

**Evaluation of Impacts to Proposed Critical Habitat for the  
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)**

**Indian Point Nuclear Generating Units 2 and 3**

**Proposed License Renewal**

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## Abbreviations, Acronyms, and Symbols

°C	degrees Celsius
°F	degrees Fahrenheit
ΔT	change in temperature
ac	acre(s)
ADAMS	Agencywide Documents Access and Management System
CFR	<i>Code of Federal Regulations</i>
cfs	cubic feet per second
DOE	U.S. Department of Energy
DPS	distinct population segment
Entergy	Entergy Nuclear Operations, Inc.
ESA	Endangered Species Act of 1973, as amended
fps	feet per second
FR	<i>Federal Register</i>
FSEIS	final supplemental environmental impact statement
ft	foot (feet)
FWS	U.S. Fish and Wildlife Service
ha	hectare(s)
IP1	Indian Point Nuclear Generating Unit 1
IP2	Indian Point Nuclear Generating Unit 2
IP3	Indian Point Nuclear Generating Unit 3
ITS	Incidental Take Statement
km	kilometer(s)
m	meter(s)
m/s	meters per second
m <sup>3</sup> /s	cubic meters per second
mi	mile(s)
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NYCRR	<i>New York Codes, Rules, and Regulations</i>
NYSDEC	New York State Department of Environmental Conservation
RKM	river kilometer
RPM	Reasonable and Prudent Measure
SAFSTOR	safe storage condition
SPDES	State Pollutant Discharge Elimination System
T&C	Term and Condition

## 1.0 Introduction

This evaluation has been prepared to support the U.S. Nuclear Regulatory Commission (NRC)'s review of Entergy Nuclear Operations, Inc.'s (Entergy) application for renewal of Facility Operating Licenses DPR-26 and DPR-64 for an additional 20 years at Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3) and to comply with the provisions of section 7 of the Endangered Species Act of 1973, as amended (ESA). This document examines the potential impacts of the proposed IP2 and IP3 license renewal on critical habitat of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), as proposed for designation under the ESA by the National Marine Fisheries Service (NMFS).

The NRC first initiated ESA section 7 consultation with the NMFS regarding the potential effects of the proposed IP2 and IP3 license renewal on Federally listed species under the NMFS's jurisdiction in 2007. Most recently, the NMFS (2013) issued a final biological opinion dated January 30, 2013, that addresses shortnose sturgeon (*Acipenser brevirostrum*) and the New York Bight, Gulf of Maine, and Chesapeake Bay distinct population segments (DPSs) of Atlantic sturgeon. The biological opinion includes an Incidental Take Statement (ITS) that exempts the incidental take of shortnose and Atlantic sturgeon impinged at IP2 and IP3 for both the remainder of the original license terms and the possible renewed license terms provided that the opinion's Reasonable and Prudent Measures (RPMs) and associated Terms and Conditions (T&Cs) are met.

On June 3, 2016, the NMFS published proposed rules to designate critical habitat for each of the five Atlantic sturgeon DPSs in the *Federal Register* (FR) (81 FR 35701, 81 FR 36077). This document evaluates the potential effects of continued operation under the existing licenses and the proposed license renewal term on critical habitat of the Atlantic sturgeon, as proposed by NMFS in its *Federal Register* notices.

Federally listed species under the jurisdiction of the U.S. Fish and Wildlife Service (FWS) were previously considered during informal consultation, which resulted in the FWS's (2015) concurrence with NRC's "not likely to adversely affect" determinations for those species.

## 2.0 Description of the Proposed Action

### 2.1 Proposed Action

The proposed action is the continued operation of IP2 and IP3 under the terms of the original licenses and the continued operation of IP2 and IP3 under the terms of renewed licenses, if granted by the NRC. The IP2 license was set to expire in September 2013, and the IP3 license was set to expire in December 2015. However, having met the requirements of section 2.109 of Title 10 of the *Code of Federal Regulations* (10 CFR 2.109), the facility is allowed to continue to operate under the existing licenses until the NRC reaches a decision on Entergy's license renewal application. If approved, the license renewal would allow IP2 and IP3 to operate through 2033 and 2035, respectively.

IP2 and IP3 are Westinghouse pressurized-water nuclear power reactors located on approximately 239 acres (ac; 97 hectares (ha)) of land in the Village of Buchanan in upper Westchester County, New York, approximately 24 miles (mi; 39 kilometers (km)) north of New York City. IP2 and IP3 began commercial operation in September 1973 and December 1975, respectively. The proposed license renewal is further described in

Chapter 1 of the NRC's final Supplemental Environmental Impact Statement (FSEIS) related to IP2 and IP3 license renewal (NRC 2010).

### **3.0 Proposed Action Area: IP2 and IP3 Site**

The implementing regulations for section 7(a)(2) of the ESA define "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area effectively bounds the analysis of ESA-protected species and habitats because only species that occur within the action area may be affected by the Federal action.

For the purposes of this ESA analysis, the NRC staff considers the action area to be the 239-ac (97-ha) IP2 and IP3 site as described in Sections 2.1, 2.2.1, and 2.2.6 of the IP2 and IP3 FSEIS (NRC 2010). The site includes 134 ac (54.2 ha) of developed areas occupied by the IP2 and IP3 generating facilities and associated infrastructure as well as developed areas occupied by Indian Point Nuclear Generating Unit 1 (IP1), which was shut down in 1974 and is currently in a safe storage condition (SAFSTOR; a decommissioning strategy that includes maintenance, monitoring, and delayed dismantlement to allow radioactivity to decay prior to decommissioning). Outside of the central developed portion of the site, small tracts of forest totaling approximately 25 ac (10 ha) are interspersed among paved areas and facilities. Maintained areas of grass cover about 7 ac (2.8 ha) of the site, and the northern portion of the site is covered by approximately 70 ac (28 ha) of hardwood forest.

