

From: Alicia Mullins
To: Frederick A. Monette
Date: 03/16/2007 1:45:41 PM
Subject: SSES Aquatic Sections

Fred,

The attached documents contain the SSES Aquatic Sections 2 and 4. If you have any questions contact me or Nathan Goodman.

Thanks

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2.2.5 Aquatic Sections

The Susquehanna Steam Electric Station (SSES) is located within the Salem Township of Luzerne County, Pennsylvania, along the Susquehanna River. The Susquehanna River is the source of water for the circulating and cooling systems at SSES. **[Onsite streams and waterbodies crossed or paralleled by transmission lines].**

The Susquehanna River covers 440 miles from Lake Otsego in New York to Havre de Grace in Maryland, where it empties into the Chesapeake Bay (PPL Susquehanna, 2006). The Susquehanna River watershed has an area of 27,500 square miles and has a flow of 19 million gallons per minute at the location where the Susquehanna River meets the Chesapeake Bay (PPL Susquehanna, 2006). The Susquehanna River has more than 49,000 miles of waterways (rivers, streams, brooks, creeks, runs, etc.) (SRBC 2006). The Susquehanna River Basin has many streams that flow into the river from upstream points. Most of these streams are unnamed, but some cross over a state border, making the Susquehanna River Basin affect three states, New York, Pennsylvania, and Maryland (Steffy and Siltinger, 2005). There are 91 crossings from state lines of streams that enter the Susquehanna River Basin (Steffy and Siltinger, 2005). 69 percent of the Susquehanna River lands are forested, with many different types of wetland areas (SRBC 2006). The Susquehanna River is a highly flooded river costing an average of 150 million dollars of flood damage a year and has a major devastating flood on average of once every 14 years (SRBC 2006).

The Chesapeake Bay is brackish, both receiving water from freshwater sources such as Rivers, as well as tidal flow from the Atlantic Ocean. Some of the larger freshwater sources for the Chesapeake Bay are also tidal, like the Potomac River and the Susquehanna River, receiving tidal water from the Chesapeake Bay. The Chesapeake Bay is North America's largest estuary (a mix of both fresh and salt water) and the world's third largest (Chesapeake Bay Foundation, 2003). The Chesapeake Bay is within a temperate zone of the eastern seaboard with distinct seasonal changes. Approximately half of the total freshwater supply to the Chesapeake Bay comes from the Susquehanna River (PPL Susquehanna, 2006). The Susquehanna River is considered to be the headwater of the Chesapeake Bay. 350 species of fish are supported by the Chesapeake Bay watershed (Chesapeake Bay Foundation, 2003). The Chesapeake Bay has almost 12,000 miles of shoreline and has an average depth of 21 feet (Chesapeake Bay Foundation, 2003).

The Susquehanna River follows a typical temperature pattern, being the coldest in the winter and showing the warmest temperatures in the late summer. Temperatures were monitored at SSES annually from February to December (PPL Susquehanna, 2006). The coldest daily average temperature for the Susquehanna River in 2004 was on December 21st, and had an average temperature of 0.1 degrees C (32.2 degrees F) (PPL Susquehanna, 2006). The warmest daily average for the Susquehanna River in 2004 was on July 5th, and had an average temperature of 26.20 degrees C (79.2 degrees F) (PPL Susquehanna, 2006). Average monthly temperatures for 2004 ranged from the coldest month of February (34.9 degrees F) to the warmest month of July (75.4 degrees F) (PPL Susquehanna, 2006).

The Susquehanna River flows across three physiographic provinces (SRBC 2006). The first being the Appalachian Plateau Province which is characterized by rugged hills of

gently tilted sandstone and shale's; the second being the Valley and Ridge Province which is characterized by sandstone and crystalline rocks that produce narrow ridges underlain by shale and limestone; and the third being the Piedmont Province which is characterized by rolling lowlands and broad highlands (SRBC 2006).

Approximately 4 million people live within the Susquehanna River watershed (SRBC 2006). Many of these people use the river for farming and drinking consumption as well as being a growing industry for outdoor tourism. **[More on commercial resources]**

The Susquehanna River is divided into six subbasins, forming one large Susquehanna River Basin. The six subbasins are Lower Susquehanna, Juniata, West Branch Susquehanna, Middle Susquehanna, Chemung, and Upper Susquehanna (Hoffman, 2002). The Lower Susquehanna River study area is considered to be all the subbasins except for the Upper Susquehanna Subbasin (Lindsey et. al, 1998). SSES is located within the Lower Susquehanna River study area. The Lower Susquehanna River study area's land use is forest areas (47 percent), agricultural areas (47 percent), urban areas (4 percent), and barren land areas (2 percent) (Lindsey et. al, 1998). Average precipitation in the Lower Susquehanna River study area ranges from 38 to 48 inches annually (Lindsey et al, 1998). The growing season for the region is May through September, and 45 percent of the annual precipitation falls during those months, most of that precipitation going to the plants for food and water (Lindsey et. al, 1998).

