UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 7, 2013

Ms. Cindy Dohner
Southeast Regional Director
U.S. Fish and Wildlife Service
1875 Century Blvd., Suite 400
Atlanta, Georgia 30345

SUBJECT: REQUEST FOR CONCURRENCE ON THE EFFECTS OF THE EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 ON THE FEDERALLY-LISTED ENDANGERED SPECIES ALTAMAHA SPINYMUSSEL

Dear Ms. Dohner:

The U.S. Nuclear Regulatory Commission (NRC) is considering issuing an amendment for Renewed Facility Operating Licenses for the Edwin I. Hatch Nuclear Plant (HNP) Units 1 and 2. HNP is located on the Altamaha River in Appling County, Georgia. The NRC staff prepared this biological assessment due to both the requested license amendment of July 5, 2012 and the U.S. Fish and Wildlife Services (FWS's) 2011 listing of the Altamaha spinymussel (*Elliptio spinosa*) as endangered and designation of critical habitat. With this letter, and in accordance with the Endangered Species Act of 1973, as amended (ESA) the NRC requests your concurrence with its determination that HNP may affect, but is not likely to jeopardize, the continued existence of Altamaha spinymussel and will have no effect on its designated critical habitat.

Project Summary and Description of Federal Action

HNP is a steam-electric generating facility operated by Southern Nuclear Operating Company (SNC). HNP is located in Appling County, Georgia, at river kilometer 80 (river mile 112), slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. The plant site is approximately 18 km (11 mi) north of Baxley, Georgia; 158 km (98 mi) southeast of Macon, Georgia; 117 km (73 mi) northwest of Brunswick, Georgia; and 108 km (67 mi) southwest of Savannah, Georgia. HNP is a two-unit nuclear plant using a closed-loop cooling system for main condenser cooling that withdraws from and discharges to the Altamaha River through a shoreline intake and offshore discharge structures.

On October 13, 1974, the NRC issued an operating license for Unit 1 with an expiration date of August 6, 2014. On June 13, 1978, the NRC issued an operating license for Unit 2 with an expiration date of June 13, 2018. By letter dated February 29, 2000, SNC submitted an application to the NRC to renew the operating licenses for HNP, Units 1 and 2, for an additional 20-year period. On January 15, 2002, the NRC renewed the licenses for HNP, Units 1 and 2 for an additional 20 years. The current expiration dates for Unit 1 and 2 operating licenses are August 6, 2034, and June 13, 2038, respectively.

The property at the HNP site totals approximately 907 (ha) (2,240 ac) characterized by low, rolling sandy hills that are predominantly forested. The property includes approximately 364 ha (900 ac) north of the Altamaha River, on the other side of the river, in Toombs County and approximately 542 ha (1,340 ac) south of the river in Appling County. All industrial facilities

associated with the HNP site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling tower area and associated facilities, is approximately 121 ha (300 ac). Approximately 648 ha (1,600 ac) are managed for timber production and wildlife habitat.

The proposed Federal action would amend Appendix A of HNP's renewed facility operating licenses as requested by SNC. On July 5, 2012, SNC sent the NRC a request for a license amendment to revise the minimum water level at which the plant could withdraw water from the Altamaha River from 60.7 to 60.5 feet (ft) (18.5 to 18.4 m), a difference of 0.2 ft (6 cm), as measured in the plant service water pump well. Withdrawn water is used for the plant service water system under normal operating conditions and the ultimate heat sink in case of emergencies. SNC's request states that the proposed change would not result in or require any physical changes to HNP systems, structures, and components, including those intended for the prevention of accidents. SNC proposes to implement the proposed operational changes within 60 days of the NRC issuing the requested amendment.

SNC calculates the water velocity through the intake traveling screens to be 2.81 feet per second (ft/s) (0.856 m/s) at the present minimum operating water level of 60.7 ft (18.50 m) mean sea level (MSL). Under the proposed license amendment, the velocity would increase to 2.93 ft/s (0.893 m/s) at the minimum operating water level of 60.5 ft (18.44 m) MSL, although the volume of surface water withdrawn would not increase.

Section 7 Consultation History

On August 31, 2000, in conjunction with the license renewal application for HNP, the NRC staff submitted a biological assessment to the National Marine Fisheries Service ("NMFS") for the Federally endangered shortnose sturgeon. At a November 3, 2003, meeting with NRC staff, NMFS informed the NRC that the biological assessment required revisions. On July 9, 2004, the NRC submitted a revised biological assessment concluding that HNP may affect the shortnose sturgeon, and that the effects are discountable and extremely unlikely to occur, and, therefore, not likely to adversely affect the species. Subsequently, the U.S. Army Corps of Engineers (COE) sent a letter dated May 19, 2005, requesting ESA section 7 consultation on the issuance of a permit to conduct maintenance dredging of the Altamaha River at HNP and requested NMFS's concurrence with its determination that periodic maintenance dredging at HNP was not likely to adversely affect the shortnose sturgeon. Because NMFS believed that the periodic maintenance dredging is interrelated to the operation of the plant, it combined these two activities into one consultation. In a letter dated August 10, 2005, NMFS found that chances of impinging juvenile and adult shortnose sturgeon on the intake trash racks or entraining shortnose sturgeon eggs or larvae in the cooling water intakes are discountable and that the effects of discharging heated effluent and dredging operations on shortnose sturgeon are insignificant. NMFS concurred with the COE and NRC staff that continued operation of HNP with periodic maintenance dredging is not likely to adversely affect shortnose sturgeon. On October 11, 2011, FWS listed the Altamaha spinymussel as endangered and designated critical habitat. The listing announcement identified several sources of stress associated with operating HNP that might adversely affect the Altamaha spinymussel population. On July 5, 2012, SNC sent the NRC a request for a license amendment, and the NRC staff began this review.