The action area also includes those portions of the Hudson River affected by the intake and discharge of cooling water, which consists of the IP2 and IP3 intakes, the discharge canal, and the area of the Hudson River into which the thermal plume extends as described under "Direct Effects" (Section 6.2). This area is consistent with the action area determined to be appropriate for IP2 and IP3 continued operation and license renewal by the NMFS (2013) in its final biological opinion. The aquatic environment is further described in Section 2.2.5 of the IP2 and IP3 FSEIS (NRC 2010).

The NRC staff expects all direct and indirect effects of the proposed action to be contained within these areas. The NRC staff recognizes that while the action area is stationary, Federally listed species can move in and out of the action area. For instance, a migratory fish species could occur in the action area seasonally as it travels up and down the river past IP2 and IP3.

### **4.0 NMFS Section 7 Consultation History**

Pursuant to its review of the IP2 and IP3 license renewal application, the NRC initiated communications with NMFS pursuant to ESA section 7 in 2007 regarding the effects of the proposed license renewal on shortnose sturgeon. That consultation resulted in the NMFS's (2011) issuance of a biological opinion in October 2011. Following the NMFS's listing of the Atlantic sturgeon in 2012, the NRC (2012) requested reinitiation of consultation to consider that species. The reinitiated consultation resulted in the NMFS's (2013) issuance of a new biological opinion in January 2013 that superseded the 2011 biological opinion and addressed both sturgeon species. Section 2.1 of the 2013 biological opinion (NMFS 2013) provides a detailed account of ESA section 7 consultation between NMFS and NRC since IP2 and IP3 began operating.

## **5.0 Federally Listed Species and Critical Habitats Considered**

### **5.1 Shortnose and Atlantic Sturgeons**

The shortnose and Atlantic sturgeons occur within the IP2 and IP3 action area. The NRC addressed the effects of IP2 and IP3 license renewal on these species through section 7 consultation with NMFS, as previously noted.

The NMFS's 2013 biological opinion describes the status of these species, provides an environmental baseline for the action area, evaluates the potential effects of continued IP2 and IP3 operations, and concludes that the continued operation of the facility is likely to adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon or the New York Bight, Gulf of Maine, or Chesapeake Bay DPS of Atlantic sturgeon. The biological opinion's ITS exempts the take of sturgeon impinged at the IP1, IP2, and IP3 cooling water intakes as specified in the ITS and provided that the corresponding RPMs and T&Cs are met.

Since the issuance of the biological opinion, the NRC staff have not identified any new information that would reveal effects to sturgeon in a manner or to an extent not previously considered, and the proposed action has not been modified in a manner that would cause an effect to sturgeon not considered in the biological opinion. Entergy has reported one incidental take of a deceased Atlantic sturgeon, which divers identified while removing debris in the Hudson River in front of the IP2 intake structure on February 25, 2015 (Normandeau 2015). This take is within the limits specified in the ITS. Therefore, this evaluation does not consider the shortnose sturgeon or Atlantic sturgeon any further.

### **5.2 Proposed Critical Habitat of the New York Bight DPS of Atlantic Sturgeon**

At the time the NMFS issued its 2013 biological opinion, it had not proposed or designated critical habitat for either the shortnose or Atlantic sturgeons. Thus, the action area contained no critical habitat.

On June 3, 2016, the NMFS published proposed rules to designate critical habitat for each of the five Atlantic sturgeon DPSs (81 FR 35701, 81 FR 36077). NMFS proposes to designate critical habitat for the New York Bight DPS of Atlantic sturgeon in the waters of the Hudson River, including the area of the Hudson River that the NRC and NMFS have determined to be the action area for IP2 and IP3 license renewal. The NMFS did not propose critical habitat for any of the other four DPSs within the Hudson River. Accordingly, this evaluation considers the effects of the proposed IP2 and IP3 license renewal on the proposed critical habitat of the New York Bight DPS of Atlantic sturgeon. Information on the proposed critical habitat is drawn from the NMFS's proposed rule (81 FR 35701) unless otherwise cited.

#### *Physical or Biological Features Essential for Conservation*

Physical or biological features ("essential features") are those features that support the life-history needs of the species, including, but not limited to, water characteristics, soil type, geological features, sites, prey, vegetation, symbiotic species, or other features. A feature may be a single habitat characteristic or a more complex combination of habitat characteristics. The NMFS has determined that the physical features essential for Atlantic sturgeon reproduction and recruitment are:

- Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0 to 0.5 parts per thousand range) for settlement of

fertilized eggs, refuge, growth, and development of early life stages (referred to later in this document as “Essential Feature 1”);