The Susquehanna River Basin Commission (SRBC) has identified several areas of major concerns in water quality for the Susquehanna River which are Nitrate in ground water and streams, trends in nitrogen and phosphorus concentrations, pesticides in ground water and streams, bacteria in groundwater, volatile organic compounds (VOCs) in ground water, radon in groundwater, trace elements in fish tissue and sediment, pesticides and other organics in fish tissue and sediment, biological communities and stream habitat (Lindsey et. al, 1998). Over 20 percent of the samples taken from streams and wells indicated levels of nitrate-nitrogen exceeded Maximum Contaminant Levels (MCL) put forth by the US Environmental Protection Agency (EPA) in 1992-1995 (Lindsey et. al, 1998). According to the SRBC, levels of pesticides, bacteria, VOCs, and radon in the water seldom exceeded levels established by the state of Pennsylvania as drinking water standards (Lindsey et. al, 1998). **[more on trace elements in fish]**

PPL Susquehanna set up a monitoring program in 1971 to assess several parameters including water quality, algae, benthic macroinvertebrates, and fish. This program ran from 1971 until 1994, when it was reduced in scope to only include fish populations and water quality (PPL Susquehanna, 2006). There were three stations set up to perform this monitoring, one upstream called upriver control station and two downstream called Bell Bend and Bell Bend I (PPL Susquehanna, 2006).

Algae, only monitored by PPL Susquehanna until 1994, found 42 genera of periphyton at the upriver control station, 39 at Bell Bend, and 40 at the Bell Bend I during the 1994 study year (PPL Susquehanna, 2006). Diatoms comprised of over 75% of all the attached algal cells found at all three monitoring sites during the 1994 study year (PPL Susquehanna, 2006). There was a shift at all three sites in periphyton algae from green algae and diatoms to mainly diatoms during the years of operation at SSES (PPL Susquehanna, 2006).

Most Benthic macroinvertebrate monitoring is focused on the EPA's ephemeroptera, plecoptera, and trichoptera (EPT) index. All species in the EPT index are considered to be pollution sensitive. At SSES, Benthic Macroinvertebrates were monitored from 1980 to 1994. At the beginning of the monitoring years (1980-1982), there were both trichopterans and ephemeropterans present with a reasonably equal distribution, however, as the monitoring continued (1982-1994), ephemeropterans became much more dominant compared to the trichopterans, and dominated the biomass collections (PPL Susquehanna, 2006). Having a high EPT index, with the presence of all three invertebrate genus is a sign of high water quality. On the lower west branch of the Susquehanna River, 13 different orders of invertebrates were found (Lower West Branch Susquehanna River Conservation Plan, 2003). These orders are Turbellaria, Annelida, Decapoda, Plecoptera, Ephemeroptera, Odonata, Megaloptera, Trichoptera, Lepidoptera, Coleoptera, Diptera, Gastropoda, and Pelecypoda (Lower West Branch Susquehanna River Conservation Plan, 2003).

In the Susquehanna River Basin, there are three species of freshwater mollusks that require attention because they are showing signs of conservation needs. They are the brook floater (*Alasmidonta varicose*), green floater (*Lasmigona subviridis*), and yellow lamp muscle (*Lampsilis cariosa*) (Comprehensive Wildlife Conservation Strategy for New York). There are four species of mollusks that historically lived in the Susquehanna River Basin and are thought to be extirpated, which are elktoe (*Alasmidonta heterodon*), lance aplexa (*Aplexa elongata*), spindle lymnaea (*Acella haldemani*), and tidewater mucket (*Leptodea ochracea*) (Comprehensive Wildlife Conservation Strategy for New York). There are zebra mussels (*Dreissena polymorpha*) in Goodyear Lake that travel downstream into the Upper Susquehanna River Basin from the outflow of Goodyear Lake (Horvath and Alfred, 2005).