Request for Concurrence with the NRC's Biological Assessment and ESA Effect Determinations

The NRC has examined the new information and the past consultation and found no reason to modify past conclusions. The attached biological assessment addresses whether the operation of HNP, including the proposed license amendment, has potential to affect the Altamaha spinymussel and its critical habitat. The NRC staff concludes that the continued operation of HNP **may affect but is not likely to jeopardize the continued existence of** the Altamaha spinymussel and that any possible adverse effects would accrue primarily through direct mortality caused by entrainment and impingement of larvae and juveniles of its unknown host fish species, although the effects are probably discountable. The staff also concludes that operation of HNP would have **no effect** on designated critical habitat of the Altamaha spinymussel.

With this letter, we are requesting FWS's concurrence with the staff's effect determinations under section 7 of the ESA. In reaching our conclusions, the NRC staff relied on information provided by the applicant, on analysis performed by NRC staff, and on information from FWS.

Conclusion

If you have any questions regarding the staff's request, please contact Dr. Dennis Logan, aquatic ecologist, at 301-415-0490. I have also forwarded a copy of this letter to Mr. Colwell, Supervisory Biologist of your Coastal Sub-office with whom my staff has been in contact.

Sincerely,

William Ford for Melanie Wong

Melanie C. Wong, Chief
Environmental Review and Guidance
Update Branch
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-321 and 50-366

Enclosures:
As stated

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Sincerely,

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Melanie C. Wong, Chief
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*concurred via email

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Letter to C. Dohner from M. Wong dated August 7, 2013

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Biological Assessment
for
Altamaha Spinymussel (*Elliptio spinosa*)

Edwin I. Hatch Nuclear Plant, Units 1 and 2

Appling County, Georgia

July 2013

Docket Nos. 50-321 and 50-366

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Prepared by

Dennis Logan, PhD
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

Table of Contents

Abbreviations, Acronyms, and Symbols

°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre(s)
cm	centimeter(s)
COE	U.S. Army Corps of Engineers
CFR	*Code of Federal Regulations*
DO	dissolved oxygen concentration
ESA	Endangered Species Act of 1973, as amended
ft	foot (feet)
ft/s	feet per second
FWS	U.S. Fish and Wildlife Service
GADNR	Georgia Department of Natural Resources
ha	hectare(s)
HNP	Edwin I. Hatch Nuclear Plant, Units 1 and 2
in.	inch(es)
km	kilometer(s)
m	meter(s)
m/s	meters per second
mgd	million gallons per day
mg/L	milligrams per liter
mi	mile(s)
MSL	mean sea level
MW(t)	megawatt-thermal
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PCE	primary constituent elements of designated critical habitat
RKm	river kilometer(s)
RM	river mile(s)
SNC	Southern Nuclear Operating Company, Inc.

1.0 Introduction and Purpose

The NRC is considering issuing an amendment for Renewed Facility Operating License Numbers DPR-57 and NPF-5. The NRC issued the licenses to Southern Nuclear Operating Company ("SNC" or "the licensee") for operation of the Edwin I. Hatch Nuclear Plant ("HNP") Units 1 and 2 in accordance with Title 10, Part 50.90 of the *Code of Federal Regulations* (10 CFR 50.90). HNP is located on the Altamaha River in Appling County, Georgia. The NRC staff prepared this biological assessment due to both the requested license amendment of July 5 2012 (SNC 2012a) and the FWS's (2011) listing of the Altamaha spinymussel (*Elliptio spinosa*) as endangered and designation of critical habitat. NRC's consideration of and granting of a license amendment is a Federal action necessitating review in accordance with 10 CFR Part 51.

Pursuant to section 7 of the Endangered Species Act of 1973 ("ESA"), as amended, on February 21, 2013, the NRC staff consulted the Georgia Department of Natural Resources ("GADNR"), Wildlife Resources Division's website regarding species of concern near HNP and requested a list of protected species through that website. In a letter to NRC dated February 28, 2013, the FWS (2013) provided information on Federally listed endangered or threatened species, as well as on proposed or candidate species, and on any designated critical habitats that may occur in the vicinity of HNP. The FWS identified two endangered aquatic species, the shortnose sturgeon (*Acipenser brevirostrum*) and the Altamaha spinymussel, for which FWS had also designated critical habitat; one threatened terrestrial species, the eastern Indigo snake (*Drymarchon corais couperi*); and one candidate species, the gopher tortoise (*Gopherus polyphemus*).

2.0 Section 7 Consultation History

On August 31, 2000, in conjunction with the license renewal application for HNP, the NRC staff submitted a biological assessment to the National Marine Fisheries Service ("NMFS") for the Federally endangered shortnose sturgeon (NRC 2000). At a November 3, 2003, meeting with NRC staff, NMFS informed the NRC that the biological assessment required revisions. On July 9, 2004, the NRC (2004) submitted a revised biological assessment concluding that HNP may affect the shortnose sturgeon, and that the effects are discountable and extremely unlikely to occur, and, therefore, not likely to adversely affect the species. Subsequently, the U.S. Army Corps of Engineers ("COE") sent a letter dated May 19, 2005, requesting ESA section 7 consultation on the issuance of a permit to conduct maintenance dredging of the Altamaha River at HNP and requested NMFS's concurrence with its determination that periodic maintenance dredging at HNP was not likely to adversely affect the shortnose sturgeon. Because NMFS believed that the periodic maintenance dredging is interrelated to the operation of the plant, it combined these two activities into one consultation. In a letter dated August 10, 2005, NMFS (2005) found that chances of impinging juvenile and adult shortnose sturgeon on the intake trash racks or entraining shortnose sturgeon eggs or larvae in the cooling water intakes are discountable and that the effects of discharging heated effluent and dredging operation on shortnose sturgeon are insignificant. NMFS concurred with the COE and NRC staff that continued operation of HNP with periodic maintenance dredging is not likely to adversely affect shortnose sturgeon.