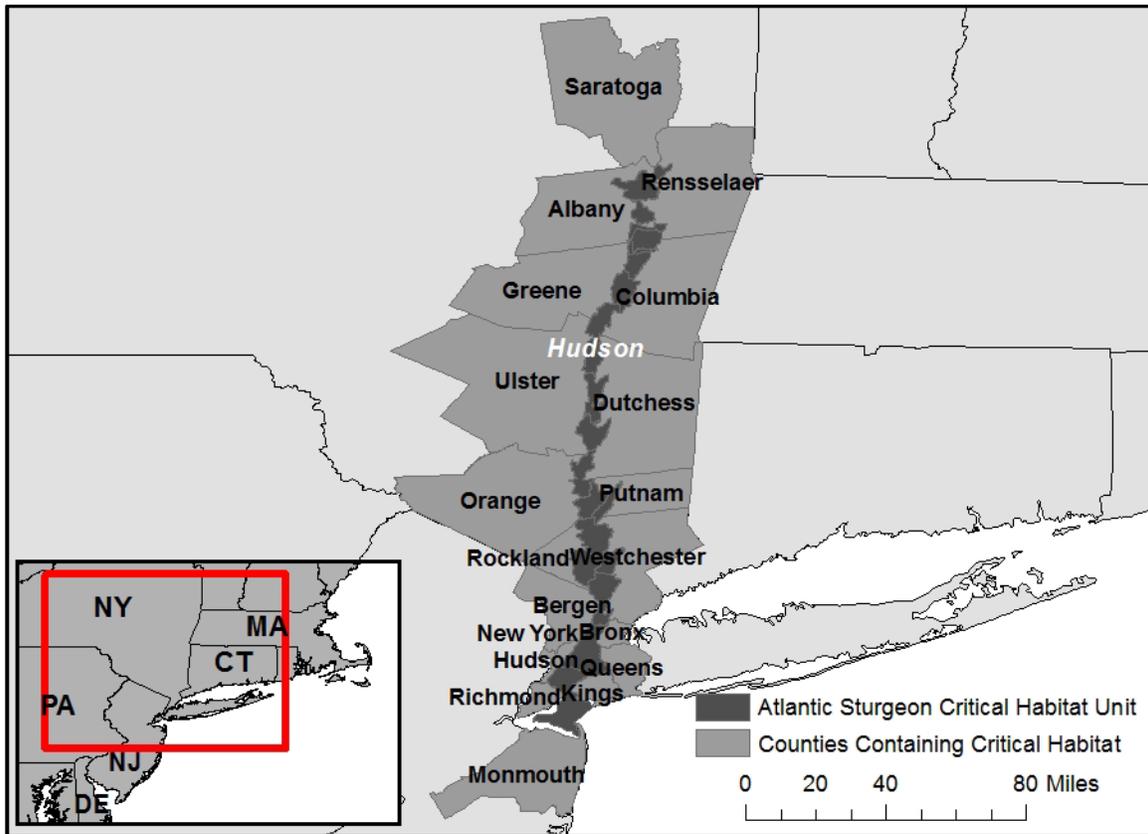
- Aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand and soft substrate (e.g., sand, mud) downstream of spawning sites for juvenile foraging and physiological development (“Essential Feature 2”);
- Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (1) unimpeded movement of adults to and from spawning sites; (2) seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary; and (3) staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (e.g.,  $\geq 1.2$  meters (m) [ $\geq 3.9$  feet (ft)]) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river (“Essential Feature 3”); and
- Water, especially in the bottom meter of the water column, with the temperature, salinity, and oxygen values that, combined, support: (1) spawning; (2) annual and interannual adult, subadult, larval, and juvenile survival; and (3) larval, juvenile, and subadult growth, development, and recruitment (e.g., 13 degrees Celsius ( $^{\circ}\text{C}$ ) (55.4 degrees Fahrenheit ( $^{\circ}\text{F}$ )) to 26  $^{\circ}\text{C}$  (78.8  $^{\circ}\text{F}$ )) for spawning habitat and no more than 30 $^{\circ}\text{C}$  (86  $^{\circ}\text{F}$ ) for juvenile rearing habitat, and 6 milligrams per litre dissolved oxygen for juvenile rearing habitat) (“Essential Feature 4”).

#### *Description of Proposed Critical Habitat*

NMFS proposes to designate critical habitat for the New York Bight DPS of Atlantic sturgeon in the waters of the Hudson River from the Troy Lock and Dam (also known as the Federal Dam) (river kilometer (RKM) 246) downstream to where the main stem river discharges at its mouth into New York City Harbor (RKM 0). The proposed critical habitat for this DPS also includes sections of the Connecticut, Housatonic, and Delaware Rivers. Within these areas, the proposed critical habitat is the full bank width with the exception of any U.S. Department of Defense sites determined to be ineligible for designation. The NMFS finds that the physical features that are essential to successful reproduction and recruitment in these specific areas may require special management or protection because of potential adverse impacts from the operation of dams, dredging projects, other in-water construction, and impacts from development along the river, such as wastewater treatment and water withdrawals.

Based on the above description and maps included in the proposed rule, the entire Hudson River portion of the IP2 and IP3 action area lies within the proposed Hudson River Critical Habitat Unit for the New York Bight DPS. Figure 1 depicts the full Hudson River Critical Habitat Unit, and Figure 2 depicts critical habitat proposed for designation in the lower Hudson River.