The Susquehanna River in the vicinity of SSES supports both warmwater and coolwater fishes, of which the most common families found are the Notropids (minnows), Catostomids (suckers), Ictalurids (catfish), Centrachids (sunfish), and Percids (darters and perch) (PPL Susquehanna, 2006). The Susquehanna River also had both smallmouth bass (*Micropterus dolomieu*) and walleye (*Stizostedion vitreum*) observed at the monitoring stations (PPL Susquehanna, 2006). Since the shift in 1995 to concentrate on water quality and fish studies, PPL Susquehanna has reported a decline in seven fish species at the Bell Bend monitoring station. These are quillback (*Sebastes maliger*), white sucker (*Catostomus commersoni*), northern hog sucker (*Hypentelium nigricans*), shorthead redhorse (*Moxostoma macrolepidotum*); muskellunge (*Esox masquinongy*), rock bass (*Ambloplites Constellatus*), and smallmouth bass. American shad (*Alosa sapidissima*) and striped bass have made a comeback since the first fish lift in 1991, although no essential habitat has been identified to be in the vicinity of the SSES. American eel have a large presence in the Susquehanna River.

Quillback are part of the Catostomidae (sucker) family which is comprised of 25 fish species (DNR, 2005). Quillback populations in the north east are considered to be stable, abundant, and common (DNR, 2005). Quillback is a warmwater fish, found in rivers and smaller streams. They like a wide variety of substrate habitat but are seldom found in mud areas and spawn in riffle areas, usually in the smaller streams (DNR, 2005). Quillback mostly live in slow moving water ranges. The major problem facing quillback on the Susquehanna River is the continual degradation to habitat as a result of deforestation and urbanization (DNR, 2005). The white sucker is native to the

Susquehanna River Basin, and lives in the Susquehanna River and its tributaries. The white sucker prefers deeper waters (Susquehanna River over smaller tributaries) during the non spawning months, and more shallow waters with riffles for spawning (DNR, 2007). Spawning usually occurs in April and May (DNR, 2007). Adults are bottom feeders and feed during the day and night (DNR, 2007). There are no reported incidents of white suckers being unstable in the Susquehanna River Basin. The northern hog sucker is considered to be a good indicator of water quality (Pennsylvania Fishes, chapter 12). They are a warmwater fish. They spawn in the spring, prefer shallow, riffle waters during spawning, prefer deep waters during the winter months, and do not like mud substrate preferring rocky, gravel, substrate (Pennsylvania Fishes, chapter 12). The shorthead redhorse is also in the sucker family, and has many of the same attributes as the other suckers. However, the shorthead redhorse is tolerant of muddy substrate, and can live and spawn in large rivers (Pennsylvania Fishes, chapter 12). They also spawn in April and May, but instead of requiring riffle habitat can spawn in shallow gravel or rubble substrate with medium or fast moving water (Pennsylvania Fishes, chapter 12).

The Muskellunge is part of the Esocidae (pike) family and native to the Susquehanna River. Muskellunge is dramatically increasing in numbers across rivers in Pennsylvania and being an excellent predator is generally attributed to the increase. Muskellunge are a coldwater fish, found mostly in lakes and large rivers (Pennsylvania Fishes, chapter 14). Muskellunge spawn in the spring, traveling to shallow waters, usually waiting to spawn until shortly after its relative, the northern pike (Pennsylvania Fishes, chapter 14). Muskellunge are solitary predators, and don't travel much during their lives, some even thought to spend entirely in one river pool, or one section of a lake, and feed on fish (Pennsylvania Fishes, chapter 14).

Rock bass is in the Centrarchidae (sunfish) family. Also native to the Susquehanna River, rock bass are very abundant throughout Pennsylvania (Pennsylvania Fishes, chapter 22). Rock bass spawn in late spring or early summer (May or June), and usually spawn in rocky substrate, even underneath large rocks (Pennsylvania Fishes, chapter 22). Rock bass live in large and small rivers, as well as some streams. Like many other fish on the Susquehanna River, rock bass face potential decreases in population from environmental degradation due to habitat loss from deforestation and urbanization (DNR, 2007). Smallmouth bass, in the same family as the rock bass, are also native to the Susquehanna River. Smallmouth bass prefer rocky substrate, with fast moving water, usually found in medium to large rivers and medium to large streams (Pennsylvania Fishes, chapter 22). In these fast moving waters, the smallmouth bass prefers to stay in the pools, behind boulders or other rocks. They spawn in May utilizing rocky riffle habitat and substrate (Pennsylvania Fishes, chapter 22).