3.0 Proposed Action

The proposed Federal action would amend Appendix A of HNP's renewed facility operating licenses as requested by SNC. On July 5, 2012, SNC (2012a) sent the NRC a request for a license amendment to revise the minimum water level at which the plant could withdraw water from the Altamaha River from 60.7 to 60.5 feet (ft) (18.5 to 18.4 m), a difference of 0.2 ft (6 cm),

as measured in the plant service water pump well. Withdrawn water is used for plant service water system under normal operating conditions and the ultimate heat sink in case of emergencies. SNC (2012a) states that the proposed change would not result in or require any physical changes to HNP systems, structures, and components, including those intended for the prevention of accidents. SNC proposes to implement the proposed operational changes within 60 days of the NRC issuing the requested amendment.

4.0 Description of Project Area

4.1 General Plant Information

HNP is a steam-electric generating facility operated by SNC. HNP is located in Appling County, Georgia, at river kilometer (RKm) 180 (river mile [RM] 112), slightly southeast of the U.S. Highway 1 crossing of the Altamaha River. The plant site is approximately 18 km (11 mi) north of Baxley, Georgia; 158 km (98 mi) southeast of Macon, Georgia; 117 km (73 mi) northwest of Brunswick, Georgia; and 108 km (67 mi) southwest of Savannah, Georgia (Figures 1and 2).

HNP is a two-unit nuclear plant, and both units are licensed for 2,763 megawatt-thermal (MW(t)). HNP uses a closed-loop cooling system for main condenser cooling that withdraws from and discharges to the Altamaha River through a shoreline intake and offshore discharge structures. The NRC's (2000) biological assessment for shortnose sturgeon for HNP describes the cooling water system in more detail.

On October 13, 1974, the NRC issued an operating license for Unit 1 with an expiration date of August 6, 2014. On June 13, 1978, the NRC issued an operating license for Unit 2 with an expiration date of June 13, 2018. By letter dated February 29, 2000, SNC submitted an application to the NRC to renew the operating licenses for HNP, Units 1 and 2, for an additional 20-year period (SNC 2000). NRC (2001) reviews the potential environmental impacts of continued operations of HNP Units 1 and 2. On January 15, 2002, the NRC renewed the licenses for HNP Units 1 and 2 for an additional 20 years (NRC 2002). The current expiration dates for the Unit 1 and 2 operating licenses are August 6, 2034, and June 13, 2038, respectively.

The property at the HNP site totals approximately 907 hectares (ha) (2,240 ac) and is characterized by low, rolling sandy hills that are predominantly forested. The property includes approximately 364 ha (900 ac) north of the Altamaha River, on the other side of the river, in Toombs County and approximately 542 ha (1,340 ac) south of the river in Appling County. All industrial facilities associated with the HNP site are located in Appling County. The restricted area, which comprises the reactors, containment buildings, switchyard, cooling tower area and associated facilities, is approximately 121 ha (300 ac). Approximately 648 ha (1,600 ac) are managed for timber production and wildlife habitat (NRC 2001).

4.2 Cooling Water System

The excess heat produced by HNP's two nuclear units is transferred to cooling water flowing through the condensers and the service water system. Main condenser cooling is provided by mechanical draft cooling towers. Each HNP circulating water system is a closed-loop cooling system that employs three cross-flow and one counter-flow mechanical-draft cooling towers to transfer waste heat to the atmosphere. Water withdrawn for the river to replace evaporation and to dilute the buildup of dissolved solids is called makeup water.

For both generating units, cooling tower makeup water is withdrawn from the Altamaha River through a single intake structure. The intake structure is located along the southern shoreline of the Altamaha River and is positioned so that water is available to the plant at both minimum flow

and probable flood conditions. The main river channel (thalweg) is located closer to the northern shoreline on the opposite side of the river from the plant and its intake structure. The intake is approximately 46 m (150 ft) long, 18 m (60 ft) wide, and the roof of the intake structure is approximately 18 m (60 ft) above the water surface at normal river level. The water passage entrance is about 8.2 m (27 ft) wide and extends from 4.9 m (16 ft) below to 10 m (33 ft) above normal water levels. Trash racks remove large debris, and vertical traveling screens with a 1-cm (⅜-in.) mesh remove smaller material.