**Figure 1. Hudson River Critical Habitat Unit**



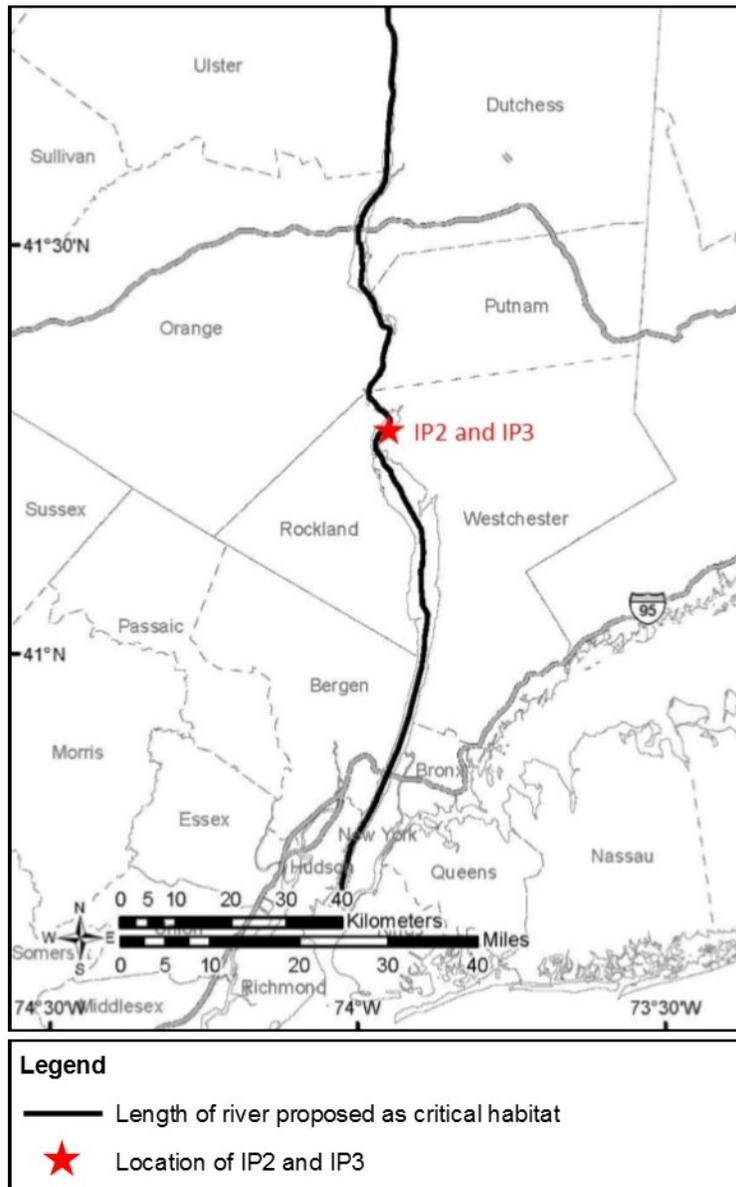
Source: Figure 2-9. Location Map of Hudson Critical Habitat Unit *in* NMFS 2016a

*Sturgeon Use of the Hudson River Critical Habitat Unit*

Based on available data, the upstream limit for Atlantic sturgeon in the Hudson River appears to be the Federal Dam at the fall line (RKM 246). Spawning may occur in multiple sites within the river. Hyde Park (RKM 134), which is considered a likely spawning area based on scientific studies and historical records, contains freshwater year round with substrate including bedrock, and water depths of 12 to 24 m (39 to 79 ft). Another potential spawning area is at RKM 112, which also contains freshwater at depths of 21 to 27 m (69 to 89 ft). Sexually immature sturgeon utilize the Hudson River estuary from the Tappan Zee (RKM 40) through Kingston (RKM 148). Immature individuals primarily occupy RKM 60 through RKM 107 during the summer months and then move downstream to RKM 19 through RKM 74 as water temperatures decline in the fall. Immature Atlantic sturgeon have also been captured in high concentrations during spring in soft-deep areas of Haverstraw Bay (RKM 57). (NMFS 2016a)

Figure 3 depicts sturgeon use of the Hudson River Critical Habitat Unit pictorially.

**Figure 2. Proposed Critical Habitat for the New York Bight DPS of Atlantic sturgeon in the Lower Hudson River**



Source: modified from Map 5, New York Bight Units 2 and 3, Housatonic River and Hudson River (Part A), in 81 FR 35701

