prolific Marcellus formation is thought to be located in the Northeast portion of the formation (Wayne County, PA and Delaware and Sullivan Counties, NY) it is reasonable to expect that natural gas production will be a major activity in the Delaware River watershed for many decades. Terry Engelder, Penn State Geoscientist, projects that 168-516 trillion cubic feet of gas is contained in the Marcellus Shale field and that about 50<sup>[10]</sup>-360<sup>[11]</sup> trillion cubic feet of that is recoverable. Engelder estimates the value of this at \$1 trillion, a major asset for the industry.

The Commission should recognize that natural gas activities, once established, are here for the long term. The life of a typical well is 20 years; it is reasonable to assume that the industry will be a dominant resource user here for the next 50 years or so. This requires planning and assessment on a large scale. While the Chesapeake build out is not difficult to develop, admittedly a basin-wide analysis of how gas drilling can be expected to affect water resources throughout the Watershed requires more assumptions and modeling. But using data such as industry projections of the most efficient spacing of wells, the land needed for each well site, signed leases, and a projection of water consumption needs and wastewater disposal, a projection of the fully built gas industry in the Basin could be modeled and the resource consumption calculated. This could then be used to assess the impacts of these activities on the resources of the Watershed, including Special Protection Waters (to prevent degradation) and the other designated uses of the River (to avoid diminishing impacts) and will help inform better decision making regarding Dockets.

## Pass-by Flow

The use of the 7Q10 to develop the pass-by flow for the withdrawal limits for this application, as is proposed in the Draft Docket, is not protective enough to prevent degradation of the water resources of the West Branch and the Basin's Special Protection Waters. The aquatic life of the stream, fish, the ecological flow needs, water quality, and the stream's hydrology need to be adequately protected in order to avoid degradation. An alternative method of setting a pass-by flow that takes these factors into account must be developed.

There are current efforts to develop a more protective and ecologically sensitive flow management method through the Flexible Flow Management Plan for which the Commission is developing rulemaking and through the work of DRBC's Regulated Flow Advisory Committee and Subcommittee on Ecological Flows, which are examining various ecological flow and hydrologic flow tools for use by the Commission in setting minimum flow standards. That work is not complete. Until the Commission adopts a better method to set a minimum flow of water in a waterway, approvals for withdrawals based on a pass-by flow calculated on the 7Q10 should not be approved.

The nationally recognized Instream Flow Council explains that the 7Q10 is not an instream flow method; it is a flow statistic designed to be used to set the volume of water needed in a stream to meet point discharge water quality standards. It was never meant to be used as a method to set safe minimum stream levels, despite the fact that some States use it. The Instream Flow Council states "The hydrologic statistic has often been misused as a minimum flow for keeping fish alive".<sup>[12]</sup> They go on to point out "This method should only be used to determine wastewater discharge criteria...This method does not protect aquatic life (Camp Dresser and McKee 1986) and its use as a standard to do so is inappropriate...The 7Q10 should never be used to make instream flow prescriptions for riverine stewardship...the 7Q10 drought flow is inadequate to conserve aquatic life or ecological integrity."<sup>[13]</sup> They further explain that "Fish communities can generally withstand near-drought conditions that occur infrequently and for short periods. However, setting such a flow as a long-term condition will not sustain them. The influence of flow on aquatic organisms includes more than just magnitude and frequency, duration and season are also important. Making such a low flow the norm is like recommending the sickest day of your life as a satisfactory level for future well-being. Use of the 7Q10 persists because it favors off-stream uses. However, it does so by sacrificing the fish and wildlife resources that belong to the public and over which government has a stewardship responsibility."<sup>[14]</sup>

While it may be argued that 48 cfs, which is the minimum flow (based on the 7Q10) set as the pass-by flow in the draft Docket is not likely to occur often, the use of this method to set the minimum flow establishes this pass-by flow as what the Commission considers to be an acceptable protective measure that could, especially in times of low rainfall or drought or when New York requires more water, become the bottom line for the stream at this location. And once further withdrawals or drilling activities occur in the contributing watershed, the occurrence of 48 cfs could become more frequent. Based on the Instream Flow Council's critical analysis, this could be devastating to fish, aquatic life, and the ecology of the West Branch. In addition to the Commission's goals of non-degradation of SPW resources, Pennsylvania's classification of the stream as Cold Water Fishery, Migratory Fish and the stated "water uses to be protected"<sup>[15]</sup> (as stated above include "maintenance and propagation of resident game fish and other aquatic life, maintenance and propagation of trout") require a protective pass-by or minimum flow level, not one based on the 7Q10. To establish this precedent now is a grave mistake. Is the Commission going to relegate the future of the West Branch to the "sickest day of its life"?