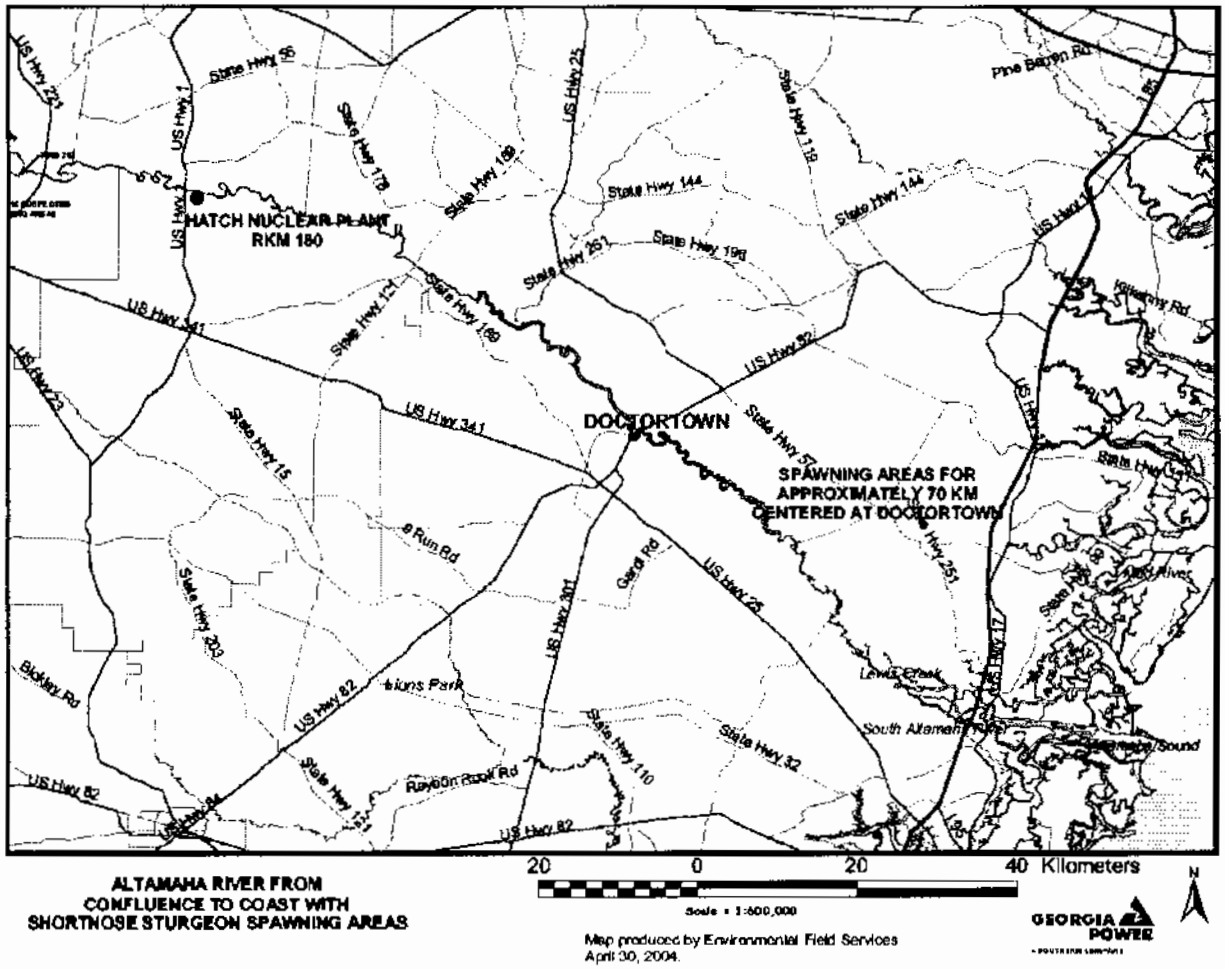

Figure 1. Altamaha River Drainage below the Edwin I. Hatch Nuclear Plant

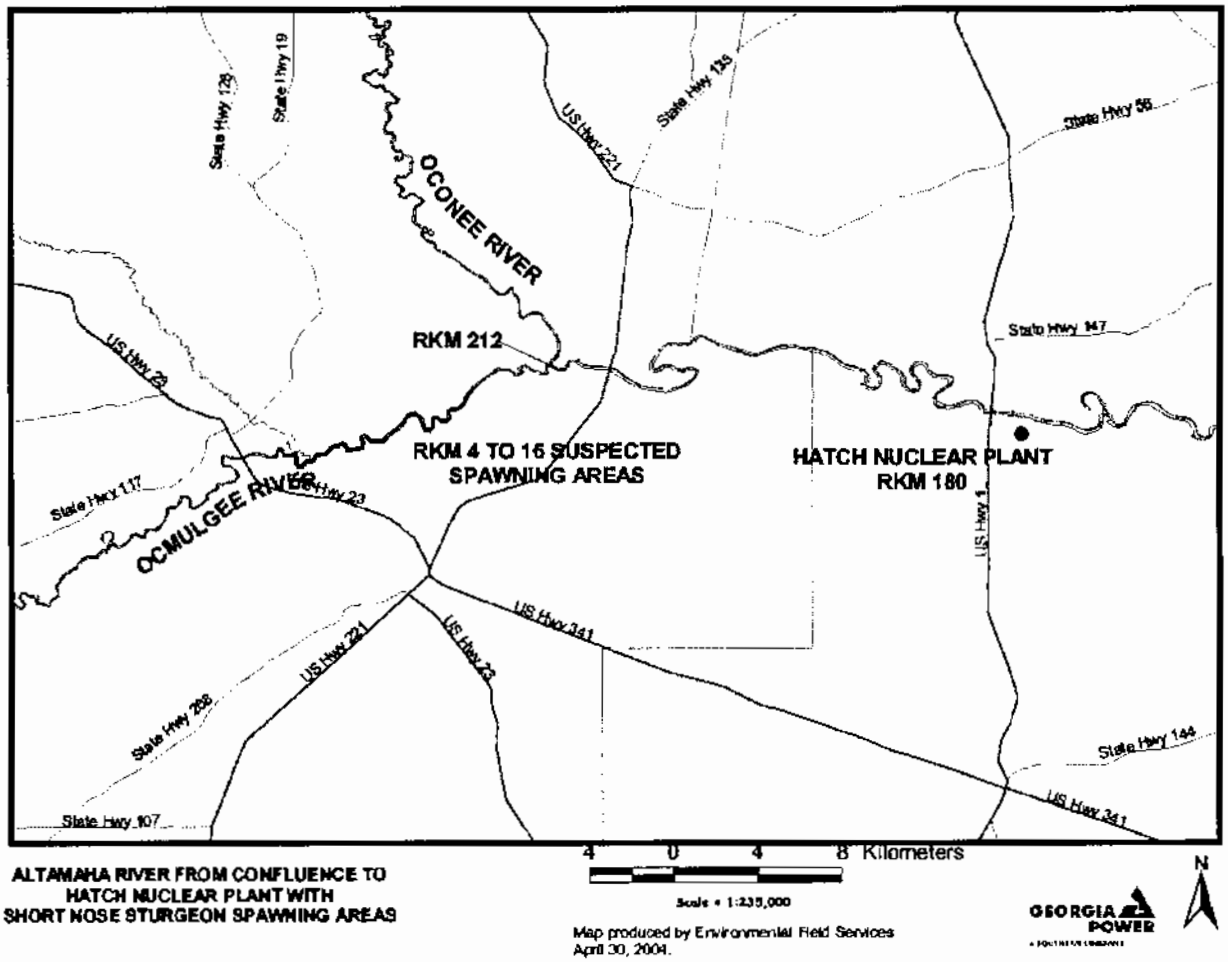

Figure 2. Altamaha River Drainage above the Edwin I. Hatch Nuclear Plant

SNC (2012b) calculates the water velocity through the intake traveling screens to be 2.81feet per second (ft/s) (0.856 m/s) at the present minimum operating water level of 60.7 ft (18.50 m) MSL. Under the proposed license amendment, the velocity would increase to 2.93 ft/s (0.893 m/s) at the minimum operating water level of 60.5 ft (18.44 m) MSL, although the volume of surface water withdrawn would not increase. SNC (2000) states that water velocity through the intake screens is 1.9 ft/s (0.6 m/s) at normal river elevation. HNP's current Georgia surface water withdrawal permit, number 001-0690-01 (reproduced in SNC 2012b), issued by the GADNR, allows SNC to withdraw a monthly average of up to 85 million gallons per day (mgd) with a maximum 24-hour rate of 103.6 mgd and requires SNC to monitor withdrawals and to report annually. SNC (2012b) reports calendar-year average water withdrawal rates of 56.58 mgd in 2007, 57.69 mgd in 2008, 55.33 mgd in 2009, 56.70 mgd in 2010, and 56.98 mgd in 2011. NRC (2001) calculated that approximately 58 percent of the water withdrawn by HNP for all uses is consumptively consumed in HNP's cooling towers and by other processes.

Water returns to the Altamaha River through a submerged discharge structure consisting of two 1.1 m (42-in.) lines that extend approximately 37 m (120 ft) out from the shore at an elevation of 16 m (54 ft) MSL. The point of discharge is approximately 384 m (1,260 ft) down river from the

intake structure and approximately 1.2 m (4 ft) below the surface when the river is at its lowest level. The National Pollutant Discharge Elimination System (NPDES) Permit for HNP, number GA0004120 (reproduced in SNC 2012b), issued by the Georgia Environmental Protection Division requires weekly monitoring of discharge temperatures but does not stipulate a maximum discharge temperature or maximum temperature rise across the condenser. The NPDES permit expired on June 30, 2012, but it has been administratively continued (SNC 2012b).

To control biofouling of cooling system components such as condenser tubes and cooling towers, an oxidizing biocide (typically sodium hypochlorite or sodium bromide) is injected into the system as needed to maintain a concentration of free oxidant sufficient to kill most microbial organisms and algae. When the system is being treated, blow down to the river is secured to prevent the discharge of residual oxidant into the river. After biocide addition, water is recirculated within the system until residual oxidant levels are below discharge limits specified in the NPDES permit.