Figure 3. Atlantic Sturgeon Use of the Hudson River Critical Habitat Unit

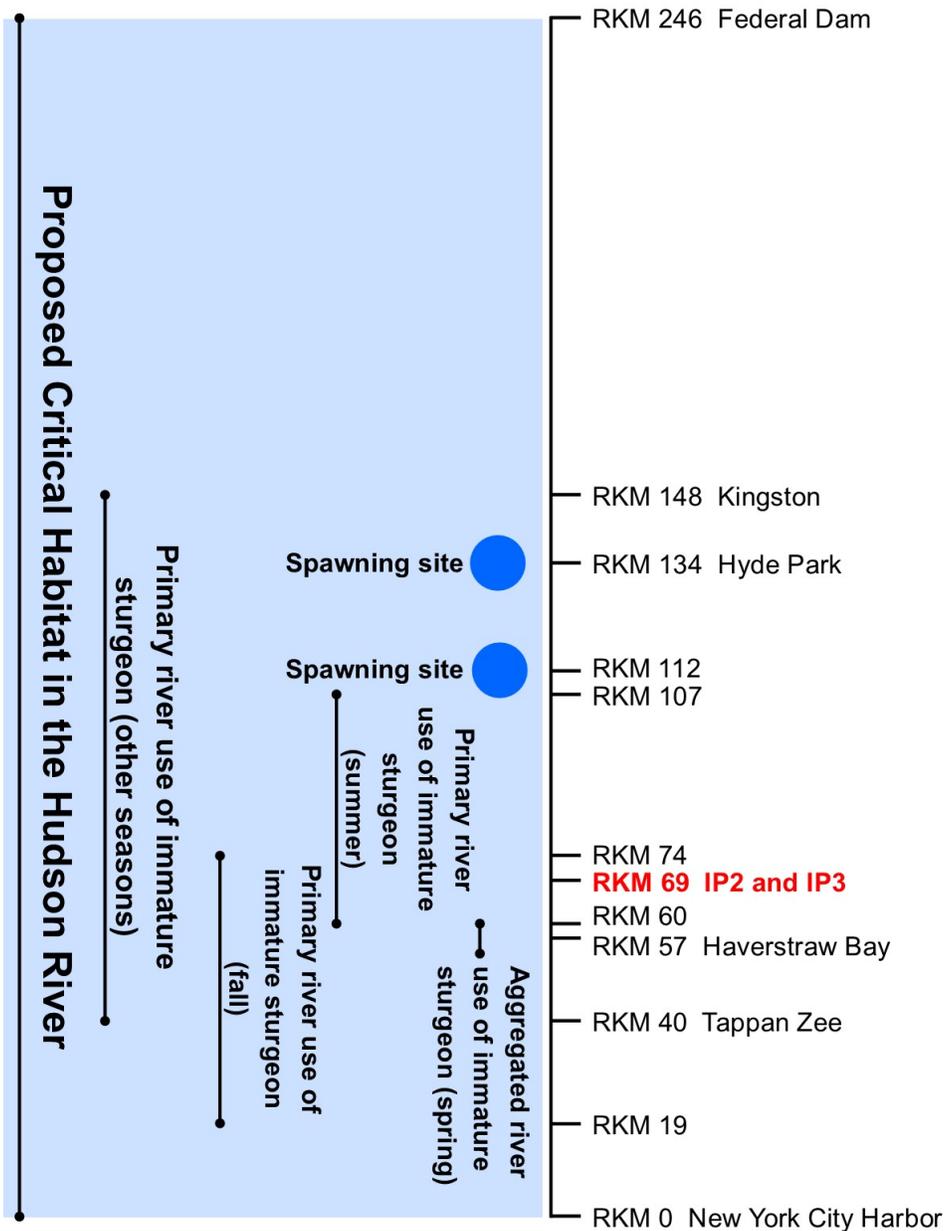


Figure data source: NMFS 2016a

## 6.0 Proposed Action Effects Analysis

### 6.1 Presence of Essential Features

The following sections consider whether the IP2 and IP3 action area contain the essential features identified by NMFS in its proposed critical habitat rule.

#### Essential Feature 1

The first essential feature is hard bottom substrate in low salinity waters for settlement of fertilized eggs, refuge, growth, and development of early life stages. Atlantic sturgeon

spawn in fresh water reaches of rivers several miles upstream of the salt wedge because early life stages have little to no tolerance for salinity (NMFS 2013). In the Hudson River, spawning may occur in multiple sites within the river, including Hyde Park at RKM 134, which contains freshwater year round with suitable substrate and bedrock, and at RKM 112, which has similar conditions (81 FR 35701). Spawning could also occur in other areas within the tidal freshwater zone of the river, which occurs from RKM 109–245 (CHGEC 1999). The IP2 and IP3 action area is within the oligohaline or low salinity zone, which extends from RKM 64–109 (CHGEC 1999), which makes it unlikely to support spawning. Thus, because the IP2 and IP3 action area is not consistently freshwater, it does not contain habitat associated with Essential Feature 1.

### Essential Feature 2

This essential feature is aquatic habitat with a gradual downstream salinity gradient of 0.5 to 30 parts per thousand and soft substrate downstream of spawning sites for juvenile foraging and physiological development. The IP2 and IP3 action area contains this type of habitat.

### Essential Feature 3

This essential feature is water of depths greater than 1.2 m (3.9 ft) and absent physical barriers to passage between the river mouth and spawning sites necessary to support movement of adults to and from spawning sites; the seasonal and physiologically dependent movement of juveniles; and staging, resting, or holding of subadults or spawning condition adults. The IP2 and IP3 action area contains this type of habitat.

### Essential Feature 4

This essential feature is water, especially in the bottom meter of the water column, with temperature, salinity, and oxygen values that support spawning; annual and interannual adult, subadult, larval, and juvenile survival; and larval, juvenile, and subadult growth, development, and recruitment. For juvenile rearing, water must be of temperatures no more than 30° C (86 °F) and have a dissolved oxygen content of 6 milligrams per litre. As previously discussed, the IP2 and IP3 action area does not include spawning habitat. However, the IP2 and IP3 action area includes waters that could support the growth, development, recruitment, and survival of juveniles, subadults, and adults. The IP2 and IP3 action area could also support larvae in late summer during years where the river's salt wedge is downstream of the IP2 and IP3 intakes (NMFS 2013). Thus, the IP2 and IP3 action area contains this type of habitat.

### Essential Features Present in the Action Area

Based on the foregoing discussion, the NRC staff concludes that the IP2 and IP3 action area contains Essential Features 2, 3, and 4.

## **6.2 Direct Effects**

This section considers the potential direct effects of the proposed action on Essential Features 2, 3, and 4. As stated in the description of the proposed action, the proposed license renewal would allow IP2 and IP3 to continue operating through 2033 and 2035, respectively. In its biological opinion, the NMFS (2013) determined that the continued operation and proposed license renewal of IP2 and IP3 could result in impacts related to water withdrawals, water discharges, and non-routine and accidental events.

## Water Withdrawals

The proposed action would require the continued operation of IP2 and IP3's once-through cooling system in order to provide station cooling. Therefore, withdrawal of Hudson River water could continue through 2033 (IP2) and 2035 (IP3). Water withdrawals can alter aquatic habitat in several ways, such as impingement and entrainment of aquatic organisms, local alteration of water velocity or regimes, and physical removal of habitat (water) from the aquatic environment.

IP2 and IP3 withdraw cooling water from the Hudson River and discharge cooling water return flows and other effluents under the terms of State Pollutant Discharge Elimination System (SPDES) permit no. NY-0004472 issued by the New York State Department of Environmental Conservation (NYSDEC 1987). IP2 and IP3 currently operate pursuant to the terms of a SPDES permit issued by NYSDEC in 1987. The permit has been administratively extended since its expiration in 1992 pending the resolution of ongoing litigation related to the NYSDEC's issuance of a draft renewed SPDES permit in 2003. Section 3.3 of the NMFS's 2013 biological opinion and Section 2.1.3 of the IP2 and IP3 FSEIS (NRC 2010) describe the cooling water system and related water withdrawals in detail.

