Endangered Species Act Section 10(a)(1)(B) Incidental Take Application

April 6, 2017

Chesterfield Power Station

Chesterfield, VA

This page is intentionally left blank -

Contents -

1 Overview and Background .... 1 -
1.1 Permit Type .... 3 -
1.2 Date of Application .... 3 -
1.3 Permit Duration .... 3 -
1.4 Contact Information .... 3 -
2 Species Covered by the Application .... 4 -
2.1 Background .... 4 -
2.2 Shortnose Sturgeon .... 4 -
2.3 Atlantic Sturgeon .... 5 -
2.3.1 Stock Assessment .... 10 -
2.3.2 Recovery and Critical Habitat .... 11 -
3 Chesterfield Power Station .... 12 -
3.1 Location .... 13 -
3.1.1 Areas Considered for Coverage Under the Permit .... 13 -
4 Environmental Baseline .... 20 -
4.1 Environmental Setting .... 20 -
4.2 Biological Resources .... 26 -
4.3 Water Quality .... 28 -
5 Activities .... 31 -
5.1 Activities to be Covered Under an Incidental Take Permit .... 31 -
5.1.1 Cooling Water Intake .... 31 -
5.1.2 Clean Water Act 316(b) Studies .... 34 -
5.2 Other Activities Considered (For Which No Incidental Take Anticipated to Occur) .... 45 -
5.2.1 Dredging .... 45 -
5.2.2 Constituent Discharge .... 47 -
5.2.3 Thermal Discharge .... 51 -
5.2.4 Vessel Movements .... 52 -
5.2.5 Shoreline and Structure Maintenance .... 54 -
6 Literature Cited .... 55 -
Appendix A: Entrainment Characterization Study Plan .... A -
Appendix B: Impingement Characterization Study Plan .... B -
Appendix C: Dredging Joint Permit Applications .... C -
Appendix D: VPDES Permit No. VA00004146 .... D -
Appendix E: Vessel Movement Summary .... E -

Tables -

Table 3-1. Geographic Coordinates for Chesterfield Power Station Outfalls .... 17 -
Table 4-1. Summary of USACE Maintenance Dredging in Permitted Area .... 25 -
Table 4-2. Median Total Suspended Sediments in the Freshwater James River .... 30 -
Table 5-1. CWA §316(b) Rule for Existing Facilities Submittal Requirements Summary .... 35 -
Table 5-2. Entrainment Sampling Details .... 37 -
Table 5-3. Sampling Depths at Chesterfield Power Station .... 39 -
Table 5-4. Summary of Development of the Sampling Approach to Characterize Entrainment .... 40 -
Table 5-5. Impingement Sampling Details .... 42 -
Table 5-6. Summary of the Development of the Sampling Approach for Characterizing Impingement .... 43 -
Table 5-7. Chesterfield Power Station Outfall Water Sources and Flows .... 49 -
Table 5-8. Gallons of Liquid Phase Hydrocarbons Recovered at Chesterfield Power Station .... 51 -

Figures

Figure 2-1. Range of the Atlantic Sturgeon Distinct Population Segments .... 7 -
Figure 3-1. Aerial Photograph of Chesterfield Power Station .... 13 -
Figure 3-2. Plan View of 2003 Dredging Location(s) for Chesterfield Power Station CWISs .... 15 -
Figure 3-3. Plan View of Barge Slip Dredging .... 15 -
Figure 3-4. Locations of Chesterfield Power Station Outfalls .... 16 -
Figure 3-5: Location of CPS in James River .... 18 -
Figure 3-6. Bathymetry at CPS .... 19 -
Figure 4-1. The James River Watershed .... 21 -
Figure 4-2. Chesterfield Power Station Area Map .... 22 -
Figure 4-3. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at - Mean Lower Low Water) .... 23 -
Figure 4-4. Survey of James River Depths in Vicinity of Chesterfield Power Station Cooling Water Intake - Structure .... 24 -
Figure 4-5. USACE Navigation Dredging Locations in the James River in Vicinity of Chesterfield Power - Station 25 -
Figure 4-6. Map Depicting the Study Area and Sampling Stations for CWA 316(a) Studies Conducted - April 1997 – February 1999 .... 27 -
Figure 4-7. Water Quality Monitoring Locations Downstream of Chesterfield Power Station .... 30 -
Figure 5-1. Chesterfield Power Station Cooling Water Intake Structure Configuration .... 32 -
Figure 5-2. Typical Plan View of Chesterfield Power Station Cooling Water Intake Structure .... 33 -
Figure 5-3. Typical Section View of Chesterfield Power Station Cooling Water Intake Structure .... 33 -
Figure 5-4. Proposed Location of Chesterfield Power Station Entrainment Sampling .... 38 -
Figure 5-5. Conceptual Design of Intake Piping for Entrainment Sampling .... 41 -

Figure 5-6. Chesterfield Power Station Impingement Sampling Location .... 44 -
Figure 5-7. Aerial Photo of Chesterfield Power Station Dredge Locations... 45 -
Figure 5-8. Typical Cross-section View of 2003 Dredging Location for Chesterfield Power Station CWISs, - February 12, 2003... 46 -
Figure 5-9. Dragline Dredge... 46 -
Figure 5-10. Typical Towboat Design .... 53 -

1 Overview and Background

With this Incidental Take Permit (ITP) Application and associated Conservation Plan (Section 6), Virginia Electric and Power Company (Dominion) requests that the National Marine Fisheries Service (NMFS) authorize take of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) incidental to the operation, permitting and maintenance of the Dominion Chesterfield Power Station (CPS) according to Section 10(a)(1)(B) of the Endangered Species Act of 1973 (ESA); specifically incidental to operation of the cooling water intakes and performance of Clean Water Act (CWA) 316(b) studies. Additional activities considered, but for which take coverage is not being requested, include dredging, constituent discharge, thermal discharge, vessel movements, and shoreline and structure maintenance. This application also considers potential effects of CPS on Shortnose Sturgeon (*Acipenser brevirostrum*); however, because of its rarity in the James River, all effects are considered to be discountable and no take of Shortnose Sturgeon are expected, based on current and foreseeable operations and maintenance. Therefore, no coverage for incidental take of Shortnose Sturgeon is being requested. Additional information on Shortnose Sturgeon are included in Section 2.2. This application provides the information required at 50 CFR § 222.307.

The CPS is a base-load facility located in Chesterfield, Virginia in the upper tidal portion (approximately river mile 82 [river kilometer, rkm 132]), of the James River that has been operating since 1945. CPS currently is authorized to withdraw and discharge water under the Virginia Pollution Discharge Elimination System (VPDES) Permit Number VA0004146 issued and effective on October 1, 2016. The VPDES permit is one of several state and federal authorizations required for the operation of CPS. The VPDES permit program is authorized under §402 of the CWA, which requires all point source discharges of pollutants to waters of the United States to obtain a National Pollutant Discharge Elimination System (NPDES) permit 33 U.S.C. § 1342. The CPS discharges authorized under the VPDES permit result from the generation of electricity using steam produced by the combustion of coal and other fossil fuels (VDEQ 2016).

Clean Water Act §316(b) requires that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. On August 15, 2014, the final CWA §316(b) Rule for existing facilities was published in the Federal Register (79 Fed. Reg. 48,300 Aug. 15, 2016). The Rule applies to existing facilities that withdraw more than 2 million gallons per day (MGD) from Waters of the United States, use at least 25 percent of that water exclusively for cooling purposes, and have or require an NPDES permit (40 C.F.R. § 125.91(a)). CPS has a design intake flow of approximate 1,090 MGD (at least 25 percent of which is used exclusively for cooling purposes), and is therefore subject to the existing facility Rule. Facilities subject to the new Rule are required to develop and submit technical studies and data, identified at CWA §122.21(r)(2)-(13), that will be used by the state NPDES Director (Director) to make a site-specific BTA determination for entrainment and will inform the facility's selection (and Director's approval) of an option for compliance with the BTA standards for impingement mortality. The specific material required to be submitted and compliance schedule are dependent on actual intake flow rates at the facility, NPDES permit renewal date, and other site-specific considerations. Facilities are to submit their CWA 316(b) application material to their Director along with their next permit renewal, unless that permit renewal takes place prior to July 14, 2018, in which case an alternate schedule may be negotiated. Based on its current configuration and operation, CPS is anticipated to be required to develop and submit each of the CWA 122.21(r)(2)-(13) submittal requirements with its next permit renewal in accordance with the rule's technical and schedule requirements, including an Entrainment Characterization Study. While these requirements do not specify that an Impingement Characterization Study must be conducted, Dominion determined that one is warranted based on the following anticipated benefits: 1) Ability to document current impingement at CPS where recent impingement data is not available to support development of CWA 122.21(r)(4) and potentially (r)(6) submittal requirements; and 2) Understanding the nature of current impingement at CPS to evaluate potential effectiveness of alternative technologies and determination of fragile species [1]composition.

To comply with the CWA §316(b) Rule's requirements for CPS's next permit renewal, Dominion developed and implemented CWA 316(b) entrainment and impingement study plans which were provided to Virginia Department of Environmental Quality (VDEQ) in April 2015.

Per the study plans, entrainment sampling was scheduled twice per month from July 1, 2015 – June 30, 2017 (Dominion 2016a) and impingement sampling was scheduled twice per month from July 1, 2015 – June 30, 2016 (Dominion 2016b). Impingement and entrainment sample collections started July 13, 2015. Two of four entrainment samples collected as part of one 24-hour sampling event on October 7 and 8, 2015 each contained one Atlantic Sturgeon yolk-sac larvae. The samples were processed according to the study plan's standard operating Quality Assurance/Quality Control procedures (Dominion 2015a). The October 7, 2015 sample collection was completed at 6:00 pm and the October 8, 2015 sample collection was completed at 5:06 am. The samples were preserved immediately after collection and were transported to the HDR Environmental Measurement Laboratory in Nanuet, New York for sorting and analysis. During sample processing, the HDR taxonomic staff preliminarily identified two specimens as Atlantic Sturgeon larvae on January 8, 2015. Identification of the specimens as *Acipenser* sp. was verified by Dominion's Millstone laboratory on January 15, 2016. Dominion reported the incidental collection of these sturgeon larvae to VDGIF and NMFS immediately following identity verification on January 15, 2016.

In an event unrelated to the CWA 316(b) entrainment sampling, one adult Atlantic Sturgeon was collected with debris on the CPS trash racks on October 3, 2015. Dominion reported the trash rack collection to NMFS on October 5, 2015. No other Atlantic Sturgeon eggs, larvae, juveniles or adults were collected in entrainment and impingement samples in 2015 or 2016, or in prior impingement or entrainment studies, which were processed and specimens were identified to the lowest taxonomic group practical.

[1] As defined in 40 CFR 125.92(m)

On February 26, 2016, NMFS recommended that Dominion suspend CWA 316(b) sampling at CPS. The sampling was suspended on March 2, 2016. Dominion and NMFS met on August 12, 2016 to discuss obtaining authorization through ESA Section 10(a)(1)(B) for take of Atlantic Sturgeon incidental to CPS operations, maintenance, and completion of sampling pursuant to VPDES-permitting requirements. Dominion continues to coordinate with NMFS in preparing this ITP Application and Conservation Plan, including the following:

- October 11, 2016 teleconference to discuss scope of permit and the means and methods to determine ITP approach;
- November 10, 2016 teleconference to discuss CPS background and activities to be permitted;
- November 29, 2016 teleconference to discuss methods for calculating take and progress on the ITP Application and Conservation Plan;
- November 30, 2016 email to provide a draft technical summary on take calculation methods;
- February 15, 2017 email from NMFS providing preliminary comments on draft ITP Application and Conservation Plan; and
- March 9, 2017 teleconference to discuss comments on the draft ITP Application and Conservation Plan.

1.1 Permit Type

An **individual permit** under Endangered Species Act (ESA) Section 10(a)(1)(B) is being requested.

1.2 Date of Application

The date of the Application is **April 6, 2016**.

1.3 Permit Duration

A permit is being requested for **10 years**.

1.4 Contact Information

Facility Name and Address:

Virginia Electric and Power Company
Dominion Chesterfield Power Station
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Location:

500 Coxendale Road
Chester, Virginia 23831

Primary contact's name:

Karen Canody
Supervisor, Environmental Biology
Business phone number: 804-271-5301
Alternate phone number: 804-627-3262
Business fax number: 804-271-2977

Officer's name:

David A. Craymer
VP Power Generation System Operations

Business tax identification number:

54-0418825

2 Species Covered by the Application

2.1 Background

As discussed in Section 1 and in greater detail in Section 5 of this document, CPS is located in the upper tidal portion of the James River. The six power-generating units at CPS utilize a once-through cooling water system that withdraws cooling water from the tidal freshwater portion of the James River through five CWISs.

Certain activities associated with CPS operations, maintenance, and completion of sampling pursuant to CWA §316(b) permitting requirements have the potential to affect Atlantic Sturgeon (see Section 3 of this document for a description of activities). The Shortnose Sturgeon rarely occurs in James River. This application considers potential effects of CPS on Shortnose Sturgeon and demonstrates that take is not anticipated; therefore, no coverage for incidental take of Shortnose Sturgeon is being requested. Incidental take coverage is not anticipated for any other listed species.

2.2 Shortnose Sturgeon

Shortnose Sturgeon was federally listed as endangered by the U. S. Fish and Wildlife Service (USFWS) on March 11, 1967. It is also listed as endangered in Virginia. This species occurs in large coastal rivers of eastern North America (NMFS 1998). In the northern part of its range, the species is considered to be "freshwater amphidromous," meaning it spawns in fresh water, but regularly enters seawater during various stages of its life (NMFS 1998). Shortnose Sturgeon are occasionally found near the mouths of rivers, and coastal migrations between rivers have been documented (Zydlewski et al. 2011). Juveniles typically move upstream in rivers in spring and summer, and downstream in fall and winter, but inhabit reaches above the freshwater–saltwater interface. Adults may move into higher salinity areas on a more regular basis (NMFS 1998).

Shortnose Sturgeon are rare in the Chesapeake Bay. Kynard et al. (2007) studied the Shortnose Sturgeon in the Potomac River, conducting extensive sampling from March 2004 to

July 2007. During this period they collected only one Shortnose Sturgeon. A second Shortnose Sturgeon reported by Kynard et al. (2007) was collected by a commercial fisher. Kynard et al. (2007) also reviewed available literature for evidence of Shortnose Sturgeon in the Potomac River and the Chesapeake Bay, but found that reliable information was scarce.

Tag/recapture research and reward programs for Atlantic Sturgeon conducted in the Chesapeake Bay from 1996-2006 also reported catches of Shortnose Sturgeon. Most of the reported captures in the Chesapeake Bay occurred in the upper Bay, from Kent Island to the mouth of the Susquehanna River and the Chesapeake & Delaware Canal, in Fishing Bay and Hoopers Island in the Middle Bay, and in the Potomac River (NMFS 2009, USFWS 2009). However, included in the tag/recapture research reward program was the report of one confirmed and one suspected Shortnose Sturgeon at the mouth of the Rappahannock River in Virginia. Aside from a recent occurrence, discussed in more detail below, these are considered the only occurrences of living Shortnose Sturgeon in Virginia (Spells 1998, VDGIF 2016a, Personal Communication Dr. Matthew Balazik) and this species has been considered extirpated from Virginia waters (VDGIF 2016a). Further, recent and historic sampling has been conducted at Chesterfield Power Station (CPS), including entrainment and impingement sampling (1977, 2005-2006), and ichthyoplankton and fish community sampling in the James River near the station (1997-1999, 2005-2006), and Shortnose Sturgeon have never been collected or observed.

While sampling for juvenile Atlantic Sturgeon in the James River on March 13, 2016, Virginia Commonwealth University researchers captured a Shortnose Sturgeon in the freshwater portion of the James River at approximately river mile 30 (rkm 48) (Personal Communication Dr. Matthew Balazik). With an estimated fork length of 29.5 inches (75 cm), the individual was considered mature and a subsequent genetic analysis assigned the fish to the Chesapeake Bay/Delaware population segment. It is unclear if the Shortnose Sturgeon captured in the James River is a remnant of a natural population that was almost extirpated or a roaming fish from either the Potomac River, about 75 miles (120 km) away, or from the Delaware River, 211 miles (340 km) away, via the Chesapeake & Delaware Canal (Welsh et al. 2002, Kynard et al. 2009, Personal Communication Dr. Matthew Balazik). This was the first and only reported occurrence of Shortnose Sturgeon in the James River, and the first and only reported occurrence in Virginia waters in the past 100 years aside from the two reports at the mouth of the Rappahannock River noted previously (Personal Communication Dr. Matt Balazik, VDGIF 2016a). Based on available information, Shortnose Sturgeon are very rare in the upper Chesapeake Bay and nearly non-existent in the lower Chesapeake Bay, including the upper James River. All effects of the CPS on Shortnose Sturgeon are considered to be discountable (i.e., the potential is so low, that it is not measurable and not anticipated to occur); therefore, no take coverage for this species is requested in this ITP Application.

2.3 Atlantic Sturgeon

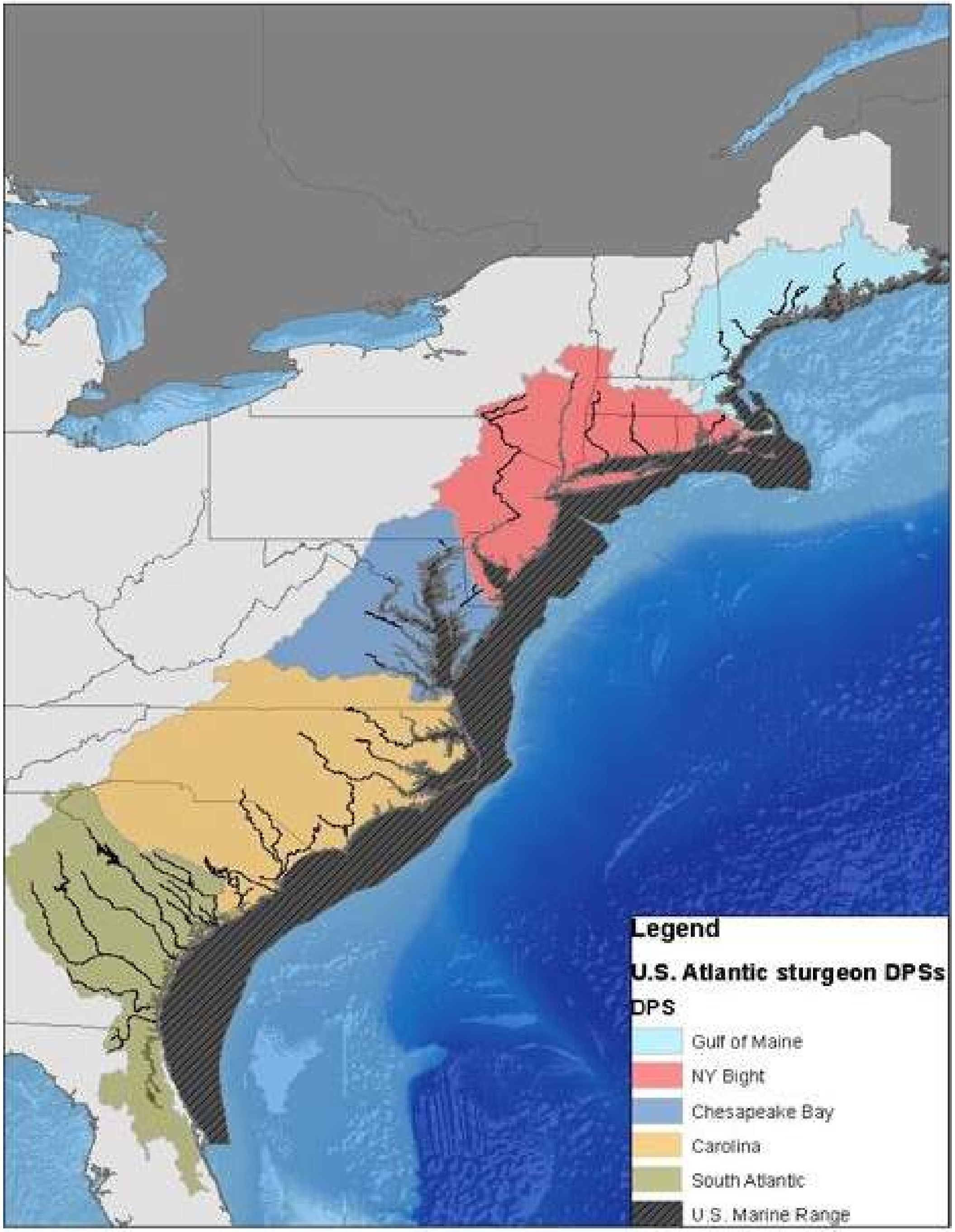
Effective April 6, 2012, Atlantic Sturgeon originating from the New York Bight, Chesapeake Bay, - South Atlantic and Carolina Distinct Population Segments (DPSs) were federally listed as -

endangered under the Endangered Species Act (ESA) (Figure 2-1). Those originating from the Gulf of Maine DPS are listed as threatened. Atlantic Sturgeon are also listed as endangered by the state of Virginia. Based on genetic studies, adult Atlantic Sturgeon from each of these five DPSs have the potential to occur throughout the full range of the five DPSs, including the James River and in the vicinity of CPS (NMFS 2012). The majority of spawning adults found in the James River are likely to originate from the Chesapeake Bay DPS. The Chesapeake DPS of Atlantic Sturgeon includes all anadromous Atlantic Sturgeon that are spawned in the watersheds that drain into the Chesapeake Bay and into coastal waters from the Delaware-Maryland border from Fenwick Island to Cape Henry, Virginia.