4.3 Maintenance Dredging

In order to ensure adequate depth of water at the HNP intake structure for continued plant operation, the river bottom near the intake structure is maintained to remove accumulated sand, silt, and debris. Periodic maintenance is performed with a hydraulic dredge, clamshell, or dragline. The COE issued permit number 940003893 under Section 404 of the Water Pollution Control Act (Clean Water Act) of 1977 for maintenance dredging in front of the HNP intake structure to remove accumulated sand, silt, and debris and ensure adequate water supply for plant operation. Removed material is spoiled in an upland disposal area with no return of material to the river. The permit contains special conditions to ensure protection of aquatic habitat. Special Conditions 1, 2, and 3 limit dredging to a specific time of the year (August 15 through November 31) and specifically prohibit dredging from December 1 through June 30 to ensure protection of anadromous fish. The permit also requires monitoring of dissolved oxygen (DO) during dredging and requires suspension of dredging operations if DO levels fall below 3.0 mg/L. The permit also specifies recordkeeping for each dredge event and reporting to the COE.

5.0 Status Review of the Altamaha Spinymussel

5.1 Life History

The Altamaha spinymussel is a freshwater mussel belonging to the family Unionidae, which is a worldwide family of mussels, also called unionids, river mussels, or naiads, with almost 300 taxa in North America. Unionids like the Altamaha spinymussel have complex life cycles The FWS's (2011) recently published species description contains the most current life history information on the Altamaha spinymussel. Unless otherwise noted, information presented here is from the FWS's review. This species in endemic to the Altamaha River drainage, and the historical distribution was restricted to the Coastal Plain portion of the Altamaha River and the lower portions of its three main tributaries, which are the Ohoopee, Ocmulgee, and Oconee Rivers. Altamaha spinymussels are found in association with stable, course to fine grained sandy sediments of sandbars, sloughs, and mid-channel islands in areas of swiftly flowing water. Much of the life history of the Altamaha spinymussel has not been studied and is inferred from life histories of other mussels of the same genus, *Elliptio*, which refers to the elliptical shape of the adult mussels.