Another consideration is that the aquatic life of the upper reaches of the Delaware River includes species in addition to trout that are sensitive to flow and temperature changes. The impact of water withdrawals and gas drilling activities, including this draft Docket, on these species is an important consideration that can be fleshed out during the gas drilling rulemaking process on which the Commission is now embarking. The federally endangered dwarf wedgemussel, *Alasmidonta heterodon*, requires specific flow regimes and temperature, and are found in the upper Delaware River (3 locations in the upper Delaware River mainstem were identified in 2000, Lellis 2001). One documented site that supports dwarf wedgemussels is located just downstream of the Cutron site, below the confluence of the West and East Branches of the River at River Mile 323.

The National Park Service has issued a report that discusses the impacts of flow and temperature on these populations [16]; the setting of a pass-by flow needs to take this into consideration. The advent of gas drilling in the Upper Delaware brings a large resource-consumer and substantial environmental influence into this sensitively balanced ecosystem. Minimum flow standards must take the needs of this federally endangered species into account. In addition, the American eel, a wondrous creature that migrates to the upper River from the Sargasso Sea, and the iconic American Shad that migrate here to spawn, also have habitat needs that are required to be protected according to existing stream designations.

For the Commission's consideration, the Instream Flow Council analyzes dozens of instream flow assessment tools in the referenced publication. Among them is the New England Aquatic Base Flow standard and methods based on the natural flow paradigm. In New Jersey, the NJ Highlands Water Protection and Planning Council has adopted the Low Flow Margin of Safety, which is conservative statistically based method. These methods are doubtless being evaluated by the Commission's SEF. Until a reliably protective minimum flow method can be adopted by the Commission and the rulemaking process can consider all the issues that need to be addressed by regulation of natural gas development, this Docket should not be approved.

### Recreation

Recreation is a protected use under the PADEP Chapter 93 designation [17]. The West Branch is a renowned trout fishing stream which is at the center of the fly fishing ecotourism industry and a popular canoeing stream. Trout fishing is a major activity that drives the local economy and is central to the cultural and social values of the region, including Hancock, which is located across the River in New York, above Point Mountain. Noise, industrial activity, lights, stormwater runoff, traffic, air emissions and withdrawal of water all could negatively impact the West Branch in terms of trout habitat and the experience of fishing. The Chesapeake application states that operations at the site "could increase to 18 to 24 hours per day" for part of a month when there is "high flow and/or multiple fracturing procedures" [18]. Also, the Site Plan shows four water hydrants which the applicant states will allow for multiple trucks to fill up at one time [19]. This will mean the capability of several trucks at once to be active on the site, compounding local impacts.

There are 2 canoe launch areas that are within a short distance of the Cutron site, both of which may be negatively impacted by noise, industrial activity, truck traffic, air emissions and stormwater runoff for the proposed facilities at the Cutron site. The Balls Eddy Access Area is located at Mile 4.6, upstream of the Cutron site. It is a PA Fish and Boat Commission facility and consists of a boat ramp, parking, trash disposal and privies. The launch is only accessible from Route 191, which is the road that provides access to the Cutron site. The Shehawken Access Area at Shehawken Creek (river mile 0.6, less than a mile from main stem confluence) is provided by the PA Fish and Boat Commission and also has access from Route 191, at the junction of Route 370. The site is rustic with limited parking and no facilities. This site is downstream less than a mile from the Cutron site and will likely be directly impacted by the Cutron site operations, perhaps even visually.

Have these impacts been considered in terms of mitigating scenic intrusion, the degradation of the recreational experience and local habitat, noise and light pollution, and air emission effects? There is no mention of this in the Docket or application.

### Questions

We have several questions regarding the draft Docket Section C. Decision:

1. Condition I. f. and g. Will PADEP apply stormwater regulations through its construction program or through its Oil and Gas Division program?
2. Condition I. i. Can clearing and construction of the Cutron site facilities begin upon Docket approval, before natural gas well permits are issued?
3. Condition I. i. Will the Commission be reviewing and approving Dockets for natural gas wells or will the States alone have primacy in the review and approval of natural gas well permits in the Basin?
4. Condition I. i. Can Chesapeake use the withdrawn water for gas well development at wells which do not identify shale as the target formation? This condition sounds as if Chesapeake cannot, for instance, use water withdrawn from the Cutron site for well development in the Oriskany formation (i.e. the Robson well).
5. Condition I. q. What does this refer to exactly? For instance, can the Executive Director approve the export of withdrawn water to wells outside of the Delaware River Basin? Can the Executive Director approve the transfer of withdrawn water by Chesapeake to another entity for use at their wells?
6. Condition I. n. Can Chesapeake construct the facilities prior to approval of an Operation Plan as long as it is before water withdrawal?
7. Condition I. w. What is the definition of "zone of influence"?
8. Condition I. y. Is this use classified as "nonessential" in regards to drought emergency restrictions?