Essential Fish Habitat in terms of both spawning and nursery habitats for Atlantic Sturgeon in Virginia waters of the Chesapeake Bay, including the James River, was described by Bushnoe et al. (2005) and Niklitschek and Secor (2005). NMFS is expected to issue a final rule designating critical habitat for the Atlantic Sturgeon by June 3, 2017. Within the James River, critical habitat has been proposed for the entire width of the mainstem James River from Boshers Dam downstream for 99 river miles (160 river kilometers) to where the river discharges into the Chesapeake Bay at Hampton Roads (see Section 2.3.2 for more detail).

The James River historically provided the largest stock of Atlantic Sturgeon in the Chesapeake Bay and the majority of the adults in the river are likely to originate from the James River and thus, the Chesapeake Bay DPS (Hildebrand and Schroeder 1928; ASSRT 2007; Hager 2011; NMFS 2012). Because early life stages (eggs and larvae), yearlings, and juveniles do not leave their natal river or estuary, any Atlantic Sturgeon from these life stages in the James River would have originated from the Chesapeake Bay DPS. Subadult Atlantic Sturgeon (greater than 50 cm but not yet sexually mature), move outside their natal rivers. Therefore, subadult and adult Atlantic Sturgeon present in the James River and in the vicinity of the CWIS could be from any of the five DPSs.

Within the Chesapeake Bay DPS, Atlantic Sturgeon were historically known to spawn in six river systems; the Susquehanna, Potomac, James, York, Rappahannock, and Nottoway Rivers (ASSRT 2007). Atlantic Sturgeon continue to use the James River for spawning. While the availability of suitable benthic substrates (i.e., rock and cobble gravel) might be the limiting factor for sturgeon spawning habitat, hydrodynamic characteristics could also be important (Bilkovic et al. 2009). Bushnoe et al. (2005) indicated that the Turkey Island and Jones Neck oxbows, which are approximately 3 to 7 miles (4.8 to 11.3 km) downstream of CPS, were potential spawning habitats due to their hydrodynamic characteristics.



Source: National Oceanic and Atmospheric Administration as cited in Balazik 2012

Figure 2-1. Range of the Atlantic Sturgeon Distinct Population Segments

However, empirical evidence of actual spawning activity or capture of early life stages at these potential spawning habitats is still lacking. Bilkovic et al. (2009) and Austin (2012) conducted Atlantic Sturgeon spawning habitat evaluations using hard substrate classifications based on side-scan sonar mapping in the upper James River. Austin (2012) characterized sturgeon spawning beds as dominated by hard substrate clean of fines/silt and ≥ 1.2 inches (30 millimeters [mm]) in size, and depths ≥ 32.8 feet [ft] (10 meters [m]). Based on these parameters and sonar mapping data, Austin (2012) described essential sturgeon spawning habitat as located in major bends of the river where scouring occurs. The author also compared historical and present day availabilities of hard bottom habitat and identified a 28 percent loss of hard bottom since 1853 over the area of river evaluated, with the greatest losses in hard bottom in the upper portions of the study area (55 percent loss in hard bottom habitat). The loss in availability of hard substrates was attributed to increased sediment loading and channel alterations (Austin 2012). Some of the losses were thought to be offset by increased availability of hard bottom habitat within the confines of the shipping channel. Results of both studies described potential rather than confirmed Atlantic Sturgeon spawning habitat. Austin (2012) noted the areas of hard substrate identified as potentially suitable also needed to be further evaluated for the presence of silt layers covering hard substrate that may negatively impact the quality of spawning substrates by smothering eggs or impairing adhesion.

Spawning has been described as occurring in flowing water between the salt front of estuaries and the fall line of large rivers, where optimal flows are 46 to 76 centimeters per second (cm/s, 1.5 to 2.5 feet per second [ft/s]), depths are 11 to 27 m (36 to 88.5 ft), with a preferred temperature range of 13-21°C (ASMFC 2012; temperatures for spawning can range from 13–26°C). While spawning has generally been characterized as occurring in April and May, strong empirical evidence suggests that spawning occurs in the fall in the tidal freshwater portion of the river upstream of river mile 67 (rkm 108) (Balazik et al. 2012a, Balazik and Musick 2015). The capture of yolk-sac larvae by CPS in October 2015 entrainment samples further corroborates the evidence of fall spawning.

CPS is located at approximately river mile 82 ([rkm 132]). In a telemetry study, Hager (2011) observed two seasonal migrations by adult Atlantic Sturgeon in the James River; in the spring during April and May and in the late summer and early fall from August into October. No fish passed above river mile 67 (rkm 108) in the spring (located downstream of CPS). The tagged adult Atlantic Sturgeon and majority of subadult Atlantic Sturgeon exited the James River when temperatures reached 24°C in early June. During the late summer to early fall residency (August-October), fish ascended the river rapidly and congregated in upriver sites between river mile 48 (rkm 77) and the fall line near Richmond, VA (river mile 95 [rkm 153]), approximately 13 miles (20.9 km) upstream of CPS. During late summer, Atlantic Sturgeon exhibited a preference for the river section where the upper James and Appomattox Rivers meet (river mile 73 [rkm 117.5]), approximately 9 miles (14.5 km) downriver from CPS (Hager 2011). From 2009 to 2011, Balazik et al. (2012a) conducted spring (April – June) and fall (August – October) Atlantic Sturgeon surveys upstream of river mile 67 (rkm 108) with telemetry monitoring. No Atlantic Sturgeon were collected during the three years of spring sampling; however, 122 Atlantic Sturgeon were collected during the fall surveys, from August 5 to October 9. All collections were made between river mile 67 and 82 (rkm 108 to 132). Of the 122 captures, 106 Atlantic Sturgeon were verified as mature males and one post-spawned female was collected on September 9. A total of 40 fish were tagged during the three year study and monitored with acoustic telemetry similar to Hager (2011). The study showed that most males staged at the upper edge of the salt wedge, then migrated upstream during September to early October before dropping back downstream. The upstream migration lasted 1 to 12 days, and exited the river and entering Chesapeake Bay from October 6 to November 8.

These studies were continued from 2012 to spring of 2014 (Balazik and Musick 2015). Based on the results of previous studies, which indicated Atlantic Sturgeon did not migrate upstream of river mile 67 (rkm 108) during the spring and observations of breaching at river mile 56 (rkm 90), spring sampling was conducted further downstream, between river mile 54 and 60 (rkm 87 and 97) and at river mile 20.5 (rkm 33). Fall sampling continued to be conducted upstream of river mile 67 (rkm 108). Balazik and Musick (2015) reported capturing a recently post-spawned female Atlantic Sturgeon on May 11, 2011, and three adult males in spawning condition (expelling milt on capture) from April 17 to May 8; all captured at approximate river mile 58 (rkm 93-94). Similar to the previous studies, the fall surveys were significantly more productive, with 236 Atlantic Sturgeon captured between August 16 and October 13, including two mature females carrying eggs, captured on September 6 and 14.

Sturgeon breaching and captures of post-spawn sturgeon by Balazik and Musick (2015) indicated that spring spawning may occur in the area of river mile 55 through river mile 60 (rkm 88.5 through rkm 96.5), more than 20 miles (32 km) downstream of CPS. Balazik and Musick (2015) also reported that sturgeon suspected of fall spawning traveled up to river mile 72 (rkm 116), approximately 10 miles (16 km) downstream of CPS and in the vicinity of CPS. Further confirmation of Atlantic Sturgeon spawning in the James River was provided by the collection of a young-of-year (13.5 cm [5.3 inches]) Atlantic Sturgeon at river mile 68 (rkm 110) in 2004 (Balazik et al. 2012b). Recently, young of the year juvenile Atlantic Sturgeon of approximately 16 inches (40-41 cm) were collected in the vicinity of Hopewell Bay in November 2016, providing additional evidence of spawning in the James River (Personal Communication Dr. Matthew Balazik).

Fecundity of female Atlantic Sturgeon can range from 1 to 2.5 million eggs (NOAA 2016). Eggs are broadcast over hard substrate in the presence of flowing water. Eggs are adhesive and demersal and are expected to attach to the substrate within 20 minutes following fertilization; therefore, viable sturgeon eggs should occur only on the spawning grounds (Hildebrand and Schroeder 1928, Jones et al. 1978, ASMFC 2012). Eggs typically hatch in 4–7 days depending on temperature (Hildebrand and Schroeder 1928, Gilbert 1989, Smith et al. 1980, Mohler 2003).

Hardy and Litvak (2004) determined the effects of temperature on the development, survival and growth of yolk-sac larvae of both Shortnose and Atlantic Sturgeon. The rate of yolk-sac absorption increased with warmer temperatures, ranging from a mean of 27 days at 13°C to nine days at 21°C (Hardy and Litvak 2004). Atlantic Sturgeon yolk-sac larvae were found to be very tolerant to temperature changes. At hatching, Atlantic Sturgeon larvae are large bodied and are assumed to undertake a demersal existence in the same areas where they were spawned (ASMFC 2012, Bath et al. 1981). Bath et al. (1981) only collected sturgeon larvae in bottom samples. Larvae are active swimmers and leave the bottom within 8 to 10 days to swim in the water column (Kynard and Horgan 2002). The yolk-sac larval stage is completed in about 8 to 12 days (Jones et al. [1978] reports 6 days). Snyder (1988) reports that Atlantic Sturgeon complete yolk absorption by 0.5 inches (13–14 mm) standard length in 6–7 days. After the absorption of the yolk, larvae move downstream to the rearing grounds (Kynard and Horgan 2002). During the first half of this migration, larvae move only at night and use benthic structure (e.g., gravel matrix) as refuge during the day (Kynard and Horgan 2002). During the latter half of migration to the rearing grounds, when larvae are more fully developed, movement occurs during both day and night. Larvae move downstream as they transition into the juvenile phase at approximately 30 mm (1.2 in) total length and develop a tolerance to salinity during this transition. Eventually Atlantic Sturgeon become residents in estuarine waters for months to years before emigrating to the open ocean (ASSRT 2007, ASMFC 2012). ASMFC (2012) notes that some Atlantic Sturgeon occupy freshwater habitats for two or more years, while others move downstream to brackish waters when the water temperature drops.

Bain et al. (2000) reported that early juveniles were collected from salinities ranging from 0–5 parts per thousand from April through October in the Hudson River and from 3–18 parts per thousand from October through March. However, temperature and dissolved oxygen are likely key habitat parameters (ASMFC 2012). Bain (1997) reported that from July through September, juvenile sturgeon use deep channels in the Hudson River. Juvenile Atlantic Sturgeon in North Carolina use deep and cool areas as thermal refuges, particularly in the summertime (Moser and Ross 1995 as cited in ASMFC 2012).

Atlantic Sturgeon are benthic feeders, using their snouts and barbels to rout through sediments, sucking up organisms with their soft mouths (NOAA 2016). They feed on worms, snails, shellfish, crustaceans, and small fish (Secor et al. 2000, NOAA 2016). Nursery and foraging habitat typically contains productive benthic invertebrate communities in soft sediments, including freshwater mussel and marine shellfish beds.

2.3.1 Stock Assessment

Information on the status of Atlantic Sturgeon populations is limited across its range, but data from long-term monitoring efforts in New York and North Carolina indicate significant annual fluctuations (ASMFC 2016a). Based on a status review initiated by NOAA Fisheries in 2009, the Atlantic Sturgeon was listed under the ESA as endangered (New York Bight, Chesapeake Bay, Carolina and South Atlantic DPSs) and threatened (Gulf of Maine DPS) in 2012.

NMFS developed an index of population abundance for Atlantic Sturgeon using fishery bycatch estimates, data from the USFWS Atlantic Coast Sturgeon Tagging Database, and published values of Atlantic Sturgeon life history parameters. The analysis resulted in a wide range in population estimates with a mean abundance of Atlantic Sturgeon in oceanic waters off the Northeast coast of the US and Canada as 417,934 fish, with a 95% confidence interval of 165,381 to 744,597 fish (Kocik et al. 2013). The Chesapeake Bay DPS oceanic population was estimated to comprise 14 percent of the total Atlantic coastal population with a mean population of 58,511 fish, with a 95% confidence interval of 23,153 to 104,244 fish (Kocik et al. 2013). The abundance index generated by this analysis was intended for use by managers prior to completion of comprehensive stock assessments.

Since the listing, a coast-wide benchmark stock assessment was initiated to evaluate stock status, stock delineation, and bycatch (ASMFC 2016a). Balazik and Musick (2015) hypothesized that a dual spawning strategy (spring and fall) could substantially affect previous population status assessments. The assessment is expected to be completed in early 2017 (ASMFC 2016b). Balazik (2012) suggested that year classes 6 through 9 were underrepresented in the James River samples as a result of the behavior pattern of oceanic migrations of subadults. He further suggested the James River stock showed symptoms of depletion because data indicates that, historically, the maximum age and length of Atlantic Sturgeon was almost three times greater than recent data collections indicate. A robust stock assessment that addresses the status of the James River has not yet been published.

2.3.2 Recovery and Critical Habitat

To date, a formal recovery plan for Atlantic Sturgeon has not been drafted, though a recovery program is in place (NOAA Fisheries 2016). At the time of listing, NMFS identified threats to Atlantic Sturgeon as continued degraded water quality, habitat impacts from dredging, continued bycatch in state and federally-managed fisheries, and vessel strikes (77 FR 5880).

Areas of critical habitat throughout all 5 DPSs have been proposed by NMFS (81 FR 36077). Within the Chesapeake Bay DPS and specifically the James River, critical habitat has been proposed for the entire width of the mainstem James River from Boshers Dam downstream for 99 river miles (160 rkm) to where the river discharges into the Chesapeake Bay at Hampton Roads. Occupied critical habitat is designated based on the physical or biological features essential to the conservation of the species that may require special management considerations or protections. 16 U.S.C. § 1532(5) NMFS (2016) stated that the physical features essential to the conservation of the Atlantic Sturgeon DPSs for reproduction and recruitment consist of:

- “Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 parts per thousand range) for settlement of fertilized eggs, refuge, growth, and development of early life stages;
- “Aquatic habitat with a gradual downstream salinity gradient of 0.5-30 parts per thousand and soft substrate (e.g., sand, mud) downriver of spawning sites for juvenile foraging and physiological development;
- “Water of appropriate depth absent physical barriers to passage (e.g., locks, dams, reservoirs, gear, etc.) between the river mouth and spawning sites necessary to support: (1) unimpeded movements of spawning adults to and from spawning sites; (2) as well as seasonal and physiologically-dependent movement of juvenile Atlantic Sturgeon to appropriate salinity zones within the river estuary; (3) staging, resting, or holding of subadults or spawning condition adults. Water depths in main river channels must also be deep enough (e.g., ≥1.2 m) to ensure continuous flow in the main channel at all times when any sturgeon life stage would be in the river; 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°C to 26°C for spawning habitat and no more than 30°C for juvenile rearing habitat and 6 milligrams per liter [mg/L] dissolved oxygen for juvenile rearing habitat)[2].”

NMFS has not proposed to designate unoccupied habitat in the James River. *See* 81 Fed. Reg. 35,701, 35,709-10 (June 3, 2016).

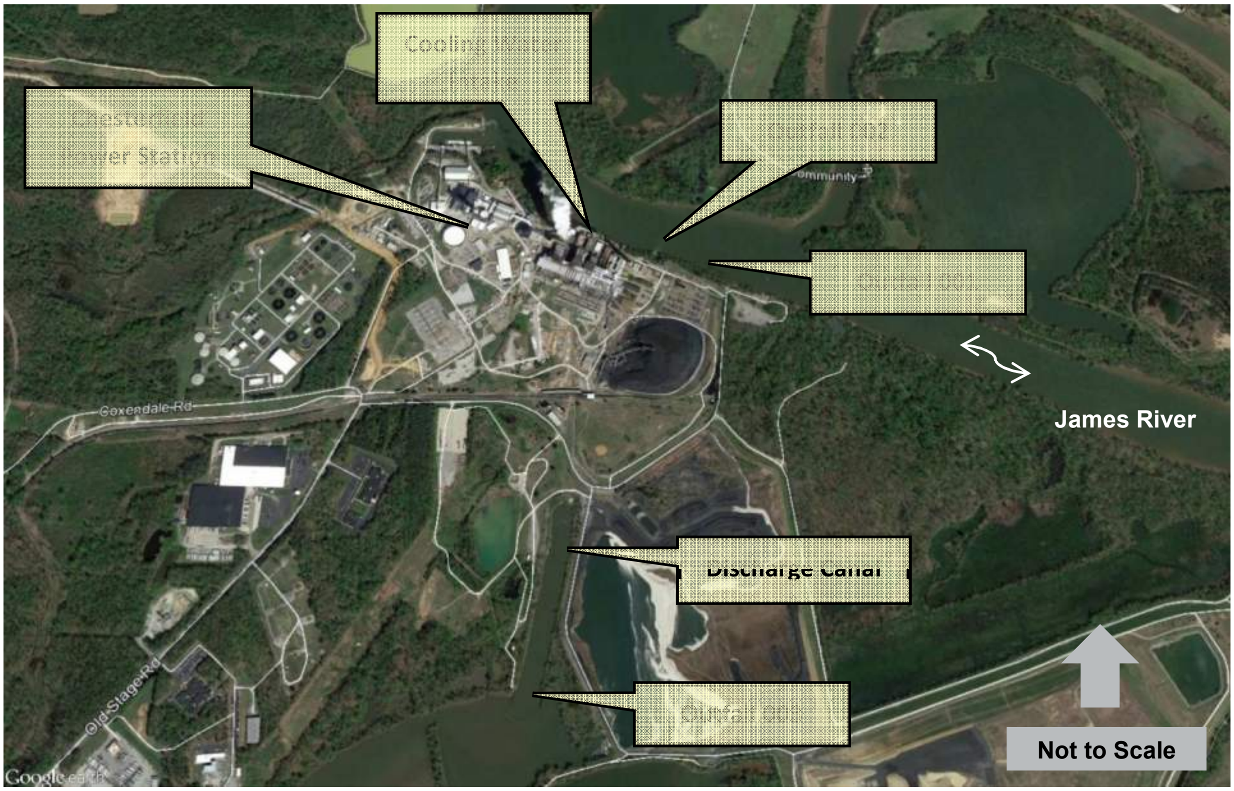
3 Chesterfield Power Station

CPS, which began its commercial operation in 1945, is located in the upper tidal portion of the James River at river mile 82 (rkm 132), approximately 13 miles (20.9 km) downstream of the fall line in the City of Richmond. Figure 3-1 provides an aerial view of CPS and its environs. CPS is a base-load facility with six power-generating units: four coal-fired units (Units 3, 4, 5, and 6) and two natural gas/distillate oil-fired combined cycle units (Units 7 and 8). Units 7 and 8 occupy the sites of the former Units 1 and 2 which were retired in 1981 after 37 and 33 years of service, respectively. All six units have been operating since 1992 when the newest Unit 8 was brought into service. CPS has a net generating capacity of 1,640 megawatts (MW) (Dominion 2016c).

As a base-load facility, CPS serves as one of Dominion’s primary means of generating the minimum amount of power necessary to meet customer demands. Accordingly, the facility generally operates twenty-four hours per day, seven days per week, although there is seasonal variation in its operations. Major outages for maintenance purposes on the generating units are scheduled for the spring and/or fall months after the end of the summer and winter peaking seasons. The duration of the maintenance outages depends on the scheduled work that needs to be done on the units (Dominion 2016a).

---

[2] The specific oxygen concentration and temperature values are provided as examples and guidance to inform the combinations of temperature, salinity, and oxygen that support successful reproduction and recruitment. Temperature, salinity, and oxygen are ephemeral by nature, fluctuating daily and seasonally in estuaries. Specific areas designated as critical habitat based on the four features are not expected to have water with oxygen concentration of 6 mg/L and the specific water temperatures at all times and within all parts of the area.



Map Source: Google Maps

Figure 3-1. Aerial Photograph of Chesterfield Power Station

3.1 Location

CPS is located approximately 82 river miles (132 rkm) upstream from the mouth of the James River. Details of the specific locations for each permitted activity are provided in the following sub-sections.

3.1.1 Areas Considered for Coverage Under the Permit

The area to be covered by the permit is the geographic extent of environmental changes (i.e., physical, chemical, and/or biological) resulting from the permitted activities (area of direct and indirect effects). The areas affected by each activity to be permitted are described in the subsequent paragraphs.