Adults reach a maximum shell length of about 11 cm (4.3 in.), and the shells have one to five spines that may reach lengths of 1.0 to 2.5 cm (0.39 to 0.98 in.) in a single row parallel to the

posterior ridge. They burrow about 5 to 10 cm (2 to 4 in.) into the substrate and pump water through their gills to obtain oxygen and food and rid themselves of waste products. They filter phytoplankton, zooplankton, suspended bacteria, other microorganisms, particulates, and dissolved organic matter from the water and in doing so can clarify the water in the stream or river. Freshwater mussels can have long life spans, and Schneider and Strayer (2006) report that, in a population of the related, congeneric pearlymussel (*Elliptio complanata*) in New York, ages ranged from 33 to 95 years old, with 94 percent of individuals more than 50 years old and individuals between 50 and 60 years old being the most abundant in the population.

Reproduction and early life history is incompletely known and understood through studies of related species of the same genus. Reproduction is thought to occur in spring. Fertilization is internal, and females brood the larvae, which are called glochidia. Females release mature glochidia into the water column, perhaps in May or June. To survive, the glochicia must find and attach to specific host fish species, although the host species are currently unknown for the Altamaha spinymussel. After some period of attachment to host fish, the immature mussels release and move to the bottom to begin a benthic existence, provided they find suitable habitat. The juvenile mussels on the bottom use the foot to extract and feed on bacteria, algae, and detritus in the sediment.

5.2 Status in the Altamaha River

The Altamaha River is formed by the confluence of the Ocmulgee and Oconee Rivers, and the range of the Altamaha spinymussel formerly included the Altamaha River and the lower portions of both the Ocmulgee and Oconee Rivers as well as the lower reach of another tributary to the Altamaha River, the Ohoopee River. The species has apparently been extirpated from the lower Oconee, Ohoopee, and Altamaha Rivers and now survives only in the Ocmulgee and Upper Altamaha Rivers, where FWS has designated critical habitat under the ESA. The Altamaha spinymussel has been observed at only 22 sites since 2000, most of which are clustered geographically and separated by long reaches with no or undetectable numbers of the species.

The remaining populations of Altamaha spinymussel are dwindling. In its determination, the FWS (2011) finds that

> The remaining small spinymussel populations are threatened by a variety of factors that are expected to persist indefinitely and impact, or have the potential to impact, remaining spinymussel habitat. These factors include siltation, industrial pollution, municipal effluents, modification of stream channels, pesticides, heavy metals, invasive species, loss of host fish, water withdrawal, recurring drought, and loss of genetic viability.

The FWS believes that the small, isolated populations of spinymussels that remain are not large enough to be resilient against any of the above factors acting on the species itself or on its habitat and that the threats to the species, particularly from habitat degradation, small population size, and drought, are current and are projected to continue into the future.

The Altamaha spinymussel is in danger of extinction throughout its range, and FWS has listed it as an endangered species throughout its range under the ESA and designated four reaches of the Altamaha, Ocmulgee, and Ohoopee Rivers as units of critical habitat.

5.3 Effects of HNP on Altamaha Spinymussel

The FWS (2011) listing announcement identified several sources of stress associated with operating HNP that might adversely affect the Altamaha spinymussel population. The stressors include elevated levels of metals in sediments below the plant, impingement and entrainment of

host fish species, effects of the thermal effluent, and dredging the river. In addition, entrainment may alter available food sources (trophic structure) for downriver populations.

5.3.1 Dredging and Sediment Contamination

Elevated levels of metals in sediments and pore water may adversely affect the mussels, including "elevated zinc and chromium below Plant Hatch" (FWS 2011). Sources of sediment contamination may include HNP operations and resuspension of buried legacy sediment contamination and its transport downstream due to dredging. NRC staff found no additional information on this subject.

The FWS (2011) found that annual dredging performed at the plant, which was the subject of the NRC's 2004 biological assessment for shortnose sturgeon, may also adversely affect the Altamaha spinymussel:

> While the amount of material removed annually is generally far less than the amount permitted ..., annual dredging could negatively impact the Altamaha spinymussel by decreasing channel stability (creating a potential head cut), altering sediment transport dynamics, increasing sedimentation and turbidity downstream during dredging operations, and decreasing habitat quality for host fishes. It is unknown how far downstream these impacts extend.

SNC (2006) disputes this assessment and states that

> A permit renewal and modification was obtained on September 7, 2005, increasing the allowable dredged volume from 35,000 to 44,424 cubic yards. This increase is expected to reduce the frequency of dredging and make the area more amenable to natural flushing during high flow events (Law, 1998). The dredging footprint and adjacent areas are poor habitat for mussels with relatively steep banks, shifting sand bars, and higher currents. Additionally, the dredging permit contains specific requirements, including those inserted by the US Fish & Wildlife Service ..., to ensure protection of aquatic species.

Dredging reports indicate that, in 2010, HNP dredged an estimated 13,409 yd^3; in 2011, about 406 yd^3; and, in 2012, about 13,866 yd^3. These actual volumes are well below the permitted limit.