Impingement and entrainment can affect critical habitat by removing prey from the habitat. Atlantic sturgeon adults and migrant subadults prey on mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Family Ammodytidae) (NMFS 2013). Although specific impingement and entrainment information is not available for Atlantic sturgeon prey, the NRC (2015) assessed impingement and entrainment on representative important species in its draft second supplement to the IP2 and IP3 FSEIS and concluded that impingement and entrainment effects would vary from small to large depending on the specific species. The NMFS (2013) addressed effects specifically to Atlantic sturgeon prey species from the continued operation of IP2 and IP3 in its biological opinion and concluded that effects would be insignificant and discountable. Therefore, the NRC concludes that impingement and entrainment would not affect Atlantic sturgeon prey species to a degree that would inhibit the growth, development, recruitment, or survival of juveniles, subadults, or adult Atlantic sturgeon or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

The Hudson River channel in the vicinity of IP2 and IP3 is one of the deepest and most turbulent flowing portions of the lower Hudson (CHGEC 1999). Upriver of IP2 and IP3, the river channel narrows abruptly, bends sharply to the east, and reaches a depth of over 150 ft (46 m) (NRC 2010). Nearer to IP2 and IP3, the river bottom consists of a series of progressively shallower gouges that result in a corrugated bottom ending in shallow water behind the Hudson Highlands (NRC 2010). River flow varies throughout the year as a function of meteorological conditions, precipitation and runoff in the upstream portion of the watershed, the influence of tides and currents in downstream portions of the river, and the location of the salt wedge. Data from the U.S. Geological Survey (USGS 2016) Green Island gauging station for the past five water years<sup>1</sup> (2011 through 2015) indicate that average annual flow has ranged from 13,830 cubic feet per second (cfs) (391 cubic meters per second (m<sup>3</sup>/s)) to 22,840 cfs (647 m<sup>3</sup>/s). For the period 1948 through 2015, the maximum flow has been 22,840 cfs (647 m<sup>3</sup>/s) in water year 2011, and the minimum flow has been 6,386 cfs (181 m<sup>3</sup>/s) in 1965 (USGS 2016).

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<sup>1</sup> Water years run from October 1 through September 30.

At IP2 and IP3, the maximum design intake flow rate for each cooling system is approximately 1,870 cfs (53.0 m<sup>3</sup>/s) (Entergy 2007), and the intake bay pumps pull in Hudson River water at between 0.6 and 1.0 feet per second (fps) (0.2 to 0.3 meters per second (m/s)). Due to the turbulence of the Hudson River in the vicinity of IP2 and IP3 and the high flow of water past the plant, IP2 and IP3 withdrawals are unlikely to significantly alter local water velocity or regimes to a degree that would appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

Regarding water use, IP2 and IP3 could physically remove roughly 16 to 27 percent of the habitat from the Hudson River aquatic environment based on average annual river flow data from the past five water years and assuming operation at 100 percent of the licensed thermal power level. However, the majority of this water is returned to the river when discharged as thermal effluent because once-through cooling systems typically experience evaporative losses of less than 3 percent (Solley et al. 1998). The NRC staff finds that although IP2 and IP3 can consume a significant portion of water flow past the plant, the removal of aquatic habitat is temporary and, therefore, is unlikely to inhibit the growth, development, recruitment, or survival of juveniles, subadults, or adults or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

#### Water Discharges

As described previously, license renewal would allow the continued operation of IP2 and IP3's once-through cooling system. Therefore, discharge of effluent to the Hudson River could continue through 2033 (IP2) and 2035 (IP3). Thermal effluent is of primary concern to aquatic habitats, although radionuclides and other chemicals can also be discharged during operation as noted in NMFS's (2013) biological opinion. Thermal impacts on sturgeon can include heat shock, which can result in direct mortality; sublethal effects, such as stunning or disorientation, which can alter predator-prey interactions by increasing susceptibility of affected individuals to predation; and an increase in susceptibility to disease or parasitism (NRC 2013). Additionally, discharge of heated water has the potential to create barriers that prevent or delay access to other areas within the river (NMFS 2013).

Thermal discharges from IP2 and IP3 are regulated through the site's SPDES permit. Both the SPDES permit and Title 6 of the *New York Codes, Rules, and Regulations* (6 NYCRR) Part 704, "Criteria Governing Thermal Discharges," impose limitations on the extent and magnitude of the IP2 and IP3 thermal plume. In a study of the IP2 and IP3 thermal plume, Swanson et al. (2011) found that the thermal plume varies greatly, primarily in response to tidal currents. For example, the plume generally followed the eastern shore of the Hudson River and extended northward from IP2 and IP3 during flood tide and southward from IP2 and IP3 during ebb tide. Depending on tides, the plume can reasonably be identified and can reach a portion of the near-shore bottom or be largely confined to the surface of the river. Temperature measurements reported by Swanson et al. (2011) generally show that the warmest water in the thermal plume is close to the surface, and plume temperatures tend to decrease with depth. During Swanson et al.'s (2011) cross-river surveys, the thermal plume extended from between 1,000 and 2,000 ft (300 to 600 m) from the eastern shore of the river on a cross-river transect of about 3,800 ft (1,150 m) and reached depths of about 35 ft (11 m). Mendelsohn et al. (2011) modeled the maximum area and width of the thermal plume—defined by the 4 °F (2.2 °C)  $\Delta T$  isotherms—in the Hudson River in response to NYSDEC's review of Swanson et al.'s (2011) study. Mendelsohn et al. (2011) reported

that for four cross-river transects near IP2 and IP3, the maximum cross-river area of the plume would not exceed 12.3 percent of the river cross-section, and the maximum cross-river width of the plume would not exceed 28.6 percent of the river width. Swanson et al. (2011) concluded that IP2 and IP3 are in compliance with NYSDEC water quality standards set forth at 6 NYCRR Part 704.