Cooling Water Intake

The approximate geographic coordinates for the CWIS are Latitude: 37°23'2.32"N, Longitude: 77°22'57.72"W. The CWIS area of influence (AOI) was calculated as a conservative zone of hydraulic influence (i.e., it errs on the side of overestimating the size of the AOI) on the movement of motile, non-motile and limited mobility life stages of fish and shellfish. The AOIs do not represent an area of potential direct impact, but instead a conservative estimate of the potential area of hydraulic influence of the CPS CWIS. Fish and shellfish can occur in the AOI and avoid, or not be drawn into the facility. The AOI is calculated based on conservative assumptions including no ambient velocity and low water depth; thus, it represents the maximum areal extent associated with the evaluated threshold velocities of 0.5 fps, 0.3 fps and 0.1 fps. The AOIs are included to define the area to be permitted; however, AOI relevance does not extend beyond this aspect of the areal extent of the area to be permitted. Based on these conservative assumptions, the AOI is estimated as follows (Dominion 2016d):

- The AOI based on a threshold velocity of 0.5 fps is conservatively calculated as a semi-circle with a radius of 69 ft centered at the CWIS. The threshold velocity of 0.5 fps is associated with motile fishes, where it is generally assumed that fish subject to 0.5 fps and lower velocities are able to swim freely and avoid impingement. For example, the CWA §316(b) rule assumes impingement is minimized at intakes with 0.5 fps through-screen velocities.

- Ambient velocities are typically expected to predominate and therefore influence movement of non-motile and limited mobility life stages (e.g., eggs and larvae). The AOI based on a range in velocity thresholds from 3.0 cm/s (0.1 fps) to 9.1 cm/s (0.3 fps), representing these ambient velocities (e.g., at slack tide or under gentle breeze conditions in a lacustrine system) is calculated as a rectangular area ranging from:

    - 2,772 ft along the river axis (i.e., 1,386 ft) upstream and 1,386 ft) downstream from the CWIS) and 359 ft wide across the river (for comparison, the James River is approximately 500 ft wide at this location), centered at the CWIS using a velocity threshold of 0.3 fps;

    - 8,315 ft along the river axis (i.e. 4,158 ft) upstream and 4,158 ft downstream from the CWIS) and extending across the river (which is approximately 500 ft wide at this location), centered at the CWIS using a velocity threshold of 0.1 fps.

Clean Water Act 316(b) Studies

The purpose of the CWA 316(b) sampling is to characterize entrainment and impingement associated with CPS operations pursuant to CWA §316(b) Rule for existing facilities. Entrainment samples are collected directly in front of the trash racks at the Unit 6 CWIS. Impingement samples are collected from the fish/debris return troughs at the east end of the intake structures after the last screen. Individual samples are collected from Unit 7, Unit 8, Units 3 & 4 together, Unit 5, and Unit 6 (a total of five sample locations). Therefore, the area of effect for entrainment and impingement sampling activities are a subset of the AOI for the CWIS operation, which is described above. The approximate geographic coordinates for the CWA 316(b) sampling are the same as the CWIS (Latitude: 37°23'2.32"N, Longitude: 77°22'57.72"W).

Dredging

Periodic dredging is necessary to remove accumulated sediments in the vicinity of the CPS CWIS to allow for reliable and efficient generation of electricity. Therefore, the approximate geographic coordinates used for the CWIS are also used for dredging (Latitude: 37°23'2.32" N, Longitude: 77°22'57.72" W). Figure 3-2 provides a plan view of the location(s) where sediments accumulate in front of CWIS and where dredging is required (Dominion 2003). Periodic maintenance dredging is also necessary within the barge slip located northwest of the CPS (Latitude: 37°23'11.42"N, 77°23'12.12"W) (see Figure 3-3).

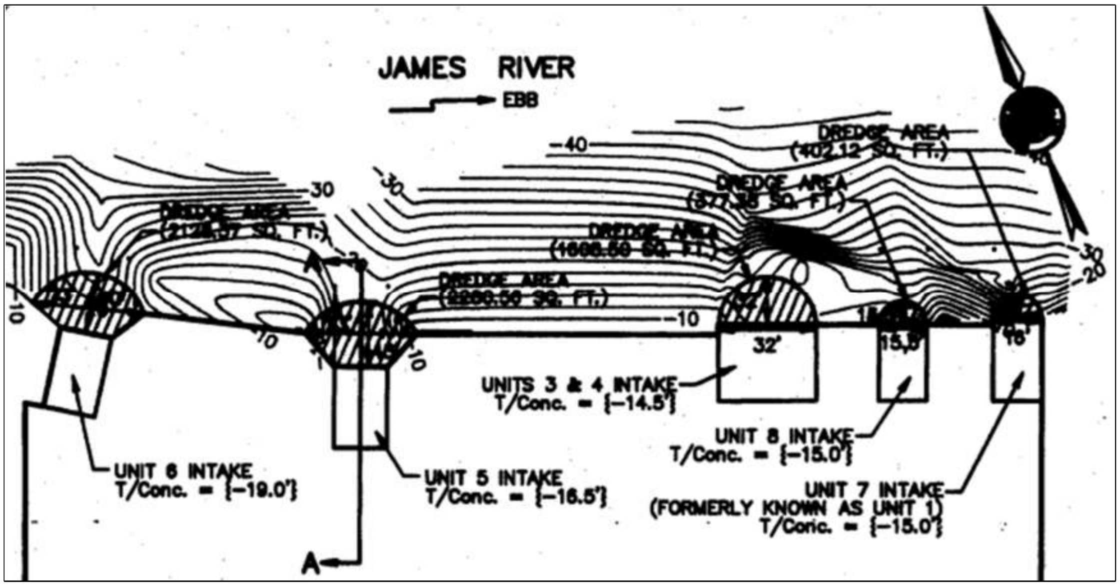
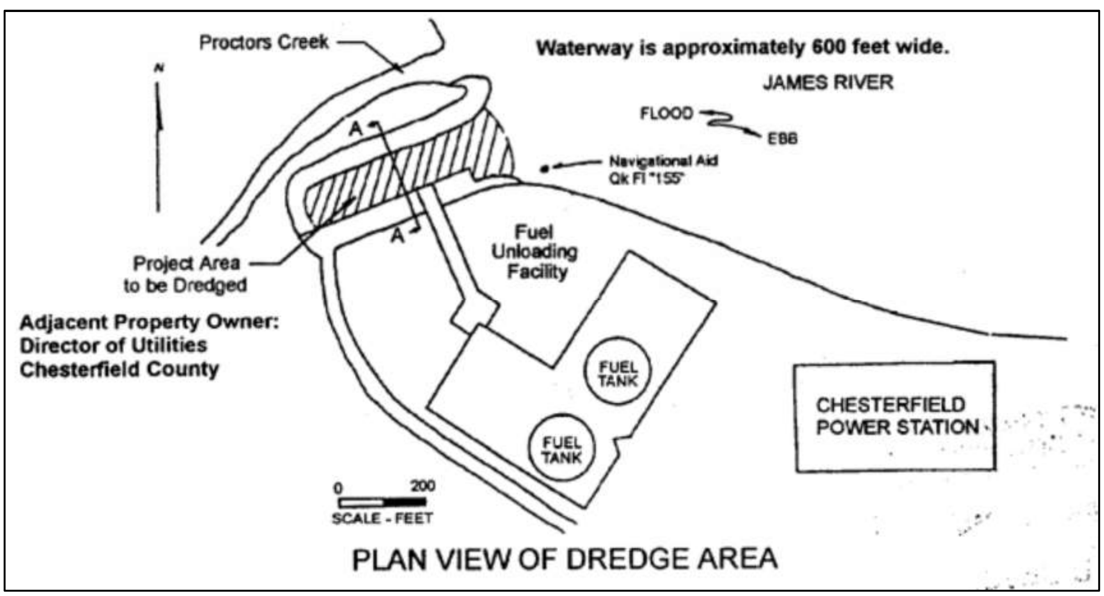


Figure Source: Resource International, LTD

Figure 3-2. Plan View of 2003 Dredging Location(s) for Chesterfield Power Station CWISs

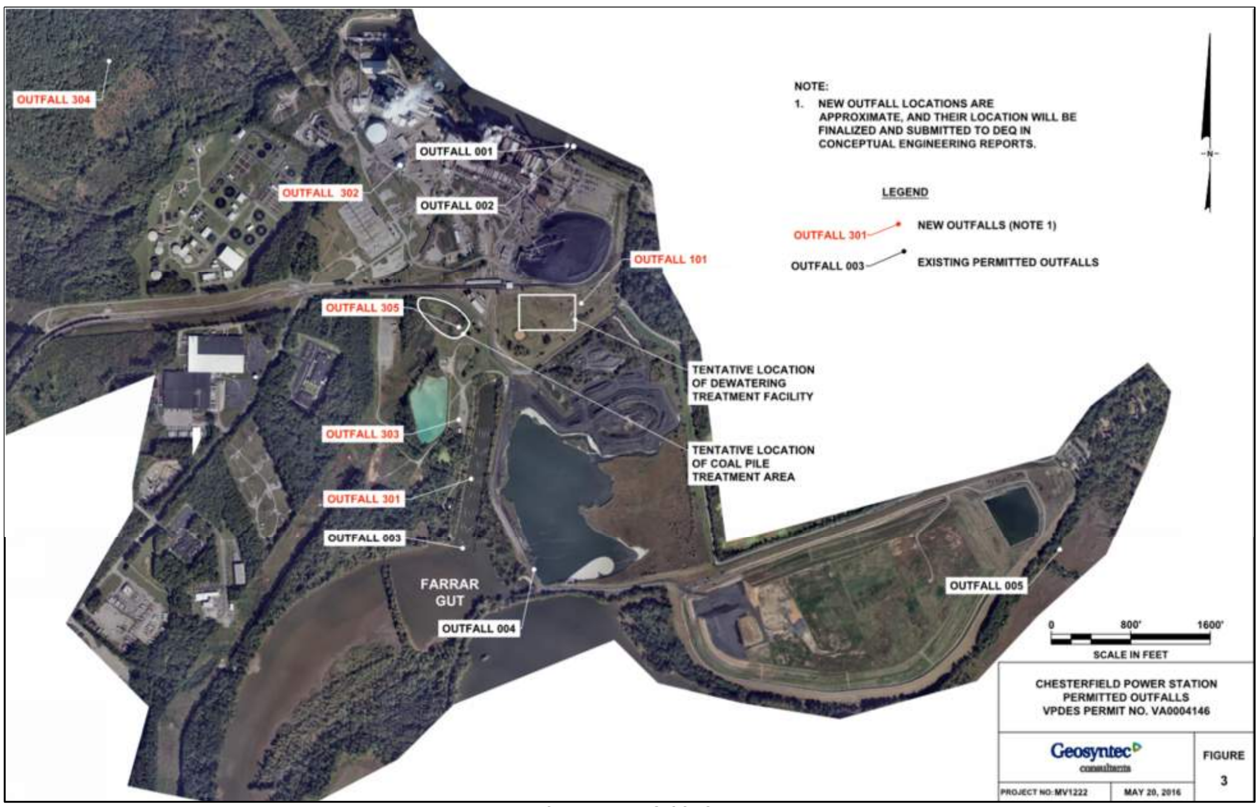


Source: USACE

Figure 3-3. Plan View of Barge Slip Dredging

Constituent Discharge

The location of the CPS VPDES outfalls are shown in Figure 3-4. The geographic coordinates for the CPS outfalls are provided in Table 3-1. CPS has 5 outfalls that discharge to the James River. Outfalls 001 and 002 discharge to the mainstem and Outfalls 003, 004, and 005 discharge to Farrar Gut. Internal Outfalls 401 and 402 (not shown in Figure 3-4) currently discharge to Outfall 004. Additionally, internal Outfalls 301, 302, 303, and 304 (upstream of Outfall 003) have been added as part of the Virginia Electric and Power Company proposal to construct a Low Volume Wastewater Treatment System (LVWWTS)[3] (VDEQ 2016). Once the LVWWTS is in service, the Upper Ash Pond and Lower Ash Pond will be drawn down via an internal outfall (101 or 201) to Outfall 001 or 002. Outfalls 401, 402, 004, and 005 will be decommissioned once the drawdown occurs. All discharges are regulated according to VPDES Permit Number VA0004146.



Source: VDEQ 2016

Figure 3-4. Locations of Chesterfield Power Station Outfalls

[3] The LVWWTS has been added to address changes to the coal combustion residuals management system in response to the Disposal of Coal Combustion Residuals from Electric Utilities final rule signed April 17, 2015.

Table 3-1. Geographic Coordinates for Chesterfield Power Station Outfalls -

Outfall	Latitude	Longitude
001*	37°22'58" N	77°22'51" W
101	TBD	TBD
002*	37°22'58" N	77°22'48" W
003*	37°22'19" N	77°23'40" W
301	37°22'71" N	77°23"02" W
302	37°22'58" N	77°23"10" W
303	37°22'35" N	77°23"04" W
304	TBD	TBD
305	TBD	TBD
004*	37°22'18" N	77°22'54" W
401	37°22'35" N	77°23'04" W
402	37°22'58" N	77°23'09" W
005*	37°22'20" N	77°21'50" W
*Indicates an external outfall.		

Thermal Discharge

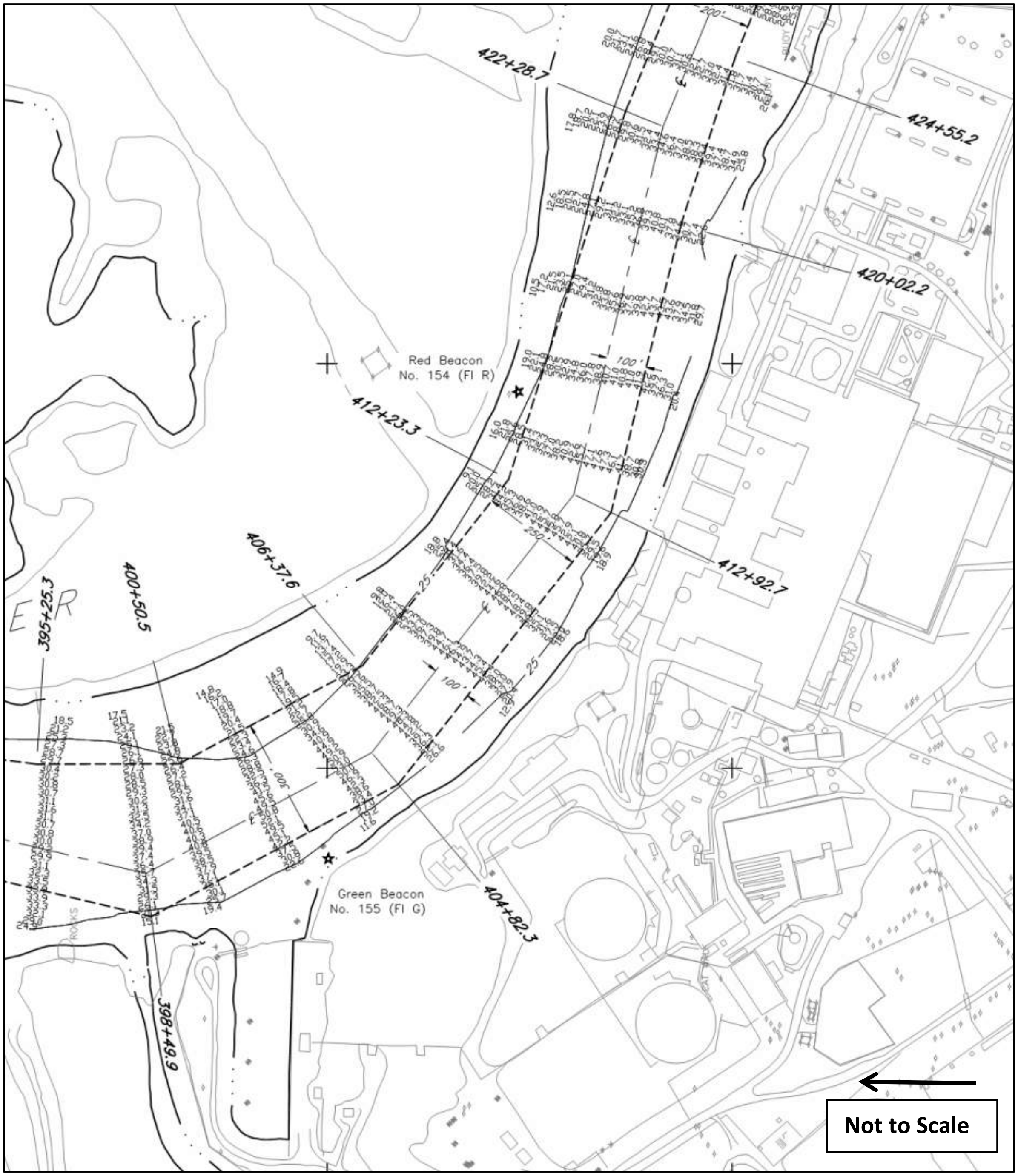
The area of effect for the thermal discharge is in the immediate vicinity of Outfalls 001 (Unit 7 and 8 cooling water), 002 (Unit 3 cooling water), and 003 (Units 4, 5, and 6 cooling water) (see Figure 3-4 and Table 3-1). CPS conducted a CWA 316(a) demonstration study (VEPCO 2000) with field surveys conducted from 1997 through 1999. The study analyzed water quality characteristics and the biological communities located upriver and downriver of the CPS discharge (with sampling locations representative of the thermal mixing zone as well as ambient conditions). A report presenting the results of these studies was submitted to the VDEQ on February 29, 2000. The report concluded that the heat rejection limits were "more stringent than necessary to assure the protection and propagation of a balanced, indigenous, aquatic community in the James River" (VEPCO 2000). The 2016 reissued VPDES permit Special Condition I.C.29 requires the development and implementation of a detailed plan for updating the studies to support renewal of the CWA 316(a) variance during the next permit reissuance (see Section 5.5 for additional detail).

Vessel Movements

The area of effect for vessel movements is from the offloading facility or barge slip at CPS to the mouth of the James River. The peak risk of propeller strike would occur during docking/undocking maneuvers. Water depths in the navigation channel adjacent to CPS range from 25 to 50 ft (USACE 2015) (see Figure 3-6). Because shallow draft vessels are used for deliveries, the risk of vessel-sturgeon interactions is generally low. Risk of propeller strike would decline progressively with distance downriver as the below keel clearances increase and the cross-sectional profile of the river widens.

Source: Google Maps

Figure 3-5: Location of CPS in James River



Source: USACE 2015

Figure 3-6. Bathymetry at CPS

The majority of the CPS vessel activities are the 4 to 6 barge deliveries and shipments of gypsum and limestone every month, discussed in more detail in Section 5. The vessels associated with CPS operations are shallow draft. A fully loaded barge would provide a minimum of 14 ft of below keel clearance during upriver transits. An empty barge would provide a minimum of 23 ft of below keel clearance on the downriver transits. Clearances would generally be deeper in those reaches where shoaling is less prevalent and where the natural channel depth exceeds the navigable depth.

Shoreline and Structure Maintenance

Shoreline and structure maintenance is limited to CPS waterfront property and the river adjacent to the CPS waterfront property. Shoreline and structure maintenance is infrequent but could include activities such as barge slip maintenance, and maintenance of ductwork over State-owned subaqueous land. See Table 3-1 for latitude and longitude locations of the outfalls, CWISs as locations where shoreline and structure maintenance may occur.