### Further Comments

1. Condition I. n. The Operation Plan should be required to be approved with the application as part of this public Docket approval process. Until the Operation Plan is submitted and approved, the draft Docket should be postponed.
2. Condition I. p. Produced waters that are removed as wastewater from gas well sites should be metered and recorded also so that the Commission can track the volume of wastewater that is being transferred out of the Basin.



3. Expiration Date: We do not agree that this Docket should be approved and urge the Commission to postpone action at this time, as discussed above. However, regarding the length of approval, 10 years is too long. Due to the emergent nature of this industrial activity in the Delaware River Watershed, the permit length should be shortened to a 3 to 5 year period. Changes in industrial technology are occurring regularly and, regarding shale well development, new technologies and mechanics are developing and being adopted very quickly. Also, environmental and flow conditions related to the River's ecosystem, global climate change, sea level rise and the FFMP and reservoir operations are all actively changing and are likely to evolve further in ways that could impact this withdrawal over the near future. This water withdrawal may be in need of revision due to these changes within the next few years so the Docket length should not exceed 3 to 5 years.

In conclusion, Delaware Riverkeeper Network recommends that the Commission postpone action on this Docket until the Commission's rulemaking on gas drilling, the FFMP and other build-out planning is completed. We urge the Commissioners to recognize the magnitude of the natural gas issue in the consideration of this water withdrawal, which is just the beginning of what will doubtless be a transforming activity in our Watershed. Action by the Commission needs to be very conservative due to the scale and nature of gas development and it is reasonable and essential that all planning, assessments and rulemaking be completed before Dockets are approved.

Thank you for your consideration.

Sincerely,

Maya K. van Rossum  
the Delaware Riverkeeper

Tracy Carluccio  
Deputy Director

[1] <http://www.state.nj.us/drbc/FFMP/index.htm>

[2] Letter to PA DEP from PA Fish and Boat Commission dated 9.19.08.

[3] [http://water.usgs.gov/osw/odrm/documents/Temporary\\_2009\\_Summertime\\_Releases\\_Agreement\\_Final\\_Approved.pdf](http://water.usgs.gov/osw/odrm/documents/Temporary_2009_Summertime_Releases_Agreement_Final_Approved.pdf))

[4] Statement to RFAC and DRBC, Peter Kolesar and James Serio, June 17, 2009).

[5] Graph, USGS 01425000 West Branch Delaware River at Stilesville NY.

[6] <http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

[7] [http://www.fishandboat.com/trout\\_repro.pdf](http://www.fishandboat.com/trout_repro.pdf)

[8] <http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

[9] [http://www.epa.gov/nps/success/state/ny\\_wbde.htm](http://www.epa.gov/nps/success/state/ny_wbde.htm)

[10] <http://www.geosc.psu.edu/~engelder/>

[11] Mary Esch, Associated Press, [pressconnects.com](http://pressconnects.com), 11.04.08

[12] Instream Flows for Riverine Resource Stewardship, Instream Flow Council, Cheyenne, Wyoming, 2004, page178.

[13] Instream Flows for Riverine Resource Stewardship, Instream Flow Council, Cheyenne, Wyoming, 2004, page178.

[14] Instream Flows for Riverine Resource Stewardship, Instream Flow Council, Cheyenne, Wyoming, 2004, page178-9.

[15] <http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

[16] Predicting Flow and Temperature Regimes at Three *Alasmidonta heterodon* Locations in the Delaware River, Technical Report NPS/NER/NRTR-2008/109, National Park Service, July 2008.

[17] <http://www.pacode.com/secure/data/025/chapter93/chap93toc.html>

[18] "Application for surface water withdrawal in the Delaware River Basin", Chesapeake Appalachia, LLC, prepared by Weston Solutions, May 2009, Project Description, page 1.

[19] "Application for surface water withdrawal in the Delaware River Basin", Chesapeake Appalachia, LLC, prepared by Weston Solutions, May 2009, Figure 3, Site Plan.