In its assessment of thermal impacts of IP2 and IP3 on shortnose and Atlantic sturgeon, the NMFS (2013) concluded that although sturgeon are likely to avoid areas exceeding 82.4 °F (28 °C), such areas would be small and avoidance behavior is extremely unlikely to preclude sturgeon from completing any essential behaviors such as resting, foraging, or migrating or to ultimately affect the fitness of any individuals. The NMFS (2013) also concluded that avoidance behavior would not increase energy expenditure, would not create any detectable effects on the physiology of any individuals, and would not have future effects on growth, reproduction, or general health. The IP2 and IP3 thermal plume does not contribute to reductions in dissolved oxygen and would, therefore, not cause changes in dissolved oxygen levels that could affect sturgeon (NMFS 2013). Finally, NMFS (2013) concluded that sturgeon prey would be impacted insignificantly, if at all, by thermal discharges. Based on NMFS's assessment of thermal impacts, the NRC staff concludes that the IP2 and IP3 thermal plume would not inhibit the growth, development, recruitment, or survival of juveniles, subadults, or adults or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

Regarding potential discharge of radionuclides, the NRC (2015) considered the impacts of exposure of aquatic organisms to radionuclides resulting from license renewal of IP2 and IP3 in Section 5.8 of its draft second supplement to the IP2 and IP3 FSEIS. The NRC staff found that the total calculated radionuclide dose to aquatic biota (including both fish and shellfish) at IP2 and IP3 is one-twentieth of the U.S. Department of Energy's (DOE) guideline value of 1 radiation-absorbed dose per day (0.01 gray per day), the level below which the DOE expects no negative population-level effects. As such, the NRC (2015) concluded that impacts to aquatic organisms during the license renewal term would be small (i.e., would not be detectable or would be so minor that they would neither destabilize nor noticeably alter important attributes of the aquatic environment). The NMFS (2013) also evaluated the impacts of radionuclide discharge on sturgeon in its biological opinion. The NMFS concluded that exposure is not likely to be at levels that would affect the health or fitness of any individuals and that effects related to radionuclides would be insignificant and discountable. Based on NRC's previous assessment and NMFS's biological opinion, the NRC staff concludes that potential discharge of radionuclides would not inhibit the growth, development, recruitment, or survival of juveniles, subadults, or adults or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

IP2 and IP3's SPDES permit limits the discharge of total residual chlorine, lithium hydroxide, boron, total suspended solids, and oil and grease, and stipulates the allowable pH of discharged water. In its biological opinion, the NMFS (2013) concludes that the discharges of these chemicals in accordance with the SPDES permit would have insignificant or discountable effects on Atlantic sturgeon. Based on the NMFS's assessment, the NRC staff concludes that chemical discharges would not result in effects that would inhibit the growth, development, recruitment, or survival of juveniles, subadults, or adults or that would otherwise diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

## Non-routine and Accidental Events

The NRC (2010) evaluated the effects of design basis and severe accidents in the IP2 and IP3 FSEIS and concluded that the impacts of both would be small. In its biological opinion, the NMFS (2013) concludes that the risk of non-routine and accidental events at IP2 and IP3 that would affect the aquatic environment, and subsequently affect sturgeon, is extremely low, and therefore, discountable. Because this impact is of such low risk, the NRC staff concludes that the potential for non-routine or accidental events would not inhibit the growth, development, recruitment, or survival or juveniles, subadults, or adults or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon.

### **6.3 Indirect Effects**

Indirect effects are those that are caused by the proposed action that are later in time, but are still reasonably certain to occur (50 CFR 402.02). The NRC staff did not identify any indirect effects associated with the proposed action. Termination of IP2 and IP3 operations and associated decommissioning of each reactor would occur eventually regardless of license renewal. While the proposed license renewal would delay the date of reactor shutdown, it would not significantly alter decommissioning impacts. Future effects on Federally listed species associated with decommissioning of IP2 and IP3 at the end of the proposed license renewal term would be addressed through section 7 consultation at the time of decommissioning.

### **6.4 Interrelated and Interdependent Effects**

Interrelated actions are those actions that are part of a larger action and depend on the larger action for their justification (50 CFR 402.02). Interdependent actions are those actions having no independent utility apart from the proposed action (50 CFR 402.02). In its 2013 biological opinion, the NMFS did not identify any interrelated or interdependent actions associated with the proposed license renewal. The NRC staff has not identified any new information that would constitute interrelated or interdependent actions and that might affect proposed critical habitat of the New York Bight DPS of Atlantic sturgeon.

### **6.5 Cumulative Effects**

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02).

In its proposed rule (81 FR 35701), the NMFS identifies a number of activities that may adversely modify critical habitat for the Atlantic sturgeon, as proposed. Such activities include in-water construction; dredging; bridge, culvert, and road projects; hydropower; utility lines; sand and gravel mining; and activities requiring National Pollutant Discharge Elimination System (NPDES) permits. For these projects, the NMFS anticipates that Federal agencies would be required to complete consultation under ESA section 7. Additionally, the actions of private entities may also require consultation if a Federal permit is required, Federal funding is received, or other entity is involved in or receives benefits from a Federal project. The effects of such actions, if taken, would be addressed by NMFS during future consultations with the applicable action agency(ies).

The NRC staff did not identify any projects in the vicinity of IP2 and IP3 that meet the definition of “cumulative effects” above. One nearby project, the Tappan Zee Bridge Replacement Project, requires Federal approval or funding, and therefore does not meet

the definition of “cumulative effects.” The NMFS (2016b) issued a biological opinion for the bridge replacement to the Federal Highway Administration, Army Corps of Engineers, and U.S. Coast Guard in June 2016 that concludes that the replacement of the Tappan Zee Bridge is likely to adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon or any DPS of Atlantic sturgeon.