Law Engineering and Environmental Services, Inc (Law 1998) performed the study cited by SNC (2006) above for Georgia Power Company. Law (1998) collected mussel at 23 sampling sites in the Altamaha River near HNP on September 25 and 26, 1998, from a 12-mi reach (RM 109.9 to RM 122.0) (19-km reach, RKm 176.8 to RKm 196.3) from sites in sand bars, sloughs, the mouth of a cypress swamp (one site), and river banks. Sampling efforts "targeted mussel habitats and areas where mussels have been collected in the past" and included areas above, near, and below HNP, which is located at RM 116. Law (1998) concludes that a 2.5-mi (4-km) reach of the river that includes the HNP site is less favorable mussel habitat than the reaches above and below and, further, that the lower mussel catch-per-unit effort in that reach is not due to operation of HNP. Law (1998) notes that

> Differences in collection rates between years likely reflect the direct effects of water levels on mussel distribution and collection efficiency. Consistent spatial differences between years suggested that the distribution of habitat within the river reach surveyed, rather than operation of Plant Hatch, accounted for the lower downstream collection rates. The highest collection rates both upstream and downstream of Plant Hatch were associated with stable sand bars. The river channel downstream of the U.S. 1 Highway bridge is relatively straight between

RM 117 and RM 114.5, a reach where collection rates were consistently lower in 1993 and 1998. The collection sites within this reach generally had steeper banks, less stable sand bars, and higher currents than collections sites at the river bends where collection rates were consistently higher.

In regard to these conclusions, the NRC staff notes that targeted sampling may help investigators understand trends at the selected sites but may not provide representative sampling needed to support broader comparisons and conclusions. This is not necessarily a criticism of the study design. Randomized sampling required for representative estimates can result in some samples with no catches, which may not only cost time and effort, but which also may introduce problems into data analysis. Investigators must therefore balance these considerations.

The NRC relies on the COE permitting process to protect endangered species because the COE, not the NRC, regulates dredging. Because of the relatively small area dredged and the reports indicating that actual dredging was about a third of the permit amount or less (in 2011), the NRC believes that the effects of dredging on Altamaha spinymussels through downstream effects and sediment resuspension and redeposition would be insignificant or discountable.

5.3.2 Entrainment and Impingement of Host Fish Species

The FWS (2011) also finds that entrainment and impingement of host fish species may adversely affect the early life stages of Altamaha spinymussel and notes that "Plant Hatch also monitors fish entrainment, so if the host fish of the spinymussel was known, management efforts could be made to reduce the potential of this impact."

The GADNR regulates entrainment and impingement at the cooling water intake structure as part of its administration of the NPDES permitting program. SNC's Clean Water Act Section 316(b) demonstration included entrainment and impingement studies (Wiltz 1981) with collections in 1975, 1976, 1977, and 1980. SNC (2000) includes the following impingement estimates from the impingement studies: 1975, 12 fish per day and 438 per year; 1976, 0.4 fish per day and 146 per year; 1977, 1.1 fish per day and 401.5 per year; 1979, 1.3 fish per day and 474.5 per year; and 1980, 1.2 fish per day and 438 per year. SNC (2000) also reports that entrainment rates were generally low. Because GADNR regulates the cooling water intake structure, the NRC relies on the GADNR to monitor impingement and entrainment to protect aquatic resources. Although the host fish species of the Altamaha spinymussel are unknown, the low entrainment and impingement rates reported for the HNP suggest that the effects to Altamaha spinymussel resulting from any entrainment or impingement of host species are likely insignificant or discountable.

5.3.3 Thermal Effects

The FWS (2011) also finds that the thermal effluent could adversely affect the host species. While FWS notes that the HNP "has made substantial efforts to reduce thermal discharges through the construction of cooling towers that have significantly reduced the thermal plume," the increased water temperatures can still have adverse effects. The HNP's thermal effluent could elicit these effects because "higher water temperatures can increase the sensitivity of mussels to certain pollutants." Because FWS finds that "[t]hese effects would be exacerbated during years of low rainfall, when less water would be available to dissipate the heat of the Plant Hatch effluent," the potential adverse effect is pertinent to the proposed license amendment.

HNP's NPDES permit allows for the discharge of combined process wastewaters, including cooling tower blowdown, to the Altamaha River. The permit also sets effluent limits for several contaminant parameters (e.g., oil and grease, total suspended solids, metals). The permit does

not impose a maximum temperature limit on the combined river discharge but does require weekly temperature monitoring at the point of mixing and quarterly reporting of discharge temperatures to the State of Georgia. The permit further stipulates compliance with NRC requirements relative to radiological constituents. The water quality of the Altamaha River, on which the HNP is located, is also subject to regulation in accordance with Georgia's Water Use Classifications and Water Quality Standards (Chapter 391-3-6-03 of the State's Rules and Regulations). For all waters in the State of Georgia, except where more stringent criteria apply, receiving water temperatures are not to exceed 90 °F and the temperature of receiving waters is not to be increased more than 5 °F above the intake temperature.