4 Environmental Baseline

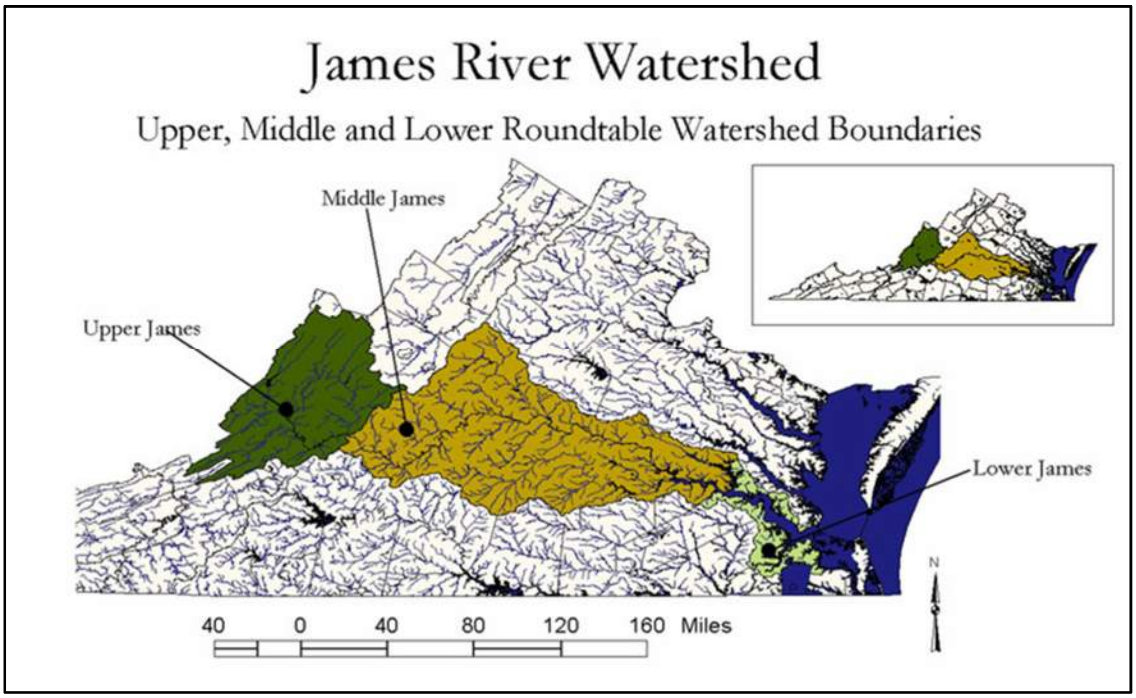
By regulation, environmental baselines for biological opinions include the past and present impacts of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02, emphasis added). The "impact" of the activities normally included in Environmental Baselines represents the prior experience, state, or condition of the endangered and threatened individuals and areas of designated critical habitat that occur in an action area and therefore, the areas considered for coverage under the permit. Knowing the prior experience, state, or condition of listed individuals or populations and areas of critical habitat is important because that prior experience, state, or condition will determine or influence the new effects of a proposed or continuing action. Activities that influence the current condition of the Atlantic Sturgeon, its habitat (e.g., water quality), and other biological resources in the areas considered under the permit include the following existing activities:

- Power generation,
- Dredging,
- Commercial and recreational fisheries,
- VPDES discharges,
- Scientific research,
- In-water construction,
- Regional permit 20 for the creation of artificial reefs,
- Runoff from surrounding land uses,
- Dam removal for fish passage, and
- Mining and leachate from abandoned coal mines.

4.1 Environmental Setting

CPS, which began operations in 1945 and has been operating at its current level since 1992, is located in the Southeast region of the United States in the Lower James River watershed. The climate in the Lower James River watershed is typically warm and humid in the summer, and generally mild in the winter with average precipitation of 40 to 48 inches of rain and approximately three inches of snow annually (Ingram et al. 2013).

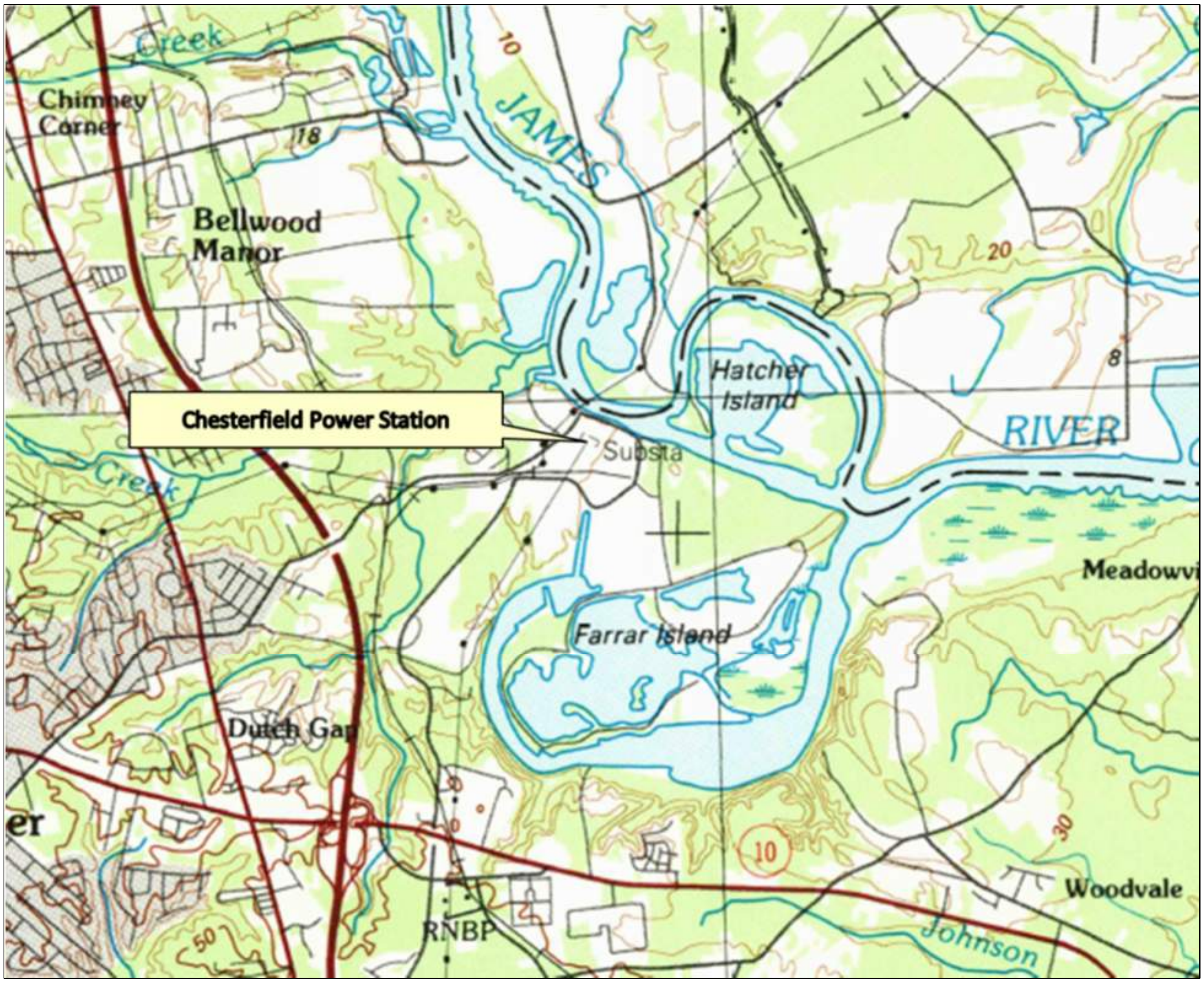
The James River watershed encompasses approximately 10,000 square miles, which makes up almost 25 percent of the State. The James River watershed covers about one-third of the Chesapeake Bay drainage area in Virginia. The river flows approximately 340 miles from the Alleghany Mountains of western Virginia to the Chesapeake Bay. The watershed is comprised of three sections: the Upper James watershed begins in Allegheny County and travels through the Allegheny and Blue Ridge Mountains until Lynchburg, the Middle James watershed runs from Lynchburg to Richmond, while the Lower James watershed stretches from Richmond to the Chesapeake Bay (Figure 4-1).



Source: Middle James Roundtable

Figure 4-1. The James River Watershed

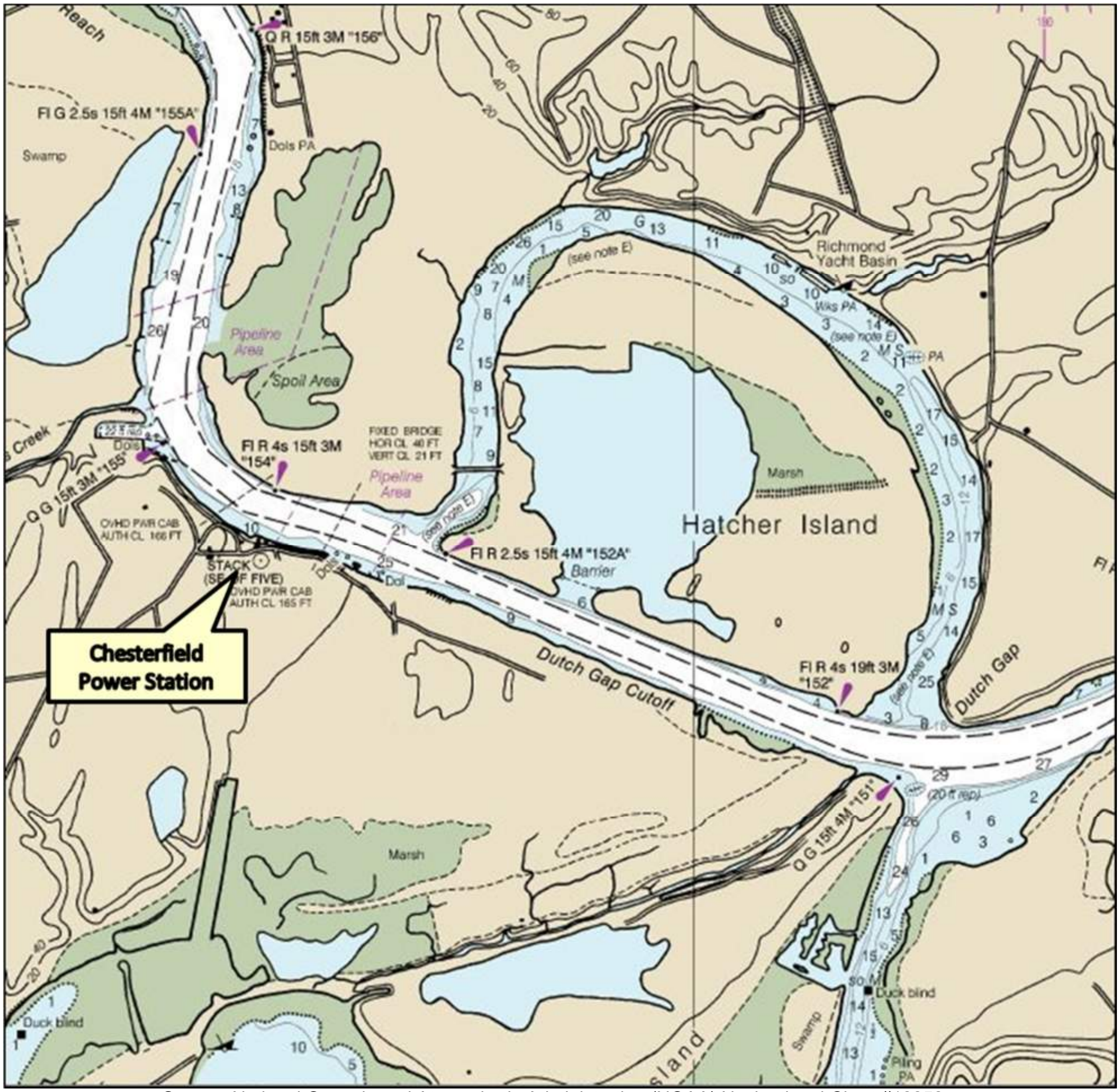
CPS is located in the Coastal Uplands Physiographic Province where the James River begins its transition from a steep-banked, narrow-channeled river to a classical meandering river with oxbows. CPS is situated directly adjacent to and across the river from Farrar Gut and Hatcher Island, respectively, two oxbows on the James River (see Figure 4-2). Man-made channels were constructed across these and other oxbows to reduce travel miles for river traffic. The river channel itself is also dredge-maintained to allow deep-draft vessels travel to the port of Richmond (VEPCO 2000).



Map Source: USGS Topographic Map of Petersburg, VA; Map ID #37077-A1-TM-100 (1984)

Figure 4-2. Chesterfield Power Station Area Map

General river depths near CPS vary from 2 to 39 ft at Mean Lower Low Water (MLLW) (Figure 4-3) and the navigational channel is maintained at 35 ft of water depth at MLLW. A bathymetric survey in front of CPS was conducted in 2011. Water depths near the outfalls range between 1 to 15 ft. The hydrographic survey is provided in Figure 4-4.



Source: National Oceanic and Atmospheric Administration (NOAA) Navigational Chart #12252

Figure 4-3. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at Mean Lower Low Water)

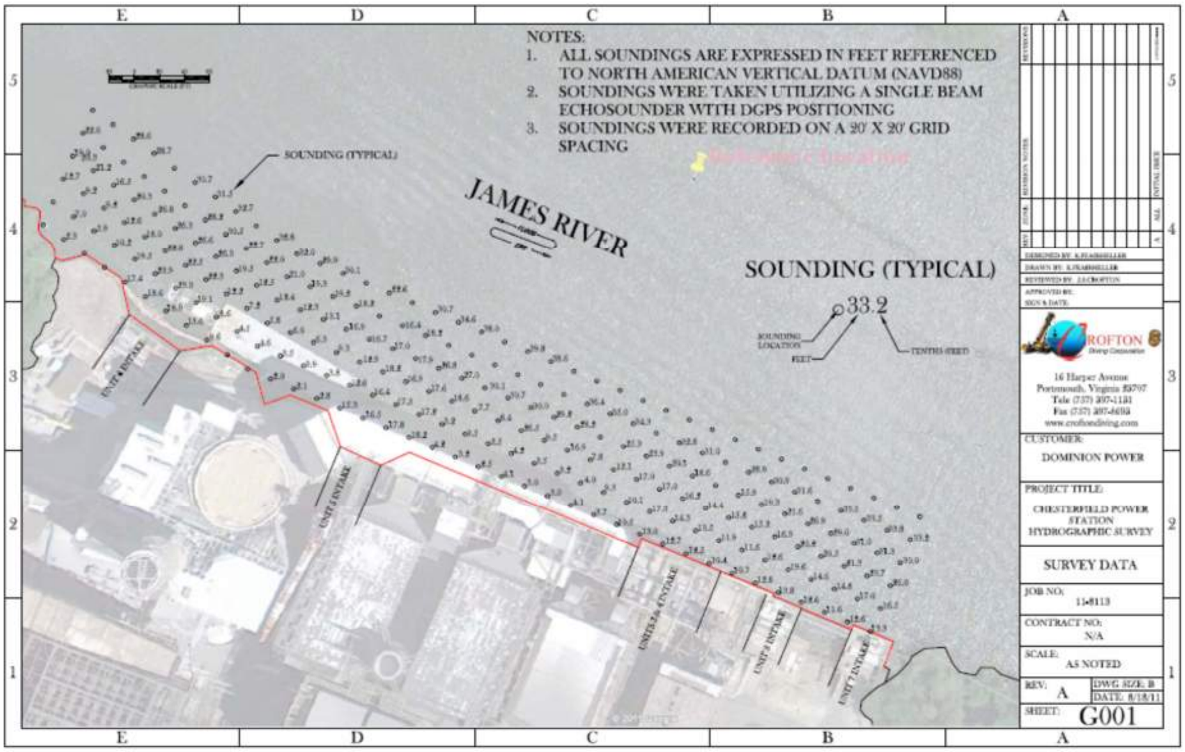
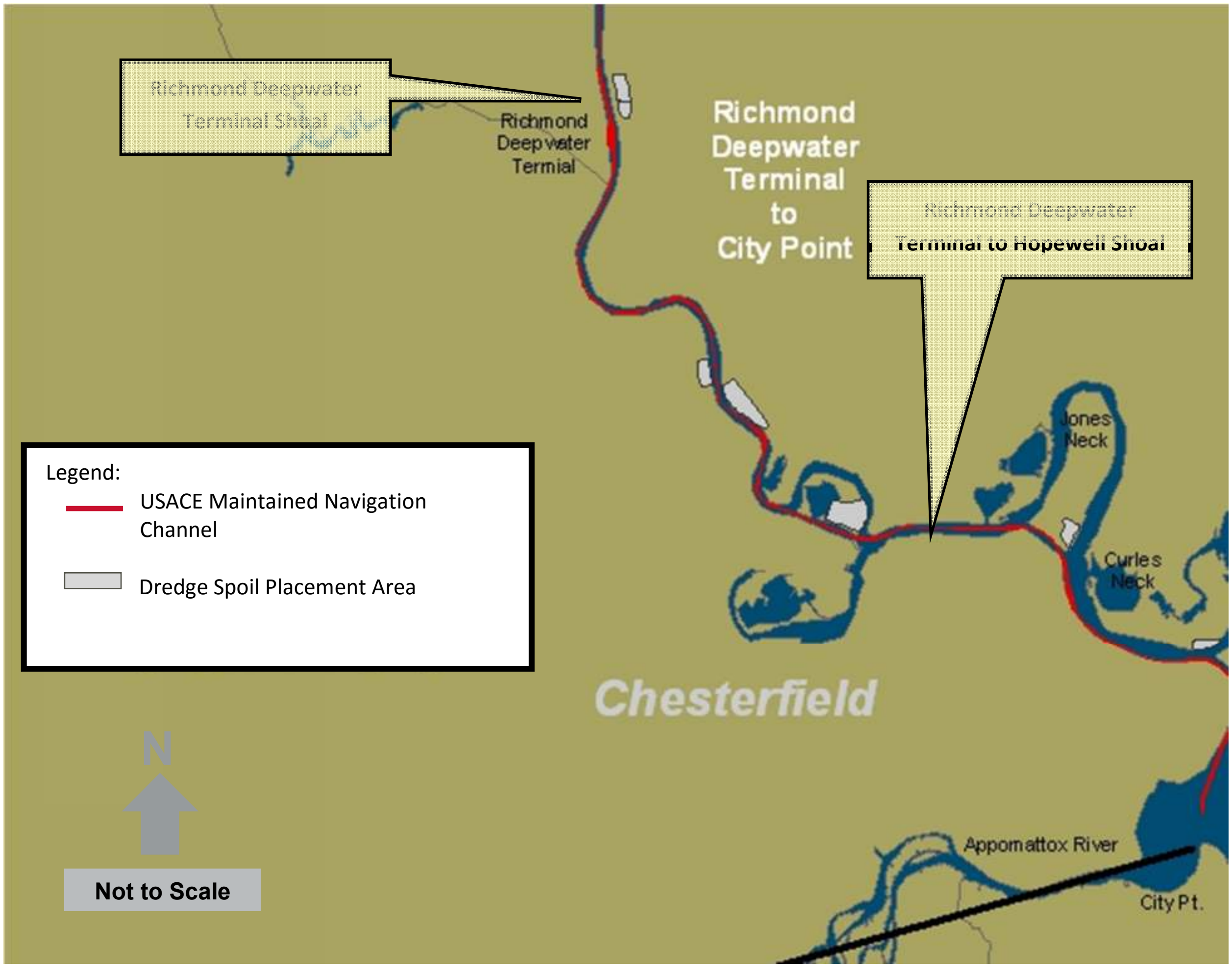


Image Source: Rofton Diving Corporation

Figure 4-4. Survey of James River Depths in Vicinity of Chesterfield Power Station - Cooling Water Intake Structure -

The James River at the CPS experiences a mean tidal amplitude of approximately 2.0 ft. The water level in this portion of the James River fluctuates greatly with an extreme high of elevation 19.0 ft and an extreme low of elevation -3.5 ft. The mean high and low water range is 5.2 ft; the mean high water is at grade elevation (El.) 3.5 ft and the mean low water is at El. -1.7 ft. Maximum tidal current is approximately 2.8 fps with average maximum ebb and flood tidal currents of 1.34 fps and 1.5 fps, respectively. The James River in the vicinity of CPS is a temperate zone river with average temperatures generally ranging from 0˚C in February to 34˚C in August.

The United States Army Corps of Engineers (USACE) conducts regular maintenance dredging of the James River Federal Navigation Channel to accommodate deep-draft vessels. The authorized channel is maintained at a width of 300 ft and depth of 35 ft from Hampton Roads to Richmond Deepwater Terminal, Virginia for a total distance of 86.1 miles via three cut-off channels in the upper section of the river. Figure 4-5 shows the navigation channel in the vicinity of CPS. Dredging occurs from the mouth of the James River to Richmond at nine shoals: Tribell Shoal, Goose Hill Shoal, Dancer Point-Swann Point Shoal, Jordan Point-Harrison Bar-Windmill Point Shoal, City Point Shoal, Richmond Deepwater Terminal to Hopewell Shoal, Richmond Deepwater Terminal Shoal (turning basin), Richmond Harbor to Richmond Deepwater Terminal Shoal, and Richmond Harbor (NMFS 2012).



Source: USACE 2004

Figure 4-5. USACE Navigation Dredging Locations in the James River in Vicinity of Chesterfield Power Station

Table 4-1 below summarizes the volumes and frequency of USACE maintenance dredging for the reaches located in the vicinity of the CPS.

Table 4-1. Summary of USACE Maintenance Dredging in Permitted Area

Source: NMFS 2012

Location	Average Dredge Volume (cubic yards)	Dredging Frequency
Richmond Deepwater Terminal to Hopewell Shoal	243,151	1-3 years
Richmond Deepwater Terminal Shoal	143,151	1-3 years

James River dredging is typically completed using hydraulic cutterhead dredge which combines a movable rotating cutter apparatus surrounding the intake of a suction pipe (Taylor 1990 as cited in NMFS 2012). The combination of mechanical cutting and hydraulic suction allows the efficient dredging of a wide variety of substrates including clay, silt, sand, and gravel.

Cutterhead dredges on the James River are typically small with a maximum pipe diameter of 36 inches. The mechanical cutterhead agitates the river sediments into a slurry which is hydraulically pumped to the dredged material placement area (NMFS 2012). In the case of the USACE maintenance dredging of the James River, the dredge slurry is pumped to designated overboard placement areas adjacent to the shoals along the channel, or upland disposal sites for the upper river segment. Dredged material is placed along the centerline of overboard placement areas and assumed to spread out to even thickness (NMFS 2012).