Both the American shad and the striped bass are anadromous fish, ones that spawn in freshwater and live in saltwater. Although they are not known to spawn in the area of SSES, they are abundant in the lower regions of the Susquehanna River and thought to be making a comeback to the region of SSES. Both fish, if a return to the upper areas of the Susquehanna River would have impacts on the commercial industry as well as anglers fishing for fun and sport. Restoration for these fish on the Susquehanna River are currently managed by the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRFC), whose membership includes Pennsylvania Fish and Boat Commission, US Fish and Wildlife Service, National Marine Fisheries Service, Maryland

Department of Natural Resources, New York Department of Conservation, and the Susquehanna River Basin Commission (Lower West Branch Susquehanna River Conservation Plan, 2003). The goal of the SRAFRC is to have over 2 million shad in the Susquehanna River Basin.

There are currently no threatened or endangered aquatic species in the vicinity of SSES (FWS letter, 2007). Therefore, no section 7 consultation is required. Further, there is no essential fish habitat in the vicinity of SSES (NMFS, 2007). Therefore, no Essential Fish Habitat is required. **[is this the right way to phrase this]**

2.2.5 References

PPL Susquehanna. 2006. Appendix E Applicant's Environmental Report – Operating License Renewal Stage Susquehanna Steam Electric Station. September.

Chesapeake Bay Foundation. 2003. General Information about Chesapeake Bay – Fact Sheet. Found at www.cbf.org. May.

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Department of Natural Resources. Rock Bass Information Sheet. <http://www.dnr.state.mn.us/fish/bass/rock/index.html>

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Horvath, Thomas. Alfred, David. 2005. Survey of zebra mussel (*Dreissena polymorpha*) veligers flowing down the Susquehanna River downstream of Goodyear Lake. Summer 2005. State University of New York Publishing.

4.1.1 Entrainment

For power plants with once-through cooling systems, the entrainment of fish and shellfish in early life stages by nuclear power plant cooling systems is considered a Category 2 issue that requires plant-specific assessment for license renewal. SSES does not operate under once-through cooling, therefore the issue of entrainment of fish and shellfish does not apply.

Table 4.X Category 2 Issues Applicable to the Operation of the SSES Cooling System During the Renewal Term

Issue-10 CFR 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR Part 51.53(c)(3)(ii) Subparagraph	SEIS Section
Aquatic Ecology			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2	B	4.1.1
Impingement of fish and shellfish	4.2.2.1.3	B	4.1.2
Heat shock	4.2.2.1.4	B	4.1.3

4.1.2 Impingement

For plants with once-through cooling systems, impingement of fish and shellfish on debris screens of cooling water system intakes is considered a Category 2 issue, requiring a site-specific assessment before license renewal. SSES does not operate under once-through cooling, therefore the issue of impingement does not apply.

4.1.3 Heat Shock

For plants with once-through cooling systems, the effects of heat shock are listed as a Category 2 issue, requiring a site-specific assessment before license renewal. SSES does not use once-through cooling, therefore the issue of heat shock does not apply.

Section 4.6.1 Aquatic Species

No Federally listed or proposed threatened and endangered aquatic species, with the exception of transient individuals, are known to exist in the vicinity of SSES or the aquatic habitats crossed by the transmission lines associated with SSES. **[Are there Federally listed or proposed threatened and endangered aquatic species located in counties that T-line crosses? (Verify with and reference Fish and Wildlife Service Letter when received)]** There are no plans to conduct refurbishment or construction at SSES during the period covered by the relicensing (PPL Susquehanna, 2006). The staff's conclusion is that the potential impacts on threatened and endangered aquatic species from reactor operation for an additional 20 years at SSES would be SMALL, and therefore, mitigation is not warranted.

References Section 4.6.1

PPL Susquehanna. 2006. Appendix E Applicant's Environmental Report – Operating License Renewal Stage Susquehanna Steam Electric Station. September.

[Fish and Wildlife Service Letter. 2006.]

Section 4.8.6.2 Aquatic Species

No Federally listed aquatic species [reference (Table 2-X)] occur in the area of SSES or within aquatic habitats traversed by the plant's transmission lines [(Similar to Section 4.6.1, verify with and reference Fish and Wildlife Service Letter when received)]. The staff, as a result, determined in Section 4.6 that continued operation of SSES would have no effect on any Federally listed species. Therefore, the continued operation of the plant is not expected to contribute to adverse cumulative impacts on any Federally listed species.

The staff has determined that the cumulative impacts to aquatic threatened or endangered species due to continued operation of SSES and associated transmission lines would be SMALL, and that no further mitigation measures are warranted.

References Section 4.8.6.2

PPL Susquehanna. 2006. Appendix E Applicant's Environmental Report – Operating License Renewal Stage Susquehanna Steam Electric Station. September.

[Fish and Wildlife Service Letter. 2006.]