The NRC (1978) modeled both average expected thermal conditions and extreme thermal conditions under conservative assumptions in the HNP, Unit 2, Final Environmental Statement and concluded that the small size of the thermal plume, even under conservative assumptions, would not block movement of fish in the Altamaha River. In support of its NPDES permit application, SNC performed a computer modeling study using CORMIX (version 5.0) and associated river bottom survey to evaluate the potential environmental impacts of operating HNP at the proposed minimum water level of 60.5 ft (18.4 m) in the plant service water pump well (summarized in SNC 2012b). This modeling incorporated ambient river temperature conditions for summer and winter and utilized historical river and HNP discharge flow rates. The modeled base case assumed ambient river temperature of 97 °F (36 °C), a temperature difference of 5 °F between the plant discharge and ambient river temperatures, and a discharge flow of 27,444 gpm. With this base case, the calculated temperature difference between the discharge plume and ambient river temperature was 2.5 °F (1.8 °C) or less at a distance of 140 ft (42.7 m) downstream from the point of discharge, with a plume surface area of 0.05 ac and a plume cross-sectional area 3 percent of the river cross-section. SNC (2012b) stated that the modeled plume "is generally fully mixed along a vertical cross-section with some lifting from the bottom in the near field due to buoyancy" and that "state and federal limitations regarding water quality criteria and thermal impacts to the Altamaha River continue to be satisfied" under the proposed license amendment.

The State of Georgia, not the NRC, regulates the discharge. The NRC relies on the State of Georgia to monitor and permit the discharge to protect the balanced, indigenous populations of fish and shellfish. Therefore, the NRC staff concludes that any thermal effects to the Altamaha spinymussel and its fish host populations would be discountable.

5.3.4 Critical Habitat

The FWS designated critical habitat in the Upper Altamaha River both above HNP (from the confluence of the Ocmulgee and Oconee Rivers downstream to the U.S. Route 1 crossing) and below HNP (from the western edge of the Moody Forest downstream to the confluence of the Altamaha and Ohoopee Rivers). Critical habitat does not include manmade structures present on the date of the rule (October 11, 2011) and the land on which such structures are located. Due to the lack of designated critical habitat at HNP, the NRC finds no adverse effects to critical habitat.

5.3.5 Habitat Fragmentation

Fragmentation of habitat in rivers can substantially reduce biodiversity and alter ecosystem function (Doi 2009). In small populations, habitat fragmentation can increase the vulnerability of species to disease, human-caused disturbance, habitat modification, and demographic accidents and can lead to population declines, abnormal population structure, and eventual extinction (Dodd 1990).

The FWS (2011) explained that the exclusion of critical habitat designation in the stretch of river that includes HNP is because that stretch does not include some primary constituent elements (PCEs) of habitat necessary to support the species. The FWS (2011) identifies two reasons that the stretch does not include PCEs necessary for the Altamaha spinymussel:

(1) Dredging for intake pipes at Plant Hatch, which destabilizes the river channel and banks, sandbar, slough, and mid-channel-island habitats and disrupts the movement of coarse-to-fine sand substrates with low to moderate amounts of fine sediment; and

(2) Thermal discharges from Plant Hatch that reduce water quality.

These effects could fragment the habitat of Altamaha spinymussels by diminishing the distribution of larvae attached to fish hosts. The NRC staff examined these effects and found them insignificant or discountable. Entrainment and impingement of host fish species may occur, but entrainment and impingement rates at HNP are low. Because the host species have not yet been identified, effects cannot now be accurately determined, but due to the low entrainment and impingement rates overall, the staff expects that any effects would be discountable.

5.3.6 Trophic Interactions

SNC (2012a) states that the hydraulic entrainment would be about 11 percent of the river flow passing the plant under minimum flow conditions without the proposed license amendment and about 11.5 percent with the license amendment. Along with the water, potential food of Altamaha spinymussels would also be entrained and removed from the river, and so staff investigated how this trophic change might affect mussels living downstream of the plant.

Adult Altamaha spinymussels filter phytoplankton, zooplankton, suspended bacteria, other microorganisms, particulates, and dissolved organic matter from the water, although which of these they use for nutrition is not presently clear. Assuming the entrainment rate of these potential foods equals the hydraulic entrainment rate, and, assuming worst case entrainment rate (minimum river flow and plant withdrawal with the license amendment), about 11.5 percent of these potential food sources would be removed. Smaller phytoplankton and suspended bacteria populations would recover quickly. The FWS did not identify food as a limiting resource for the adult mussels, which are most likely to be limited by other adverse habitat modifications. Therefore, the effect of entrainment on food of adult mussels is likely discountable.

The juvenile mussels on the bottom use the foot to extract and feed on bacteria, algae, and detritus in the sediment. These benthic food sources would not be adversely affected by upstream entrainment, so the effect of entrainment of potential food on juvenile mussels is also discountable.

5.3.7 Cumulative Impacts

FWS (2011) presents a detailed "Summary of Factors Affecting the Species." In short, FWS finds that the present threats to the Altamaha spinymussel populations that remain today include siltation, industrial pollution, municipal effluents, modification of stream channels, pesticides, heavy metal pollution, invasive species, loss of host fish, water withdrawal, recurring drought, and the loss of genetic variability. Although operation of HNP contributes to the cumulative impact, the direct and indirect effects of plant operation are a small contribution to the cumulative impact on the species.

6.0 Conclusion

The Altamaha spinymussel has historically been found in the main stem of the Altamaha River and its larger tributaries. HNP lies close to the center of its present range. Although FWS has designated critical habitat above and below HNP, critical habitat does not include the Altamaha River near HNP. The NRC staff examined several sources of stress associated with the operation of HNP that the FWS (2011) suggested might affect the species. The staff found that the potential effects of dredging and sediment contamination, entrainment and impingement of host fish species, trophic interactions, and habitat fragmentation are insignificant or discountable. The staff also finds no adverse effects to critical habitat. The staff concludes that the present and future operation of HNP may affect, but is not likely to jeopardize the continued existence of, Altamaha spinymussel and that the present and future operation of HNP would have no effect on Altamaha spinymussel critical habitat.

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