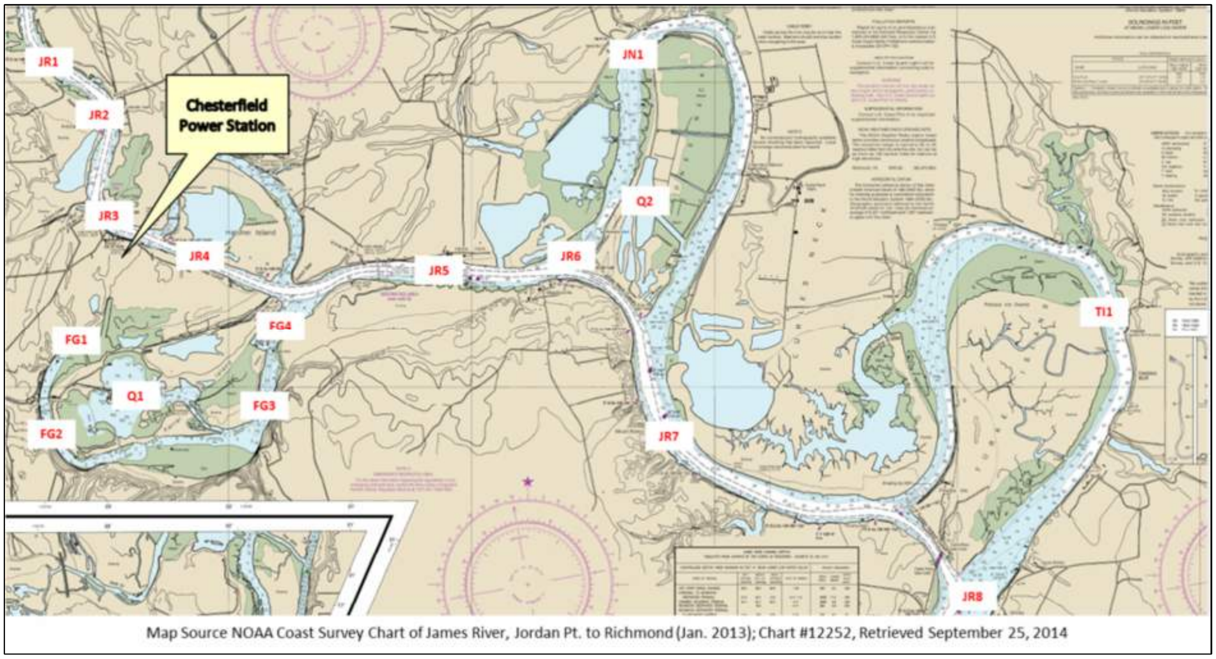
Due to the necessity to continually maintain the James River navigation channel, USACE maintenance dredging projects on the James River are indefinite with a total project life of fifty years (NMFS 2012). Dredging activities associated with CPS are discussed in Section 5. In the lower James River dredging is permitted to occur between June 15 and February 15 of a given year. The middle and upper James River dredging is permitted to occur from July 1 to February 15 of a given year (NMFS 2012, VDGIF 2016b). Annual dredging typically does not exceed several weeks within the permitted dredging window or several days per shoal, however the duration of dredging is subject to several factors such as the volume of material to be dredged, size and type of dredge utilized, and distance to the placement area (NMFS 2012).

The State of Virginia has been delegated authority to issue pollutant discharge permits by the U.S. Environmental Protection Agency (VDEQ 2017). These permits authorize the discharge of pollutants in the area considered for coverage. Some of the facilities that operate pursuant to these permits include municipalities for sewage treatment plants and other industrial users. The state of Virginia will continue to authorize the discharge of pollutants through the VPDES permits.

Recreational and commercial fishing activities in state waters have the potential for take of Atlantic Sturgeon. Under Amendment 1 of the Atlantic Sturgeon Fishery Management Plan, states must maintain complete closure of any directed fishery for Atlantic Sturgeon and prohibit landings from any fishery (ASPRT 2016). There is no indication that reopening the commercial fishery is reasonably certain to occur. However, the Chesapeake Bay supports numerous commercial and recreational (CBFEAP 2006). A number of Atlantic Sturgeon are taken through non-directed fisheries bycatch. However, Virginia does support a program that monitors Atlantic Sturgeon in Virginia state waters (ASSRT 2016), and it is not clear to what extent these continued activities would affect Atlantic Sturgeon.

4.2 Biological Resources

Biological resources in the vicinity of CPS include phytoplankton, zooplankton, benthic macroinvertebrates, juvenile and adult fishes, aquatic macrophytes, and vertebrate wildlife and are characterized based on the results of the CPS CWA 316(a) demonstration study conducted 1997 – 1999 (Figure 4-6). Phytoplankton was diverse and dominated by green algae and diatoms, which varies seasonally. Rotifers were the most abundant of 25 taxonomic groups of zooplankton, followed by two groups of crustacean zooplankton, copepods and cladocerans. Zooplankton diversity and density vary seasonally and by location (VEPCO 2000).



Source: Modified from Dominion 2016b

Figure 4-6. Map Depicting the Study Area and Sampling Stations for CWA 316(a) Studies Conducted April 1997 – February 1999

Benthic macroinvertebrates near CPS are dominated numerically (98%) by Oligochaeta (worms) and Chironomidae (midges). Overall abundance of phytoplankton, zooplankton, and benthic invertebrates increased from upstream to downstream (VEPCO 2000). Additionally, Blue Crab (*Callinectes sapidus*), Asiatic Clam (*Corbicula fluminea*), and Common Grass Shrimp (*Palaemonetes pugio)* were collected in the 2005-2006 finfish surveys using electrofishing and gill netting and impingement study (EA 2007).

Juvenile and adult fish species most frequently caught in 1997 to 1999 electrofishing samples included Gizzard Shad (*Dorosoma cepedianum)*, Threadfin Shad (*Dorosoma petenense)*, Bluegill Sunfish (*Lepomis macrochirus)*, Largemouth Bass (*Micropterus salmoides)*, Common Carp (*Cyprinus carpio*), Spottail Shiners (*Notropis hudsonius*), and White Perch (*Morone americana*). The most frequently caught juvenile and adult fish taxa using gillnets included Gizzard Shad, Threadfin Shad, White Perch, Blue Catfish (*Ictalurus furcatus*), and Channel Catfish (*Ictalurus punctatus*). A total of 35 native and introduced, riverine, and estuarine species have been collected (VEPCO 2000).

Hydrodynamics in the James River drive the presence of aquatic macrophytes and plant community diversity. Protected oxbows, such as the Farrar Gut support richer and more diverse plant communities consisting of Pickerelweed (*Pontederia cordata*), wild rice, Smartweed (*Polygonum pensylvanicum*), Arrow-Arum (*Peltandra virginica*), and Broadleaf Cattail (*Typha latifolia*). Conversely, regions of the river subject to current scouring appear to support reduced plant diversity consisting of Water-willow (*Justicia americana*) and Smartweed patches. (VEPCO 2000)

The CWA 316(a) demonstration study conducted 1997-1999 characterized the interaction of the thermal discharge from the station's Outfall 003 with spatial and temporal variation of biological resources near CPS. The study compares results from sampling in 1997 to 1999 to sampling from 1968 to 1971 (VEPCO 2000). The CWA 316(a) study indicated the following:

- Phytoplankton abundance overall increased while nutrient concentrations decreased in concentration from 1970 and 1971 sampling. These results indicate that water quality has improved and that station operations do not negatively impact the phytoplankton community.
- Crustacean zooplankton abundance overall increased from 1970 and 1971 sampling to 1990's sampling. These results indicate that that station operations do not negatively impact the zooplankton community.
- The benthic macroinvertebrate communities were similar during both study periods. Benthic macroinvertebrate density in the areas closest to the station's Outfall 003 in the upper section of Farrar Gut was lower than in the lower section and at the mouth of Farrar Gut, and in the James River. The results of the CWA 316(a) demonstration study (VEPCO 2000) indicate the fish assemblage has remained relatively stable over 30 years when compared to populations in the 1960's (Jensen 1974), with exceptions that included the following:
    - Introduced Blue Catfish and Flathead Catfish (*Pylodictis olivaris*) replaced White Catfish (*Ameriurus catus*) and Brown Bullhead Catfish (*Ameriurus nebulosus*).
    - Gizzard and Threadfin Shad, which comprised the most abundant species collected, were less prominent in the 1960s.

The results of the CWA 316(a) study demonstrated that heat rejection limits are "more stringent than necessary to assure the protection and propagation of a balanced, indigenous, aquatic community in the James River" (VEPCO 2000). The reissued VPDES permit contains a Special Condition I.C.29 that requires the development and implementation of a detailed plan for updating the studies to support renewal of the CWA 316(a) variance during the next permit reissuance. Results of the updated studies or demonstration are due to VDEQ no later than 270 days prior to the expiration date of the permit, September 30, 2021. This is the same due date that is included in the permit for submittal of the CWA 316(b) information required by 40 CFR Part 122.21(R)(2)-(13).

4.3 Water Quality

The VDEQ 2014 CWA Section 305(b)/303(d) Water Quality Assessment Integrated Report (VDEQ 2014) provides a summary from 2007 to 2012 water quality results for the State of Virginia's rivers, lakes, and estuarine environments. The Lower James River was designated as an impaired water body for Aquatic Life. The results indicate that the significant cause for use impairment, ranked by percentage of the water body that is impaired, to the James River Basin was due to bacteria (74%), followed by impaired benthos (19%), dissolved oxygen (12%), PCBs in fish (8%), pH (8%), and temperature (4%) (VDEQ 2014).

In review of the sources of these water body impairments, ranked by percentage of the water body that is impaired, it was determined that the predominant suspected source was non-point sources (54%) followed by wildlife other than waterfowl (40%), unknown sources (24%), unspecified domestic waste (22%), and agriculture (21%) (VDEQ 2014).

The VDPES permit for CPS does not include a municipal sewage or other bacterial load to the James River which was determined to be “the most significant impairment for [recreational] use” in the state (VDEQ 2014). For aquatic life, the most significant impairment for rivers was low dissolved oxygen levels which were found in 29 percent of assessed rivers (VDEQ 2014). CPS CWA 316(a) sampling demonstrated that oxygen levels in Farrar Gut were adequate to support aquatic life, particularly during the hottest summer months (VEPCO 2000).

Temperature, dissolved oxygen and nutrient monitoring were conducted from May of 1997 through February 1999 for the CWA 316(a) study (VEPCO 2000). These results indicated that despite the influence of the thermal discharge at Outfall 003, river water temperature mirrored seasonal changes in air temperature. Additionally, the oxbows act as heat sinks, but the tidal cycle influences the thermal plume, confining it to Farrar Gut on the incoming tide and extending it downriver on the outgoing tide. Aquatic life is fully supported by the observed dissolved oxygen values and dissolved oxygen has improved since the 1970’s (VEPCO 2000). Dissolved oxygen in the tidal freshwater James River varies between 13 mg/L during winter months to a typically 6 mg/L during the summer, with no values of less than 5 mg/L recorded (Moore 2006).

Nutrient concentration data indicate that water quality in the James River, Farrar Gut, and associated oxbows has shown improvement since 1971 (VEPCO 2000). Concentration of total phosphorus, total Kjeldahl nitrogen, and ammonia and nitrate+nitrite concentrations in the James River, Farrar Gut, and oxbows suggest that the nutrient load upstream of the James River is greater than that of the discharge to the Farrar Gut (VEPCO 2000).

Median Total Suspended Solids (TSS) in the area of Turkey Island and Shipley Cove (approximately 8 miles downstream of the CPS) ranged from 16.0 to 35.0 mg/L during April to October over the period of 1999 to 2005 (Moore 2006). These TSS levels are typical of the freshwater, tidal portions of the James River as shown in comparison to locations monitored downstream of the CPS (Table 4-2) shown in Figure 4-7 (Moore 2006).

Table 4-2. Median Total Suspended Sediments in the Freshwater James River

Source: Moore 2006

Location	1999	2000	2001	2002	2003	2004	2005
	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)	TSS (mg/L)
Turkey Island	33.5	26.0	31.5	30.0	26.0	35.0	32.0
Shirley Cove	21.0	19.0	22.0	24.0	16.0	21.0	24.0
Tar Bay	31.0	28.0	29.5	34.5	24.0	32.0	28.0
Powell's Creek	37.5	29.0	36.0	35.5	31.0	38.0	38.0
Westover	--	--	30.0	30.0	26.0	32.0	36.0
-- No data							

Source: Moore 2006

Figure 4-7. Water Quality Monitoring Locations Downstream of Chesterfield Power - Station -

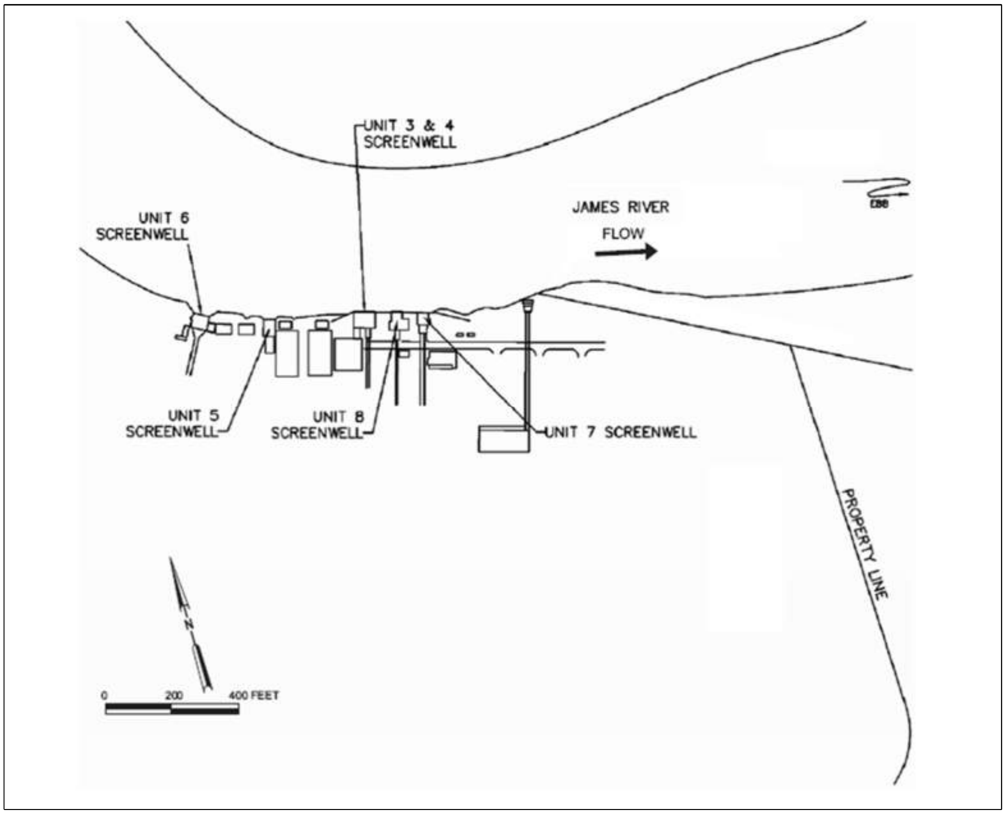
5 Activities

This section describes activities associated with CPS operations and maintenance that were identified as having the potential to affect Atlantic Sturgeon, including activities for which Dominion seeks coverage under an ESA § 10 ITP and activities that Dominion considered but for which no incidental take is anticipated to occur. This section describes activities to be performed within the next 10 years; activities considered include the necessary cooling water intake or operation of CWISs, CWA 316(b) studies, dredging, constituent discharge, thermal discharge, vessel movement, and shoreline and structure maintenance. Some of these activities, such as dredging and shoreline maintenance, would occur intermittently or infrequently (e.g., only once) within the requested 10-year duration of the permit. Dominion and NMFS discussed obtaining authorization under an ITP for these activities at meetings on August 12, 2016 and October 11, 2016. The activities that were considered are described below. Cooling water intake and CWA 316(b) studies are the only activities for which incidental take is anticipated; therefore, coverage under the ITP is only being requested for these two activities. The remainder of activities were considered, but incidental take is not anticipated, and therefore, coverage is not being requested. Potential effects of all activities and the estimated take are presented in Sections 2 and 3 of the Conservation Plan.

5.1 Activities to be Covered Under an Incidental Take Permit

5.1.1 Cooling Water Intake

The six power-generating units at CPS utilize a once-through cooling water system that withdraws cooling water from the tidal freshwater portion of the James River through five CWISs. All the intake pipes associated with the CWISs are constantly submerged and aligned flush with and parallel to the south shoreline. See Figure 5-1 for the unit configuration layout. The total design flow at CPS with all pumps working to capacity is approximately 1,090.3 million MGD [i.e., 1687.0 cubic feet per second (cfs)]. Over 98 percent of the water withdrawn from the James River is used for cooling water purposes (Dominion 2016a). Additional “service waters” are drawn occasionally to test and maintain fire suppression and other facility support functions. Intakes to these pumps are fitted with traveling screens.



Source: CH2M HILL (2007)

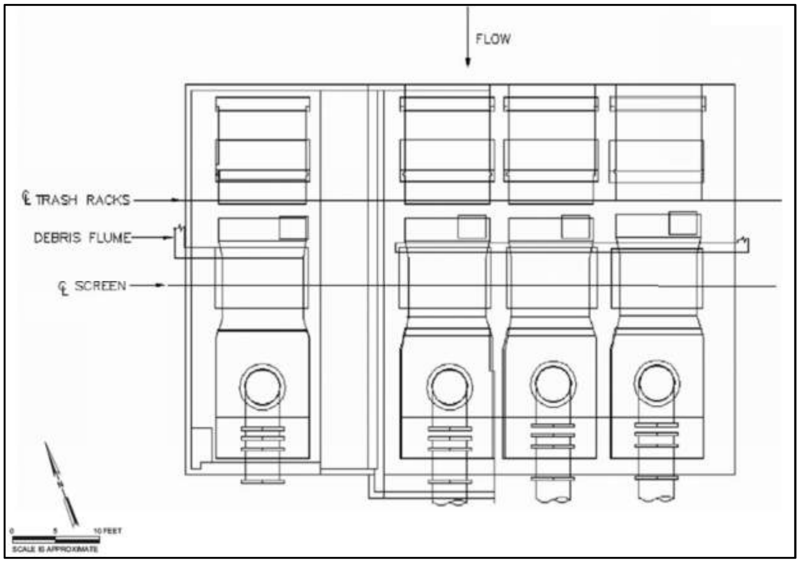
Figure 5-1. Chesterfield Power Station Cooling Water Intake Structure Configuration

The James River in the vicinity of CPS CWISs is approximately 500 ft wide and flows in a generally southeasterly direction. Water depths directly in front of the intakes generally range from 29 to 33 ft with a typical depth of 31 ft. Depths generally increase to 40 to 50 ft with distance from the shoreline along the upriver reach fronting the plant and barge slip, but gradually decrease to approximately 30 ft proceeding downriver. The intake structures are designed to operate at river levels ranging from 3.5 ft below mean sea level (MSL) to 19.0 ft above MSL. The mean high and low water levels differ by approximately 5.2 ft with the mean high water mark at 3.5 ft above MSL while the mean low water mark is 1.7 ft below MSL (Dominion 2016a).

As river water is drawn toward the intakes it first encounters a curtain wall that extends beyond the low water level. The curtain walls for Units 3, 4, 7, and 8 extend to 4.5 ft below MSL while the curtain wall for Units 5 and 6 drops down to approximately 4.0 ft below MSL. Downstream (i.e. toward the intakes) of the curtain wall are the trash racks which are installed across the intake structures in front of the screen bays. Trash racks extend across the entire length of each intake structure (i.e. from the intake structure invert to the intake deck) and prevent large debris from entering the screen houses. The trash racks for Units 3 and 4 are approximately 14.5 ft tall by 9.9 ft wide with 0.375-inch bars placed vertically on 4.0-inch centers. The Unit 5 trash rack is approximately 16.5 ft tall by 12.5 ft wide with 0.375-inch bars on 4.5-inch centers. The Unit 6 trash rack is approximately 19.0 ft high by 15.0 ft wide with 0.375-inch bars on 4.0-

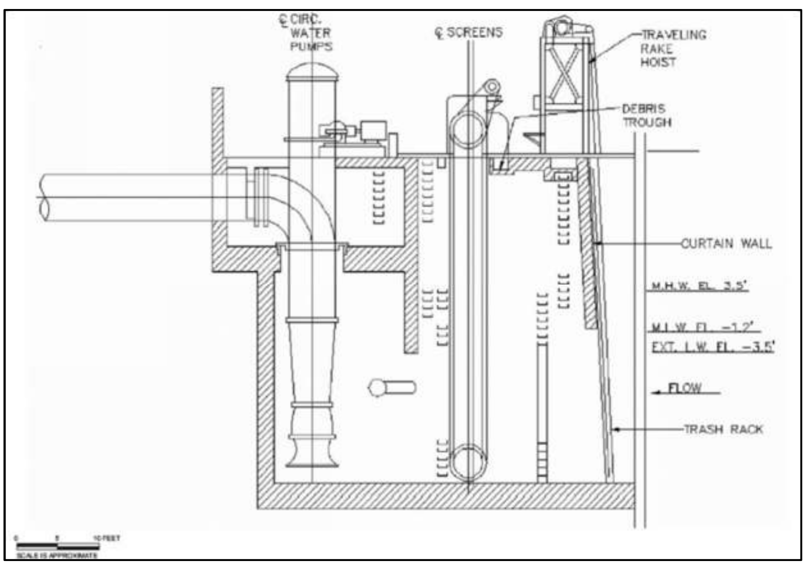
inch centers. Units 7 and 8 have trash racks that are approximately 14.5 ft high by 11.0 ft wide with 0.375-inch bars on 3.0-inch centers (Dominion 2016a). The approach velocity at the CPS's trash racks is 0.49 to 1.09 fps, with a through-rack velocity of 0.51 to 1.13 fps.