## 7.0 Conclusion and Determination of Effects

### Summary of Effects

The proposed action has the potential to affect proposed critical habitat of the New York Bight DPS of the Atlantic sturgeon in the Hudson River. The IP2 and IP3 action area contains habitat meeting the criteria of Essential Features 2, 3, and 4 as described in NMFS’s proposed rule. The NRC staff evaluated the impacts of water withdrawals, water discharges, and non-routine and accidental events on these essential features. More specifically, the NRC considered impingement and entrainment of prey species, local alteration of water velocity or regimes, physical removal of habitat (water) from the aquatic environment, thermal discharges, discharge of chemicals and radionuclides, and design basis and severe accidents. The NRC staff concluded that although impacts exist, none of these impacts would affect proposed critical habitat such that continued operation and license renewal of IP2 and IP3 would inhibit the growth development, recruitment, or survival of juvenile, subadult, or adult Atlantic sturgeon or otherwise appreciably diminish the value of the proposed critical habitat for the New York Bight DPS of Atlantic sturgeon. Accordingly, the NRC makes the following conclusion.

### Proposed Critical Habitat of the New York Bight DPS of Atlantic Sturgeon

The NRC staff concludes that the proposed action *may affect, but is not likely to destroy or adversely modify* proposed critical habitat of the New York Bight DPS of Atlantic sturgeon in the Hudson River.

## 8.0 References<sup>2</sup>

10 CFR Part 2. *Code of Federal Regulations*, Title 10, *Energy*, Part 2, “Agency rules of practice and procedure.”

50 CFR Part 402. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 402, “Interagency cooperation—Endangered Species Act of 1973, as amended.”

81 FR 35701. National Marine Fisheries Service. Endangered and threatened wildlife and plants; designation of critical habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic sturgeon; proposed rule; request for comments. *Federal Register* 81(107): 35701-35732. June 3, 2016.

81 FR 36077. National Marine Fisheries Service. Endangered and threatened wildlife and plants; designation of critical habitat for the Carolina and South Atlantic Distinct Population Segments of Atlantic sturgeon; proposed rule; request for comments. *Federal Register* 81(107): 36077-36123. June 3, 2016.

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<sup>2</sup> References with Agencywide Documents Access and Management System (ADAMS) accession numbers can be accessed through NRC’s web-based ADAMS search engine at <http://adams.nrc.gov/wba/>. Click on the “Advanced Search” tab and choose the following criteria under Document Properties: “Accession Number” in the Property box, “is equal to” in the Operator box, and the ADAMS Accession Number of the document in the “Value” box.

6 NYCRR Part 704. *New York Codes, Rules, and Regulations*, Title 6, *Department of Environmental Conservation*, Part 704, “Criteria Governing Thermal Discharges.”

[CHGEC] Central Hudson Gas and Electric Corporation. 1999. Draft Environmental Impact Statement for State Pollutant Discharge Elimination System Permits for Bowline Point, Indian Point 2 and 3, and Roseton Steam Electric Generating Stations. Consolidated Edison Company New York, Inc. New York Power Authority and Southern Energy New York. December 1999. ADAMS Accession No. ML083400128.

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[NMFS] National Marine Fisheries Service. 2011. Endangered Species Act Section 7 Consultation Biological Opinion for Relicensing – Indian Point Nuclear Generating Station F/NER/2009/00619. October 14, 2011. ADAMS Accession No. ML11290A231.

[NMFS] National Marine Fisheries Service. 2013. Endangered Species Act Section 7 Consultation Biological Opinion for Continued Operations of the Indian Point Nuclear Generating Station, Units 2 and 3, Pursuant to Existing and Proposed Renewed Operating Licenses. January 30, 2013. ADAMS No. ML13032A256.

[NMFS] National Marine Fisheries Service. 2016a. Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon: Draft Biological Information and ESA Section 4(b)(2) Source Document with the Draft Economic Analysis and Initial Regulatory Flexibility Analysis. 226 p. Available at <[http://www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/docs/draft\\_biological\\_information\\_and\\_esa\\_section\\_4\\_b\\_2\\_source\\_document\\_with\\_irfa\\_and\\_econ\\_anal.pdf](http://www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/docs/draft_biological_information_and_esa_section_4_b_2_source_document_with_irfa_and_econ_anal.pdf)> (accessed 3 August 2016).

[NMFS] National Marine Fisheries Service. 2016b. Endangered Species Act Section 7 Consultation Biological Opinion; Federal Highway Administration, New York Division, Army Corps of Engineers, New York District, U.S. Coast Guard; Tappan Zee Bridge Replacement. June 20, 2016. 203 p. Available at <[https://www.greateratlantic.fisheries.noaa.gov/protected/section7/bo/actbiops/tz\\_biop\\_signed\\_06202016.pdf](https://www.greateratlantic.fisheries.noaa.gov/protected/section7/bo/actbiops/tz_biop_signed_06202016.pdf)> (accessed 17 August 2016).

[NRC] U.S. Nuclear Regulatory Commission. 2010. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 38, Regarding Indian Point Nuclear Generating Unit Nos. 2 and 3. Washington, DC: NRC. NUREG-1437, Supp. 38. Volumes 1, 2, and 3. December 2010. ADAMS Accession No. ML103270072.

[NRC] U.S. Nuclear Regulatory Commission. 2012. Letter from David J. Wrona, Branch Chief, to Patricia A. Kurkul, Northeast Regional Administrator. Subject: Request to reinstate section 7 consultation for the Indian Point Nuclear Generating Unit Nos. 2 and 3 due to listing of Atlantic sturgeon. May 16, 2012. ADAMS Accession No. ML12100A082.

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