Plan and section drawings of typical portions of the CPS CWIS are provided in Figures 5-2 and 5-3, respectively.



Source: CH2M HILL (2007)

Figure 5-2. Typical Plan View of Chesterfield Power Station Cooling Water Intake - Structure -



Source: CH2M HILL (2007)

Figure 5-3. Typical Section View of Chesterfield Power Station Cooling Water Intake - Structure -

The traveling water screens are located between 10 and 20 ft inside of the trash racks (Figures 5-2 and 5-3). The vertical travelling screens rotate up and while out of water, debris and impinged organisms are washed off by a spray into a water-filled fish and debris return trough. This water-filled trough conveys spraywash water and materials that adhered to the travelling screen back into the James River. These discharges are permitted in the Virginia Discharge Elimination System (VPDES) Permit (VA0004146).

Each of the power-generating units contains two traveling screens except Unit 6, which has three traveling screens, for a total of 13 traveling screens. Units 3, 4, 7, and 8 have 8-ft wide screens, and Units 5 and 6 have 10-foot-wide screens. All of the screens have standard 3/8-inch mesh.

Each of the screens is designed for continuous operation. Units 4, 5, and 6 rotate at a single speed of approximately 10 feet per minute (ft/min), while Unit 3 can rotate at 3 ft/min or 10 ft/min in automatic mode. Units 7 and 8 can rotate at either 5 ft/min or 10 ft/min depending on loading. During normal operation, the screens are typically manually controlled for all units (Dominion 2016a). Screen wash pumps for Units 7 and 8 draw water from the individual unit pump house. Units 3 through 6 do not have operating screen wash pumps, and the wash water for these screens is fed from the ash sluice water system from each unit.

Cooling water that has travelled through the screens is conveyed to the circulating water pumps, located 12 and 18 ft inside the traveling screens, through individual bays. Each unit has a separate circulating water system comprised of thirteen vertical shaft, wet-pit, circulating cooling water pumps, two each for Units 3, 4, 5, 7, and 8 and three for Unit 6. The circulating pumps are located in the respective Unit's pump house. Upon exiting the circulating cooling water system, the water is returned to the James River via one of three cooling water discharge points: one for Unit 3, one for Units 7 and 8, and one for Units 4, 5, and 6. The discharge for Units 3, 7, and 8 discharge directly into the James River, approximately 100 ft downstream from the CWIS (via outfalls 001 and 002). Units 4, 5, and 6 discharge into a discharge canal and then into Farrar Gut, an oxbow that flows into the James River approximately 1.2 miles downstream from the intake structures (via outfall 003). The outfall configuration is provided in Figure 3-4.

5.1.2 Clean Water Act 316(b) Studies

As described in Section 1, Dominion developed study plans at CPS for impingement and entrainment characterization to support CWA §316(b) Final Rule compliance. Table 5-1 provides a summary of the CWA 316(b) rule requirements. Under these plans (Dominion 2016a and Dominion 2016b), sampling started July 13, 2015. Sampling was suspended on March 2, 2016.

Table 5-1. CWA §316(b) Rule for Existing Facilities Submittal Requirements Summary -

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source water physical data	Characterization of the source water body including intake area of influence
(3)	Cooling water intake structure data	Characterization of cooling water system; includes drawings and narrative; description of operation; water balance
(4)	Source water baseline biological characterization data	Characterization of biological community in the vicinity of the intake; life history summaries; susceptibility to impingement and entrainment; must include existing data; identification of missing data; threatened and endangered species and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival)
(5)	Cooling water system data	Narrative description of cooling water system and intake structure; proportion of design flow used; water reuse summary; proportion of source water body withdrawn (monthly); seasonal operation summary; existing impingement mortality and entrainment reduction measures; flow/MW efficiency
(6)	Chosen method of compliance with impingement mortality standard	Provides facility's proposed approach to meet the impingement mortality requirement (chosen from seven available options); provides detailed study plan for monitoring compliance, if required by selected compliance option; addresses entrapment where required
(7)	Entrainment performance studies	Provides summary of relevant entrainment studies (latent mortality, technology efficacy); can be from the facility or elsewhere with justification; studies should not be more than 10 years old without justification; new studies are not required.
(8)	Operational status	Provides operational status for each unit; age and capacity utilizations for the past five years; upgrades within last 15 years; uprates and Nuclear Regulatory Committee relicensing status for nuclear facilities; decommissioning and replacement plans; current and future operation as it relates to actual and design intake flow
(9)	Entrainment characterization study	Requires at least two years of data to sufficiently characterize annual, seasonal, and diel variations in entrainment, including variations related to climate, weather, spawning, feeding, and water column migration; facilities may use historical data that are representative of current operation of the facility and conditions at the site with documentation regarding the continued relevance of the data to document total entrainment and entrainment mortality; includes identifications to the lowest taxon possible; data must be representative of each intake; must document how the location of the intake in the water body and water column are accounted for; must document intake flows associated with the data collection; documentation in the study must include the method in which latent mortality would be identified (including QAQC); sampling and data must be appropriate for a quantitative survey
(10)	Comprehensive technical feasibility & cost evaluation study	Provides an evaluation of technical feasibility and incremental costs of entrainment technologies; Net Present Value of facility compliance costs and social costs to be provided; requires peer review
(11)	Benefits valuation study	Provides a discussion of monetized and non-monetized water quality benefits of candidate entrainment technologies from (r)(10) using data in (r)(9); benefits to be quantified physical or biological units and monetized using appropriate economic valuation methods; includes changes in fish stock and harvest levels and description of monetization; must evaluate thermal discharges, facility capacity, operations, and reliability; discussion of previous mitigation efforts and affects; benefits to environment and community; social benefits analysis based on principle of willingness-to-pay; requires peer review
(12)	Non-water quality environmental and other impacts assessment	Provides a discussion of non-water quality factors (air emissions and their health and environmental impacts, energy penalty, thermal discharge, noise, safety, grid reliability, consumptive water use, etc.) attributable to the entrainment technologies; requires peer review
(13)	Peer review	Documentation of external peer review, by qualified experts, of submittals (r) (10), (11), and (12). Peer Reviews must be approved by the NPDES Director and present their credentials. The applicant must explain why it disregarded any significant peer reviewer recommendations.

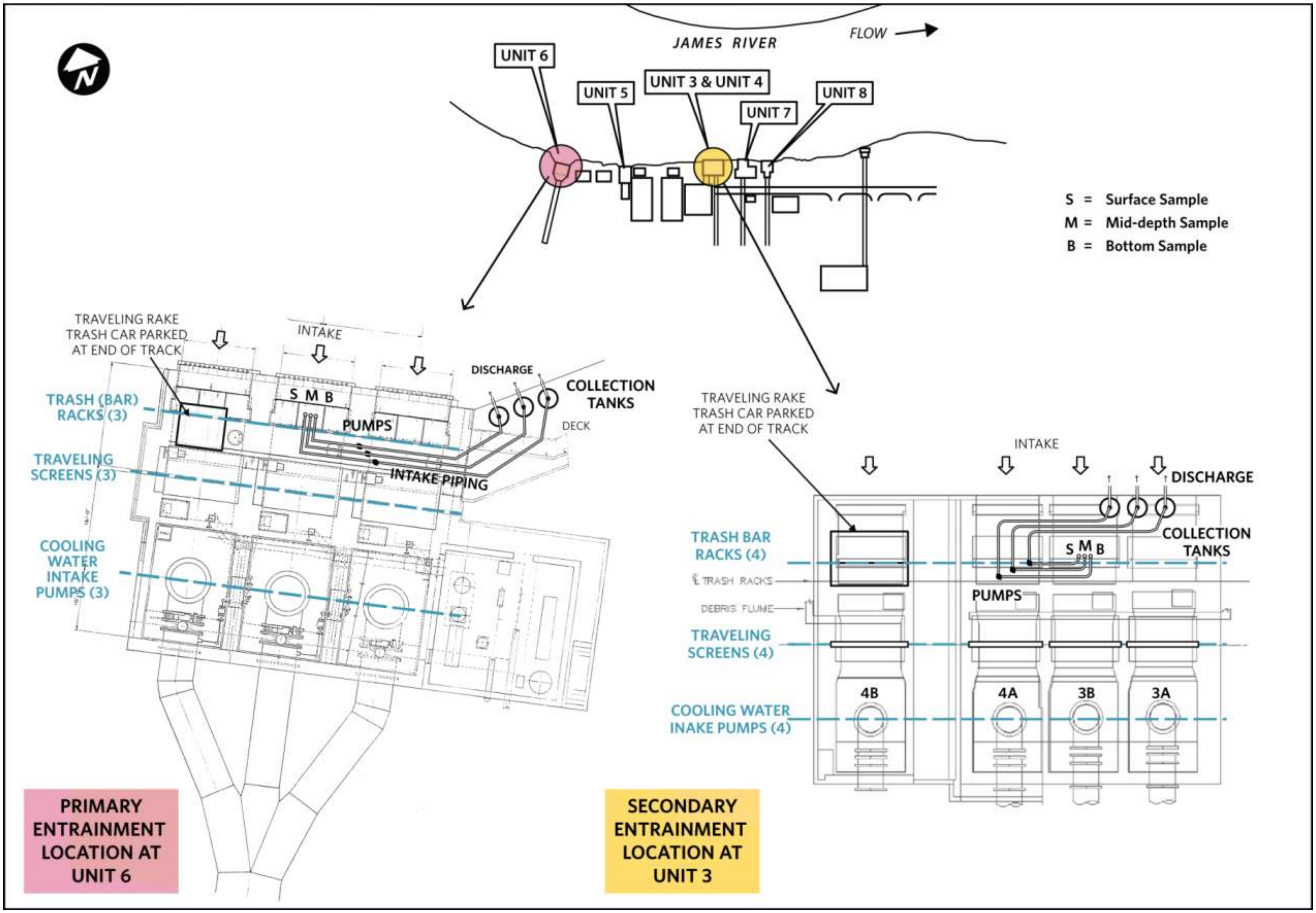
Entrainment

The purpose of the entrainment sampling is to characterize the occurrence of fish eggs, larvae, and juveniles, and shellfish life stages entrained through the CPS once-through cooling water system. Table 5-2 provides details of the entrainment sampling. Samples are collected on the river side directly in front of the trash racks at the Unit 6 CWIS. The primary sample location is at Unit 6, Screen B, in front of the trash rack (See Figure 5-4). Unit 6 was selected as the primary sampling location because it represents the highest volume (approximately 40%) of water withdrawn at CPS and has traditionally operated more than the other Units. Unit 3 was chosen as the secondary location in the event that Unit 6 was not operating because Unit 3 shares a common intake structure with Unit 4 and the combined volume at Units 3 and 4 represents the second highest volume of water withdrawn. Unit 3 also has relatively close access to the water from the intake structure deck as compared to other units which facilitates sampling, and sufficient deck space for the sampling equipment. Additional detail for the basis of the sampling design is provided in Section 5 of the *Entrainment Characterization Study Plan* (Dominion 2016a) (see Appendix A of the ITP Application).

During each 24-hr sampling event, concurrent samples are collected from near surface, mid-water and near bottom depths four times, centered at 0400, 1000, 1600, and 2200 hours. Samples are collected by pumping water through a 0.5-m diameter mouth plankton net constructed of 335-μm netting suspended in a buffering tank. A total of four samples, one every six hours, are collected from each depth over a 24-hr period sampling event (Dominion 2016a). Samples are collected for approximately 100 minutes per depth, or the time required to collect 100 cubic meters of water based on the pump flow rate. Because of its protected status, the entrainment sampling plan includes explicit methods focused on maximizing the potential of identifying early life stage Atlantic Sturgeon even though collection of Atlantic Sturgeon in an entrainment sample is expected to be a rare or infrequent event (Dominion 2016a). For additional details regarding the entrainment sampling please refer to Appendix A.

Table 5-2. Entrainment Sampling Details -

Entrainment	Details
Units to be sampled	Unit 6 (Primary Location) and Unit 3 (Secondary Location)
July 1, 2015 – March 2, 2016; Sixteen months of sampling events[1]	Twice per month sampling events (within the first and third week of each month) for 24 months (2/month x 24 months = 48 sampling events)
Daily collection schedule	Samples collected every 6 hours in a 24-hr period (4 collections / 24-hr period)
Targeted organisms	Fish eggs, larvae, and juveniles; shellfish life stages
Depths	Near surface, mid-depth, near bottom for a total of 3 depths
Number of samples collected per depth	1 sample per depth by pumping water through a 335-μm net suspended in a buffering tank (Three sub-samples for each depth will be combined)
Sample duration	~100 minutes per depth per 6-hour sample (or time required to get 100 m^3 per depth per 6-hour sample)
Number of samples per sampling event	4 collections/survey x 3 depths/collection x 1 sample/depth = 12 samples/survey
Total number of samples	12 samples/survey x 2 surveys/month x 24 months = 576 samples
[1] Schedule is dependent on the issuance date of the incidental take permit.	



Source: Dominion 2016a

Figure 5-4. Proposed Location of Chesterfield Power Station Entrainment Sampling

Near surface, mid-water and near bottom pumped samples will be collected from intake piping installed along the front of the trash racks with the face of trash racks used to stabilize the temporary intake piping. The near bottom sample will be collected approximately 3 ft above the bottom, the mid-depth sample will be collected at the mid-depth of the water column at Mean Sea Level (MSL), and the surface sample intake will be positioned 3 ft below the surface at Mean Low Water (MLW) in order to make sure that the intake piping of the surface sample is low enough to stay below the water surface and the system keeps its prime (Dominion 2016a). The sampling depths for CPS are shown in Table 5-3. Figure 5-5 presents the conceptual design of intake piping for the entrainment sampling at three depths.

Table 5-3. Sampling Depths at Chesterfield Power Station

Sampling Location	Sampling Depth Relative to Mean Sea Level (MSL)	Sampling Depth from Intake Deck Level (+18 at MSL)
Near surface (Mean Low Water – 3 feet)	-4.2’	-22.2
Mid-depth (Mid-point of Mean Sea Level and bottom of intake)	-9.5’	-27.5
Near bottom (bottom of intake + 3 feet)	-16.0’	-34.0’

Cooling water will be pumped using portable gas-powered four-inch centrifugal pumps (trash pump) and four-inch diameter PVC intake piping installed at the face of the trash racks. The pumped intake water will be filtered through a 335-micron mesh conical plankton net suspended in a 200-gallon polyethylene sample buffering tank. The sampling approach was developed to characterize entrainment[4] as summarized in Table 5-4.

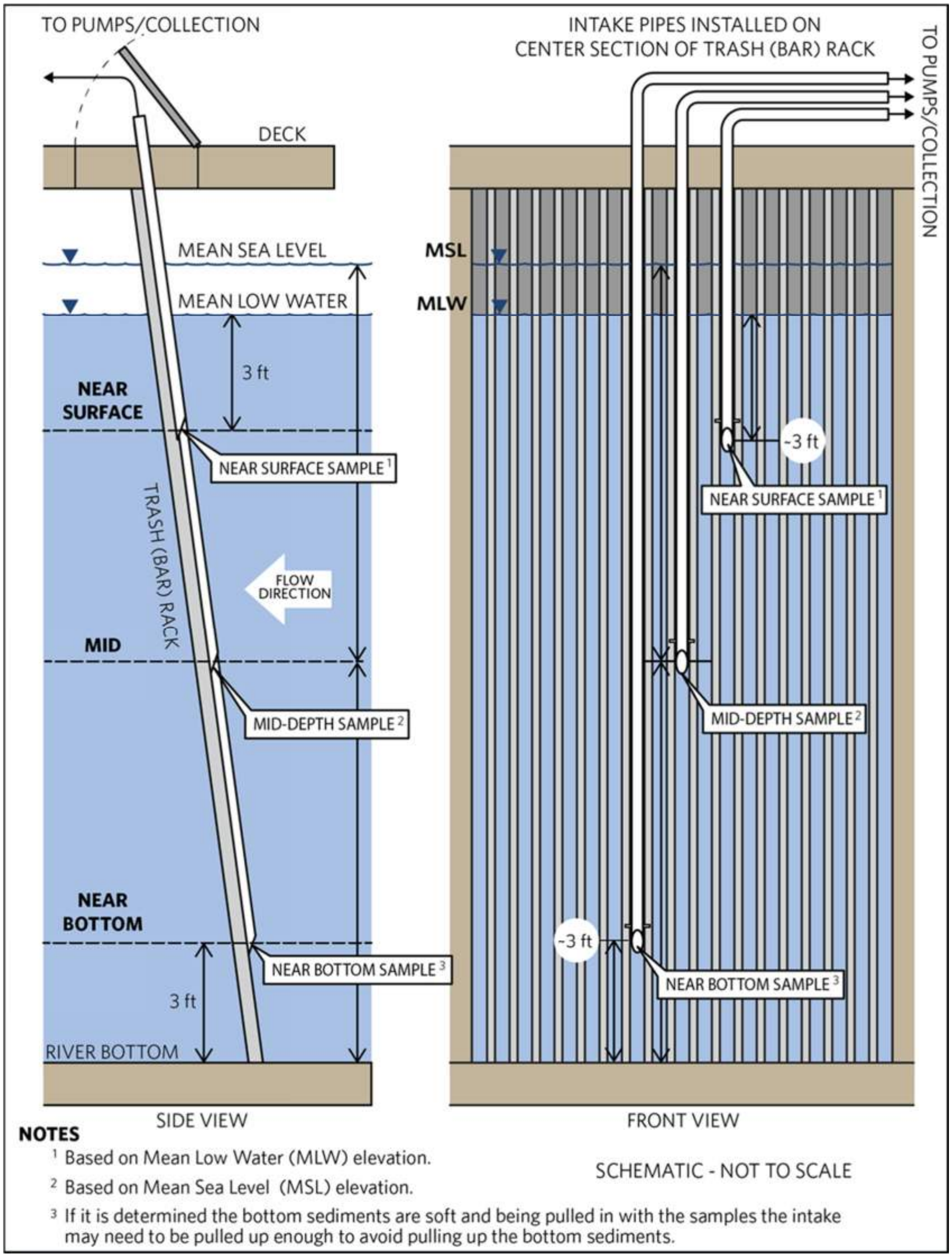
[4] As required under 40 CFR Part under 122.21(r)(9).

Table 5-4. Summary of Development of the Sampling Approach to Characterize - Entrainment[5]

Data Needs[6]	Basis for Developing the Data
Two years of data and annual variation	Evaluation of species and life stage composition and densities based on Year 1 and Year 2 entrainment studies
Seasonal variation	Evaluation of monthly species and life stage compositions based on the Year 1 and Year 2 studies
Diel variation	Evaluation of densities in four samples collected daily during the entrainment studies.
Variation related to climate and weather	Evaluation of data relative to water temperature and weather events (e.g., rain events)
Variation related to spawning, feeding and water column migrations	Evaluation of data to determine species and life stage period of occurrence for spawning and feeding variation; Evaluation of differences among near surface, mid-depth and near bottom collections for water column migrations
Identification of lowest taxon possible	The resolution of taxonomic and life stage designations will be monitored through regular evaluations of catch data with the goal of reducing percent of unidentified organisms and increasing resolution of genera and higher taxonomic designations
Data must be representative of each intake	Sampling in front of Unit 6 would be representative of "average" intake water because this Unit withdraws almost 40% of the total volume of the cooling water withdrawn at the CPS
How the location of the intake in the water body is accounted for	Sampling of near surface, mid-depth and near bottom at the trash racks assumed to be the best method to account for intake location
Document flow associated with the data collections	Facility will monitor flows for period of sampling for use in the final report produced after sampling
Methods in which latent mortality will be identified	Assume 100% mortality
Data must be appropriate for a quantitative survey	Data will be expressed as taxon and life stage specific densities which can be multiplied by flow to support quantification of entrainment

[5] As required under 40 CFR Part under 122.21(r)(9).

[6] As required under 40 CFR Part under 122.21(r)(9).



Source: Dominion 2016a

Figure 5-5. Conceptual Design of Intake Piping for Entrainment Sampling

Impingement

The purpose of the impingement sampling is to characterize the rate of impingement at CPS. Table 5-5 provides details of the impingement sampling. Impingement sample collection events are planned for twice per month over a 12-month study period. Impingement samples will be collected from the fish/debris return troughs which extend from the east end of the intake structures from an origin inside the last screen. Individual samples will be collected from Unit 7, Unit 8, Units 3 & 4 together, Unit 5, and Unit 6 (a total of 6 sample locations; however the samples from the two sample locations at the Unit 3 & 4 intake will be analyzed together). Drop-in baskets/nets will be used to collect the samples. At the Unit 3 & 4 intake structure 3 screens drain to the east side of the structure and one screen drains to the west side of the structure (Dominion 2016b). See Figure 5-6 for the impingement sampling locations where the nets will be inserted into the troughs. The sampling approach was developed to characterize impingement[7] as summarized in Table 5-6. Although no Atlantic Sturgeon are expected to be encountered during impingement sampling, because of its protected status the impingement sampling plan includes explicit methods focused on handling Atlantic Sturgeon, even though collection of Atlantic Sturgeon is expected to be a rare or infrequent event (Dominion 2016b). For additional details regarding the impingement sampling please refer to Appendix B.

Table 5-5. Impingement Sampling Details

Impingement	Details
Units to be sampled	Units 3 & 4, 5, 6, 7, and 8
July 1, 2015 – March 2, 2016; Four months of sampling events (or as appropriate, once the ITP is issued)	Twice per month sampling events (within the first and third week of each month) for 12 months [2/month x 12 months = 24 sampling events]
Daily collection schedule	Samples collected every hour in a 24-hr period (24 collections / 24-hr period)
Targeted organisms	Adult and juvenile fish and shellfish
Sampling location	Sample common fish return trough screenwash at the end of the last screen at each intake structure
Sampling gear	3⁄8-inch square mesh drop-in basket/net after the last screen at each intake structure
Sample duration	10 minutes as the target interval (every hour)
Number of samples per survey	24 sample collections/survey
Total number of samples	24 samples/survey x 2 surveys/month x 12 months x 6 sampling locations = 3,456 samples
[1] Schedule is dependent on the issuance date of the ITS.	

[7] Although 40 C.F.R. § 122.21(r)(2)-(13) do not specify that an Impingement Characterization Study must be conducted, Dominion has determined that such a study would be beneficial for a number of reasons, including that it would give Dominion the ability to document current impingement at CPS where recent data is not available to supplement data to be provided pursuant to §122.21(r)(4) and potentially inform the chosen method of compliance pursuant to (r)(6).

Each sampling event will encompass a 24-hour period with 24, one-hour subsampling periods. If a sampling event is missed due to weather or other events, the scheduled sampling event will be conducted within 96-hours of resolution of the complicating event.

Table 5-6. Summary of the Development of the Sampling Approach for Characterizing - Impingement -

Data Needs	Basis for Developing the Data
Species most susceptible to impingement	Evaluation of species and life stage composition and densities based on Impingement Study
Identification of fragile fish and shellfish species (<30% impingement survival)	Evaluation of literature values and initial impingement survival values from Impingement Study
Diel variation	Evaluation of densities in 1-hour sample collections in the Impingement Study
Variation related to climate and weather	Evaluation of the Impingement Study data relative to water temperature and weather events (e.g., rain events)
Period of occurrence	Evaluation of the Impingement Study monthly densities
Impingement data to support alternative technology evaluations	Evaluation of the Impingement Study densities, length and weight data, and initial impingement survival

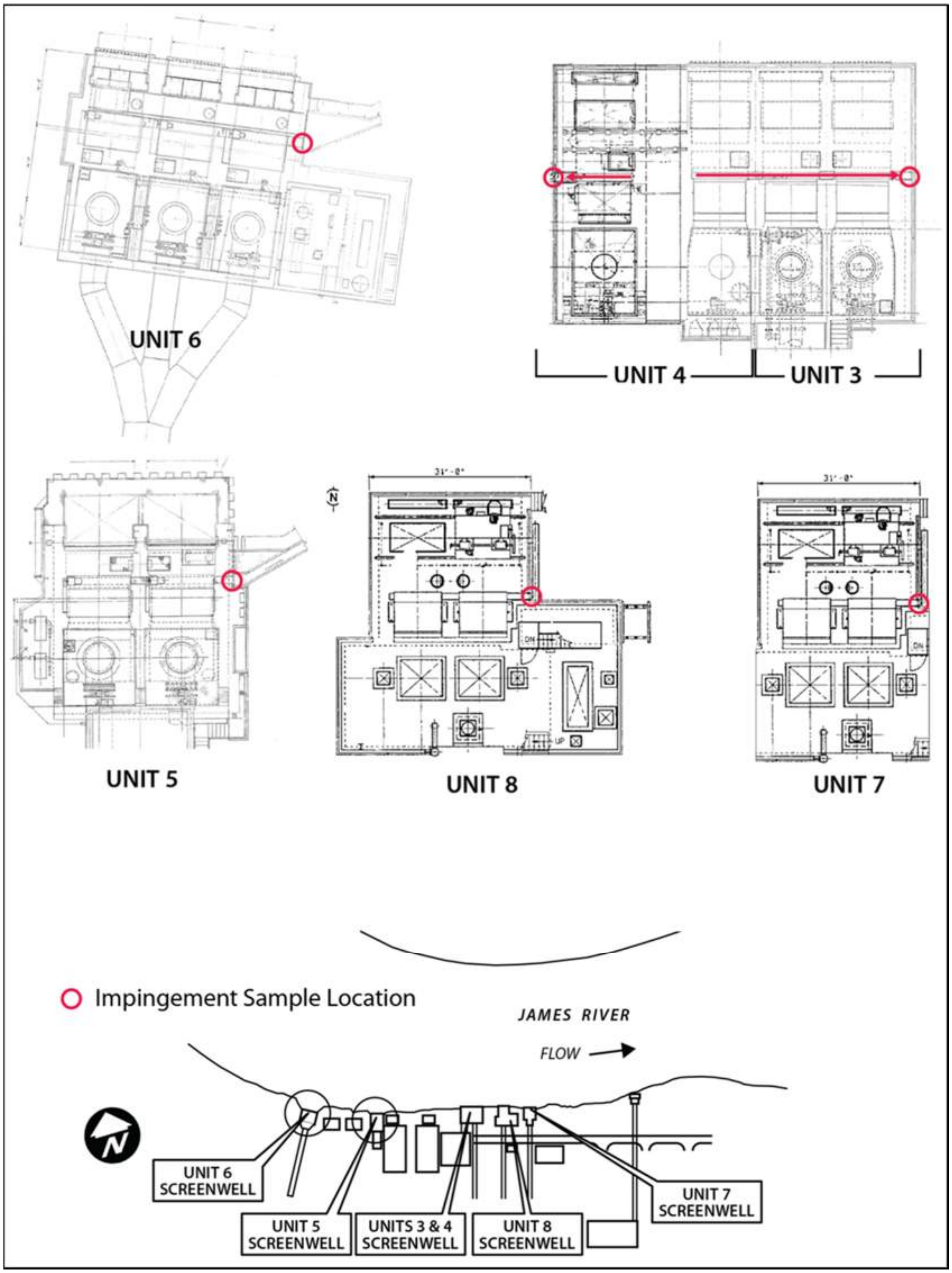


Figure 5-6. Chesterfield Power Station Impingement Sampling Location -

5.2 Other Activities Considered (For Which No Incidental Take Anticipated to Occur)

5.2.1 Dredging

Periodic dredging is necessary to remove accumulated sediments and debris in the vicinity of the CPS CWISs and barge offload slip to allow for reliable and efficient generation of electricity (Figure 5-7). All applicable permits including CWA Section 404/Rivers and Harbors Act Section 10 dredging would be obtained prior to completing any dredging.

Figure 5-7. Aerial Photo of Chesterfield Power Station Dredge Locations

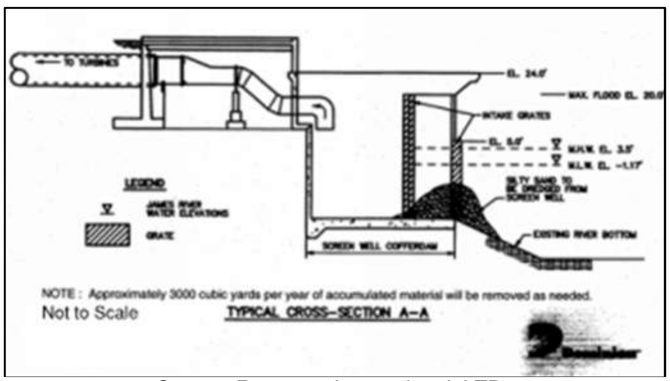
Figure 5-8 and Figure 3-2 provides a cross section and plan view of the location(s) where sediments accumulate in the vicinity of the CWISs and where dredging is required to occur periodically (Dominion 2003).

Dominion dredged up to ten cubic yards (cy) of material in front of the CPS CWISs in 1990 to facilitate removal of accumulated sediments. Dominion was also permitted to dredge up to 3,000 cy of material annually as necessary over an area of approximately 6,500-7,000 square feet (sq ft) through 2013. River sediments in the vicinity of the intake structure are composed of approximately 60% silt and 40% sand. The sediments are dredged via dragline dredges and transferred to trucks for disposal at an upland facility to prevent the sediments from re-entering the waterway (Dominion 2003). Dominion expects that a similar level of dredging (i.e, similar volume, area, and location) will be required intermittently over the next 10 years.

A dragline is used for the dredging within the vicinity of the CWISs (Appendix C). Dragline dredging consists of barge-mounted or land-based crane equipped with a dragline bucket (Figure 5-9) (FAO 1995). A large open-topped and open-faced drag bucket suspended by a hoist cable from the crane is lowered to the river bottom then a drag cable drags the bucket along the river bottom towards the dredge while removing river sediment. The bucket is then lifted from the river bottom and dumped into a scow or other dredged material receiving vessel.

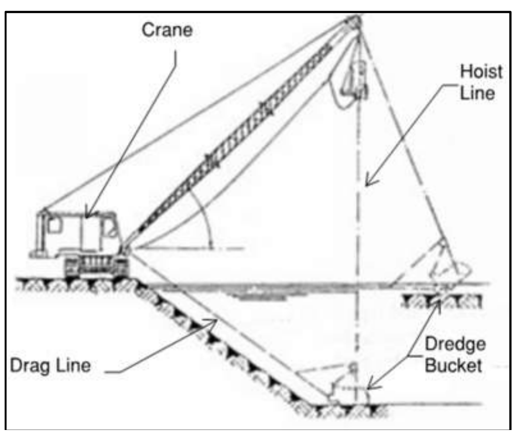
The volume of the bucket varies with the size of the crane operating the dragline bucket. A dragline bucket is lowered to the bottom of the channel and then dragged back to the crane across the bottom while remaining in contact with the river bottom over the duration of the drag (McDougal 2007). Dragline dredging is a common method applied for near-shore dredging scenarios (FAO 1995).

The Virginia Department of Game and Inland Fisheries (VDGIF) recommended that dredging occur outside the February 15 through June 30 timeframe to avoid impacts to anadromous fish such as Striped Bass (*Morone saxatilis*), Alewife (*Alosa pseudoharengus*), American Shad (*A. sapidissima*), Hickory Shad (*A. mediocris*), and Blueback Herring (*A. aestivalis*). Dominion has complied with this recommendation and has planned its dredging operations to occur outside of that timeframe. Dominion further proposes to avoid dredging within the proposed Atlantic Sturgeon spawning seasons (April 1 – May 15; September 1 – October 15). If dredging within the proposed Atlantic Sturgeon spawning seasons cannot be avoided Dominion proposes to implement monitoring; Section 4.3.3 and 6.3 of the Conservation Plan provides additional details on proposed mitigations.



Source: Resource International, LTD.

Figure 5-8. Typical Cross-section View of 2003 Dredging Location for Chesterfield Power Station CWISs, February 12, 2003 -



Source: FOA 1995

Figure 5-9. Dragline Dredge -

Periodic maintenance dredging is also necessary within the barge slip located northwest of the CPS (Figure 3-3). CPS was permitted between 2003 to 2008 to dredge a total of 8,000 cy of material as necessary over an area of approximately 1.4 acres to achieve an elevation of -21.0 ft MLW. River sediments in the vicinity of the barge slip and intake structures are composed of approximately 60% silt and 40% sand. Dredging in the barge slip is accomplished via hydraulic or clamshell methods with direct transfer to trucks for disposal at an existing CPS ash pond as permitted (Dominion 2003). This pond is in the process of being closed. Dominion expects that a similar level of intermittent dredging (i.e., similar volume, area, and location) will be required over the next 10 years.

Hydraulic dredging consists of barge-mounted, rotating cutterhead fitted to the terminus of a suction pipe (NMFS 2012). This is the preferred method for the removal of material from the James River (NMFS 2012). Rotating cutterheads disrupt bedded river sediments to create a sediment/water slurry which is then pumped to a nearby dredged material placement location. Typical cutterhead dredge suction pipes used in the James River vary between 18 to 20 inches in diameter, with a maximum of 36 inches (NMFS 2012). As discussed in more detail in Section 2 of the Conservation Plan, Dominion does not anticipate that incidental take will result from dredging activities.

5.2.2 Constituent Discharge

CPS was issued a Virginia Pollution Discharge Elimination System (VPDES) permit (Number VA00004146) effective as of October 1, 2016. The permit authorizes the discharge of various constituents and contains monitoring requirements and limitations for the CPS outfalls, shown in Figure 3-4, to the James River and Farrar Gut. Dominion is currently undertaking an integrated ash project (IAP) at CPS. The IAP is an extensive multi-year project that is being driven by recently promulgated regulatory requirements (i.e., Federal Effluent Guidelines and the CCR Rule) that affect almost every aspect of how the station currently manages wastewater. Work to be performed during the IAP includes:

- closure of the Upper Ash Pond (UAP) and Lower Ash Pond (LAP);
- construction of a new Fossil Fuel Combustion Product (FFCP) Management Facility;
- conversion from a wet to dry ash management system;
- construction of a new Low Volume Wastewater Treatment System (LVWWTS) to manage wastewaters that will remain following closure of the LAP and UAP and that will be generated by the new FFCP Management Facility; and
- installation of a new wastewater treatment system to remove selenium from the station's FGD waste stream.

As described below, implementation of the IAP will eliminate the existing process wastewater discharges from the station's two ash ponds and provide additional treatment for many waste streams, thereby substantially reducing the concentrations of key constituents in the remaining discharges.

As shown in Table 5-7, Outfalls at the CPS discharge to multiple water bodies and from a variety of waste water sources. The VPDES permit contains conditions for each discharge that were developed with consideration for the IAP and the resulting transition in wastewater management and discharges that will occur. In developing the proposed permit conditions the VDEQ, in many cases, went beyond existing regulatory requirements and agency permitting guidelines to ensure the protection of water quality in the receiving waterbodies. To comply with EPA's Coal Combustion Residuals Rule and the Virginia Solid Waste Management Regulations, CPS will close the LAP and UAP sedimentation basins and convert to a dry ash management system. Upon initiation of the decommissioning of the ash ponds, Outfalls 004 and 005 will no longer discharge to the Farrar Gut and all water generated during the closure process will be conveyed to a treatment plant within the CPS. This water will be treated to meet stringent discharge limits at the exit point of the CPS treatment plant and will then be conveyed via Outfall 101 to Outfalls 001 and/or 002 for discharge to the James River. Additionally, a new LVWWTS will be constructed (Outfall 301 below) to receive and treat the various CPS waste steams as detailed in Table 5-7. Effluent from the LVWWTS will be monitored at the plant discharge for compliance with VPDES requirements. The LVWWTS plant effluent will then be conveyed through a diffuser to Outfall 003 prior to discharge to the Farrar Gut. At all times the CPS will be subject to VPDES Permit No. VA0004146, or a subsequent VPDES permit as appropriate, to meet CWA requirements. CPS monitors for and reports effluent limits of the VPDES permit number VA0004146 as required (Dominion 2015b).

Virginia's Safe Water Control Board has designated the James River and Farrar Gut as Tier 1 with respect to the Water Quality Standards antidegradation policy. Tier 1 or existing use protection, the existing water quality and the existing uses of the water body must be maintained (VDEQ 2016). This is the lowest of three tiers with regards to water body protection and expanded water body uses. Based on the CWA water body designation and the VDEQ antidegradation policy, chemical discharges are permitted through the VDEQ VPDES as summarized in Appendix D.

Table 5-7. Chesterfield Power Station Outfall Water Sources and Flows -

Outfall[a]	Receiving Water Body	CWA Section 303(d) List[b]	Wastewater Source	Treatment	Flow, MGD (max. of 30 day averages)
001	James River, Main Channel	Category 5D	Unit 7 and 8 cooling water	Dechlorination	212
101	Outfall 001 or 002	Not Applicable	Discharge from Centralized Source Water Treatment Facility – will receive effluent from Lower Ash Pond and Upper Ash Pond during closure process	To be determined – treatment methods will be selected to ensure compliance with restrictive discharge limitations and will be submitted for approval prior to commencement of treatment construction	5.0
002	James River, Main Channel -	Category 5D	Unit 3 cooling water	Dechlorination	89
003	James River, - Farrar Gut	Category 4A	Unit 4, 5, and 6 cooling water	Dechlorination	753
301	Outfall 003	Not Applicable	Discharge from Low Volume Wastewater Treatment System	Sedimentation, oil and grease removal, and neutralization at a minimum. Engineering report to be submitted for approval prior to commencement of construction.	6.0
302	Internal Outfall 301	Not Applicable	Flue gas desulfurization wastewater and combustion residual leachate (if redirected to this outfall)	Wastewater equalization, pH elevation, gypsum desaturation, heavy metal precipitation, coagulation, flocculation, clarification, pH adjustment, and sludge dewatering. Wastewater treatment is achieved through chemical addition. Upgrade to meet new FEGs anticipated. Engineering Report will be submitted for approval prior to construction.	0.11 (0.30 if leachate directed to FGD WWTP).
303	Internal Outfall 301	Not Applicable	Metals cleaning wastewater	Lime addition, mixing, and chemical precipitation	2.7
304	Internal Outfall 301	Not Applicable	Leachate form the Fossil Fuel Combustion Product Management Facility	To be determined – Treatment methods will be selected to ensure compliance with restrictive FEGs limitations and will be submitted for approval prior to commencement of treatment construction. Wastestream may be treated separately and routed to the LVWWTS via Outfall 304 or be routed to the FGD wastewater treatment system for discharge to the LVWWTS through Outfall 302.	0.19
305	Internal Outfall 301	Not Applicable	Coal pile runoff	Settling and metals treatment - Engineering report to be submitted for approval during permit term.	2.4
004	James River, Farrar Gut	Category 4A	Discharge from Lower Ash Pond[c]	Settling, skimming. Some sources to the LAP receive treatment prior to discharge to the ash pond. There is also occasional chemical coagulation and pH adjustment as needed. Discharge will be eliminated with closure of lower ash pond.	17.47
401	Outfall 004	Not Applicable	Metal cleaning wastewater	See Internal Outfall 303 above	2.7
402	Outfall 004	Not Applicable	FGD	See Internal Outfall 302 above	0.11
005	James River, Farrar Gut	Category 4A	Storm water runoff from coal ash pond closures and recovery wells and drains	Settling, skimming. Discharge will be eliminated with closure of upper ash pond.	4.05

[a] The James River is tidally influenced at the discharge points. Flow frequencies cannot be determined for tidal waters; therefore, conservative tidal dilution rates were used to establish wasteload allocations (WLAs) and effluent limits. Historically the standard tidal dilution ratios (2:1 acute, 50:1 chronic) were used to establish WLAs for Outfalls 001 and 002. In the current permit VDEQ restricted the chronic mixing zone to 2:1, This is also true for internal Outfall 101. Farrar Gut is also tidal; however, the gut is dominated by the discharge from the facility's Outfall 003. Outfalls 003 and 004 discharge at the head of Farrar Gut where tidal influence is minimal; therefore, these outfalls are evaluated without dilution. At Outfall 005, which is near the mouth of Farrar Gut, conservative tidal dilution ratios of 2:1 acute and 2:1 chronic (historically 50:1) were used to evaluate discharge. Note that the Fossil Fuel Combustion Product Management Facility is considered an "Existing Facility" under the recently promulgated ELG rule; however, VDEQ applied the more restrictive "New Facility" ELG limits to Outfall 304.

[b] - Category 5D means the Water Quality Standard is not attained where TMDLs for a pollutant(s) have been developed but one or more pollutants are still causing impairments requiring additional TMDL development. Category 4A means the water is impaired or threatened for one more designated uses but does not require a TMDL because the TMDL for specific pollutant(s) is complete and USEPA approved.

[c] Receives ash sluice water and wastewater from sumps throughout the CPS (low volume wastes, screen backwash associated with reuse of the Proctor's Creek WWTP effluent, wastewater from the station's car wash (non-chemical), storm water from the Unit 6 FGD runoff collection system, coal pile runoff, water treatment plant wastewater, a portion of drainage area 4 and various other onsite tank containment areas including the station's light oil storage tank. Additionally treated discharge from the metals treatment pond and the treated discharge from the FGD WWTP.

Source: VDEQ 2016

This page is intentionally left blank -

Dominion installed an oil recovery plan at the CPS in 2014 to address historical petroleum releases associated with VDEQ's Pollution Complaint (PC) #94-1599 (Dominion 2014). Dominion's Corrective Action Plan (CAP) to achieve the primary remedial objective is to recover liquid phase petroleum (#2 fuel oil) to a thickness of 0.01 ft or less from the subsurface (Dominion 2014). To recover oil residual and free phase product multi-phase extraction (MPE) methods are used through application of high vacuum in four recovery wells (Dominion 2014).

Installed in 2015, a dual-phase extraction (DPE) method was installed in four recovery wells and one observation well (Dominion 2016e). Several weeks after installation emulsification of oil within the treatment system resulted operational issues and the system was shut down for repairs. CPS staff continue to recover oil manually from the DPE wells on a monthly basis until the DPE system is modified and returned to service (Dominion 2016e). Table 5-8 summarizes the total gallons of liquid phase hydrocarbons recovered at the CPS from January to June of 2016.

Table 5-8. Gallons of Liquid Phase Hydrocarbons Recovered at Chesterfield Power Station

Source: Dominion 2016c

Well number	1/20/2016	2/17/2016	3/31/2016	4/13/2016	5/12/2016	6/9/2016	Total
	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons	Gallons
PZ-1	0.05	0.05	0.05	0.05	0.05	0.05	0.3
MPE-1	0.1	0.15	0.05	0.1	0.1	0.1	0.6
MPE-2	0.01	0.01	0.1	0.01	0.01	0.01	0.15
MPE-3	0.1	0.1	0.05	0.05	0.1	0.2	0.6
MPE-4	0.31	0.36	0.21	0.26	0.36	0.46	1.96
Total	**0.57**	**0.67**	**0.46**	**0.47**	**0.62**	**0.82**	**3.61**

As discussed in more detail in Section 2 of the Conservation Plan, Dominion does not anticipate that incidental take will result from constituent discharge.

5.2.3 Thermal Discharge

CPS conducted a CWA 316(a) demonstration study (VEPCO 2000) during the period from 1997 through 1999. The study analyzed water quality characteristics and the biological communities located upriver and downriver of the CPS discharges (with sampling locations representative of the thermal mixing zone as well as ambient conditions). A report presenting the results of these studies was submitted to the VDEQ on February 29, 2000. The report concluded that the heat rejection limits were "more stringent than necessary to assure the protection and propagation of a balanced, indigenous, aquatic community in the James River" (VEPCO 2000).

By letter dated July 20, 2001 VDEQ concurred that the demonstration was successful at the conditions observed during the study. However, VDEQ also concluded that the studies had not adequately predicted the temperatures that would be experienced under "full load" conditions and additional assessments would be needed to determine if the CWA 316(a) conclusions remained the same under the full thermal load scenario. To address VDEQ's concern Dominion's consultant HydroQual performed additional thermal modeling under full thermal loading conditions using a sophisticated hydrodynamic model ECOM. The results of this modeling along with technical opinions from two well-known fisheries biologists, Dr. John Ney (Virginia Tech) and Dr. Cynthia Jones (Old Dominion University) were provided to VDEQ. Both biologists concluded that the increase in temperatures resulting from full load conditions would not change the conclusions of the CWA 316(a) demonstration. VDEQ concurred with this determination and granted the CWA 316(a) variance with issuance of the VPDES permit in 2004.

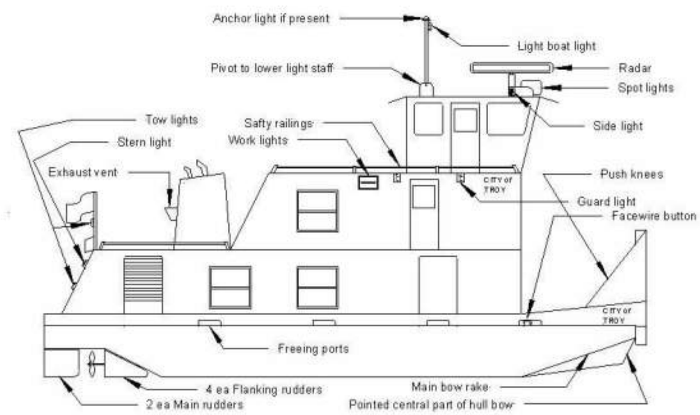
The CWA 316(a) variance was renewed with the most recent reissuance of the permit effective October 1, 2016. The 2016 VPDES permit fact sheet states that, "The Heat Rejected limitations are supported by the CWA 316(a) variance approved with the 2004 permit reissuance. The limitations are appropriate to ensure that heat rejection does not exceed the values in the CWA 316(a) study" (VEPCO 2000, Appendix D). The current CPS VPDES permit (VA0004146) contains heat rejection limits of 11.3×10^8 British thermal units/hour (Btu/hour) for Outfall 001 (Units 7 and 8), 6.52×10^8 Btu/hour for Outfall 002 (Unit 3), and 5.55×10^9 Btu/hour (Units 4, 5, and 6) (see Figure 3-4 for outfall locations).

The reissued VPDES permit Special Condition I.C.29 requires the development and implementation of a detailed plan for updating the studies to support renewal of the CWA 316(a) variance during the next permit reissuance. To satisfy this requirement, Dominion intends to perform similar thermal modeling and analysis. Results of the updated studies or demonstration are due to VDEQ no later than 270 days prior to the expiration date of the permit on September 30, 2021. This is the same deadline that is included in the permit for submittal of the CWA 316(b) information required by 40 CFR Part 122.21(r)(2)-(13). As discussed in more detail in Section 2 of the Conservation Plan, Dominion does not anticipate that incidental take will result from thermal discharge.

5.2.4 Vessel Movements

Operation of the CPS requires periodic deliveries (typically 4 to 6 deliveries per month) of limestone by means of barges with drafts of up to 10.5 ft that must transit the James River from points of origin outside of the river. In addition, gypsum is produced by CPS operations and is transported away from the plant periodically (4 to 6 shipments per month) by means of barges with drafts of up to 10.5 ft that must transit the James River from the CPS to points outside of the river. The typical process schedules a limestone delivery and gypsum shipment together so that one barge and towboat is utilized, therefore the boat will transit towards and away from the CPS in a loaded condition. Additional vessel trips with similar vessels are required when the CPS oil tank is cleaned (approximately every 2 years). Based on records of multiple barge deliveries for the 12-month period preceding October 2016 (See Appendix E for more information), these vessel activities can be characterized as routinely consisting of barges having a loaded draft of approximately 10.5 ft, whereas empty barges have a draft of approximately 2.0 ft. According to National Oceanic and Atmospheric Administration (NOAA) Chart 12252, the navigation channel in the reach of the James River from Hopewell to Richmond has a project depth (authorized navigable depth) of 35 ft, which the U.S. Army Corps of Engineers maintains to a depth of 25 ft. Consequently the fully loaded barge would provide a minimum of 14 ft of below keel clearance during transits, and a minimum of 23 ft of below keel clearance when empty. Actual clearances would generally be deeper in those reaches where shoaling is less prevalent and where the natural channel depth exceeds the project depth.

The CPS limestone deliveries and gypsum shipments are typically performed via contracted towboats. These vessels are typically compact, square-bowed, and shallow-draft, designed for use on inland waterways. Although capable of transporting arrays of multiple barges, the CPS activities involve maneuvering a single barge. CPS utilizes an outside contractor to provide tow services for the barge deliveries described above. The towboats typically used vary in draft between 8.7 to 10.5 ft when handling fully loaded barges. These towboats utilize propellers that range in width between 63 and 79 inches (Figure 5-10). While navigating the James River, towboats adhere to United States Coast Guard (USCG) Navigation Rules and Regulations regarding vessel speed, navigation, communications, and other aspects of navigating safely within inland waterways.



Source: Towboat Tour 2016

Figure 5-10. Typical Towboat Design

During arrivals at the barge slip the towboat turns the barge from the axis of the navigation channel to face into the slip. The barge is initially tied off alongside dolphins that extend riverward. Final maneuvering into the slip to the off-loading/loading facility is accomplished by a cable winch system. During departures the process is reversed.

Dominion expects that there will be similar levels of vessel traffic associated with CPS operation over the next 10 years. Vessel traffic associated with periodic dredging also occurs in the vicinity of the CPS CWIS and the barge slip. All required permits will be obtained prior to this activity. As discussed in more detail in Section 2 of the Conservation Plan, Dominion does not anticipate that incidental take will result from vessel movements.

5.2.5 Shoreline and Structure Maintenance

Examples of possible shoreline maintenance activities that would be required over the next 10 years include barge slip maintenance and maintenance of ductwork over State-owned subaqueous land within the James River, as well as general shoreline and shoreline facilities maintenance. Barge slip maintenance could include widening to the north by removing alluvial sediments, with the installation of new 30-inch mooring dolphins and removal of the existing dolphins. Potential construction means and methods which may be implemented, but are not limited to, include:

- Vibratory Pile Driving,
- Impact Pile Driving,
- Dewatering,
- Concrete and/or Riprap Placements,
- Excavation, and
- Dredging.

All applicable permits including CWA Section 404/Rivers and Harbors Act Section 10 dredging would be obtained prior to initiating any dredging activity. As explained in more detail in Section 2 of the Conservation Plan, Dominion does not anticipate that incidental take will result from shoreline and structure maintenance.

6 Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Habitat Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

ASMFC. 2016a. Atlantic Sturgeon Fact Sheet. Available online. Retrieved October 11, 2016. http://www.asmfc.org/species/atlantic-sturgeon

ASMFC. 2016b. Sturgeon Technical Committee Meeting Summary for January 26, 2016. Available online. Retrieved October 11, 2016. http://www.asmfc.org/species/atlantic-sturgeon

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Atlantic Sturgeon Plan Review Team (ASPRT). 2016. 2016 Review of the Atlantic States Marine Fisheries Commission Fishery Management Plan for Atlantic Sturgeon *(Acipenser oxyrinchus oxyrinchus)* for Fishing Year 2013 and 2014. Available online; http://www.asmfc.org/uploads/file/56ba055fSturgeonFMPReview2016.pdf. Retrieved on April 5, 2017.

Austin, G. 2012. Essential spawning habitat for Atlantic Sturgeon in the James River, Virginia. M.S. Thesis, Virginia Commonwealth University, Richmond, VA.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. *Environmental Biology of Fishes* 48: 347-358.

Bain, M.B., N. Haley, D. Peterson, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic Sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River estuary: Lessons for sturgeon conservation. Boletin-Instituto Español de Oceanografía 16: 43-53.

Balazik, M.T. 2012. Life history analysis of James River Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) with implications for management and recovery of the species. Doctoral Dissertation, Virginia Commonwealth University, Richmond, VA.

Balazik, M.T. and J.A. Musick. 2015. Dual Annual Spawning Races in Atlantic Sturgeon. PLoS ONE 10(5): e0128234. doi:10.1371/journal.pone.0128234.

Balazik, M.T., G.C. Garman, J.P. Van Eenennaam, J. Mohler, and L.C. Woods III. 2012a. Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia. Transactions of the American Fisheries Society. 141(6):1465-1471.

Balazik, M.T., S.P. McIninch, G.C. Garman, and R.J. Latour. 2012b. Age and growth of Atlantic Sturgeon in the James river, Virginia, 1997-2011. Transactions of the American Fisheries Society. 141(5):1074-1080.

Bath, D.W., J.M. O'Connor, J.B. Alber, L.G. Arvidson. 1981. Development and identification of larval Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*A. brevirostrum*) from the Hudson River estuary. Copeia 3:711-717.

Bilkovic, D.M., K. Angstadt, and D. Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia. Final report to NOAA Chesapeake Bay Office, Award Number NA06NMF4570303. Virginia Institute of Marine Science, Center for Coastal Resources Management, Gloucester Point, Virginia. Available online. Retrieved October 13, 2016. http://ccrm.vims.edu/research/mapping_surveying/sturgeon/index.html

Bushnoe, T.M., Musick, J.A., and D.S. Ha. 2005. Essential spawning and nursery habitat of Atlantic sturgeon (*Acipenser oxyrinchus*) in Virginia. Appendix 1 in Musick, J.A. (Prin. Inv.), Essential Fish Habitat of Atlantic Sturgeon in the Southern Chesapeake Bay, Virginia Institute of Marine Science Special Scientific Report Number 145, Final Report to NOAA/NMFS Award NA03NMF4050200(AFC)37.

Chesapeake Bay Fisheries Ecosystem Advisory Panel (CBFEAP). 2006. Fisheries ecosystem planning for Chesapeake Bay. American Fisheries Society, Trends in Fisheries Science and Management 3, Bethesda, Maryland.Available online: http://hjort.cbl.umces.edu/multisp/FEP_FINAL.pdf. Accessed on April 5, 2017.

Dominion Resources Services, Inc. (Dominion). 2003. Intake Maintenance Dredging - Joint Permit Application, Chesterfield Power Station, Chesterfield, Virginia.

Dominion. 2014. *Dominion - Chesterfield Power Station VPDES General Permit VAG83 Registration Statement.* Chesterfield Power Station, Chesterfield, Virginia.

Dominion. 2015a. *Entrainment and Impingement Characterization Standard Operating Procedures.* Prepared by HDR Engineering, Inc.

Dominion. 2015b. Fact Sheet Dominion – Chesterfield Power Station Attachments. Chesterfield Power Station, Chesterfield, Virginia.

Dominion. 2016a. Entrainment Characterization Study Plan. Prepared by HDR Engineering, Inc.

Dominion. 2016b. Impingement Characterization Study Plan. Prepared by HDR Engineering, Inc.

Dominion. 2016c. Chesterfield Power Station. Retrieved October 14, 2016. Available Online: https://www.dom.com/corporate/what-we-do/electricity/generation/fossil-fueled-power-stations/chesterfield-power-station.

Dominion. 2016d. Dominion 316(b) Implementation, Chesterfield Power Station Area of Influence. Prepared by HDR Engineering, Inc.

Dominon. 2016e. *Corrective Action Progress Report.* Chesterfield Power Station, Chesterfield, Virginia.

EA Engineering, Science, and Technology (EA) 2007. Impingement Mortality and Entrainment Characterization Report, Chesterfield Power Station, June 2005 – 2006. EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

Food and Agricultural Organization of the United Nations (FAO). 1995. *Construction and Maintenance of Artisanal Fishing Harbours and Village Landings.* Retrieved October 18, 2016, from FAO Training Series: http://www.fao.org/3/a-v5270e.pdf

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and Shortnose Sturgeons. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28pp.

Hager, C. 2011. Atlantic Sturgeon review: Gather data on reproducing subpopulation of Atlantic Sturgeon in the James River. Contract EA133FIOCN0317.

Hardy, R.S., and M.K. Litvak. 2004. Effects of temperature on the early development, growth, and survival of Shortnose sturgeon, *Acipenser brevirostrum*, and Atlantic sturgeon, *Acipenser oxyrinchus*, yolk-sac larvae. Environmental Biology of Fishes 70:145-154.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Department of Commerce, Bulletin of the United States Bureau of Fisheries, Volume XLIII.

Ingram, K., K. Dow, L. Carter, J. Anderson, eds. 2013. Climate of the Southeast United States: Variability, change, impacts, vulnerability. Washington DC: Island Press.

Jensen, L.D., J.R. Edmunds, and C. D. Meyers. 1974. Fish Studies. Chapter 7 in Jensen 1974.

Jones, P.W., F.D. Martin, and J.D. Hardy, Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

Kocik J, C. Lipsky, T. Miller, P. Rago, and G. Shepherd. 2013. An Atlantic Sturgeon Population Index for ESA Management Analysis. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-06. 36 pp. Available online. Retrieved May 14, 2013. http://www.nefsc.noaa.gov/nefsc/publications/

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, and Shortnose Sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Biology of Fishes 63: 137-150.

Kynard, B., M. Breece, M. Atcheson, M. Kieffer, and M. Mangold. 2007. Final Report Status of Shortnose Sturgeon in the Potomac River, PART I – FIELD STUDIES. Available online. Retrieved October 21, 2014. http://www.fws.gov/northeast/marylandfisheries/reports/FINAL%20REPORT%20SNSPotomac.pdf

Kynard, B., M. Breece, M. Atcheson, and M. Mangold. 2009. Life history and status of shortnose sturgeon (*Acipenser brevirostrum*) in the Potomac River. J. Appl. Ichthyol. 25:34-38.

McDougal. 2007. Lake Line, Equipment and Methodology. Dredge America. Retrieved october 18, 2016. Available Online: http://www.dredgeamerica.com/pdf/Dredge_Equipment_Methodology.pdf.

Mohler, J.W. 2003. Culture manual for the Atlantic sturgeon. United States Fish and Wildlife Service Publication, Hadley, Massachusetts.

Moore, K., Neikirk, B., & Anderson, B.-A. (2006, April). *Water Quality Conditions and Restoration of Submerged Aquatic Vegetation (SAV) in the Tidal Freshwater James River 2005.* Retrieved October 21, 2016, from http://www.vims.edu/GreyLit/VIMS/sramsoe392.pdf

National Marine Fisheries Service (NMFS). 1998. Recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland 104 pp.

NMFS. 2009. Letter from Ms. Patricial A. Kurkul, Regional Administrator, NMFS NE Region to Ms. Beth Bachur, Acting Chief, Maryland Section Southern, Department of the Army, dated May 7, 2009, regarding Endangered Species Act Section 7 Consultation for maintenance dredging at the Possum Point Station in the Potomac River (NABOP-RMS-2007 64780).

NMFS. 2012. Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).

NMFS. 2016. 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. Available online. Retrieved October 12, 2016. https://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

Niklitschek, E.J., and D.H. Secor. 2005. Modeling spatial and temporal variation of suitable nursery habitats for Atlantic sturgeon in the Chesapeake Bay. Estuarine, Coastal and Shelf Science 64:135-148.

National Oceanic Atmospheric Administration (NOAA). 2016. Atlantic Sturgeon. NOAA-Chesapeake Bay Office. Available online. Retrieved October 17, 2016. http://chesapeakebay.noaa.gov/fish-facts/atlantic-sturgeon

NOAA Fisheries. 2016. Atlantic Sturgeon Recovery Program. NOAA Fisheries Greater Atlantic Region Available online. Retrieved October 12, 2016. https://www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/

Secor, D.H., E.J. Niklitschek, J.T. Stevenson, T.E. Gunderson, S.P. Minkkinen, B.Richardson, B. Florence, M. Mangold, J. Skjeveland, A. Henderson-Arzapalo. 2000. Dispersal and growth of yearling Atlantic sturgeon, *Acipenser oxyrinchus*, released into Chesapeake Bay. Fisheries Bulletin. 98:800-810.

Smith, T.I. J., E.K. Dingley, and D.E. Marchette. 1980. Induced spawning and culture of Atlantic sturgeon. Progressive Fish-Culturist 42: 147-151.

Snyder, D.E. 1988. Description and identification of shortnose and Atlantic sturgeon larvae. American Fisheries Society Symposium 5:7-30.

Spells, A. 1998. Atlantic sturgeon population evaluation utilizing a fishery dependent reward program in Virginia's major western shore tributaries to the Chesapeake Bay. An Atlantic Coastal Fisheries Cooperative Management Act Report For National Marine Fisheries Service.

Towboat Tour. 2016. *Towboat Tour*. Retrieved November 2, 2016, from Boats: http://towboattour.com/boats

U.S. Fish and Wildlife Service (USFWS). 2009. USFWS Update, Shortnose Sturgeon in the Potomac River. Web. [http://www.fws.gov/northeast/marylandfisheries/reports/shortnose_fact_sheet_7_21_09.pdf]. Retrieved October 11, 2016.

U.S. Army Corps of Engineers (USACE). 2004. *United States Army Corps of Engineers, Norfolk District*. Retrieved October 20, 2016, from James River Middle Reach: http://www.nao.usace.army.mil/Portals/31/siteimages/civilworks/JamesRiverPartner/040304-A-CE999-001.jpg

USACE. 2015. Richmond Deepwater Terminal to Hopewell, Project Condition, Survey of October and November 2014, James River, Virginia. Page 8 of 18.

Virginia Department of Environmental Quality (VDEQ). 2014. Final 2014 305(b)/303(d) Water Quality Assessment Integrated Report. Retrieved On: October 19, 2016. Available Online: http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2014305(b)303(d)IntegratedReport.aspx.

VDEQ. 2016. Fact Sheet: VA0004146, Dominion Chesterfield Power Station. Retrieved On: October 19, 2016. Available Online: http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/Coal_Ash/Chesterfield/VA0004146%20-%20Fact%20Sheet.pdf

VDEQ. 2017. Virginia Pollutant Discharge Elimination System Permit Program. Available online: http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination.aspx. Retrieved on April 5, 2017.

Virginia Department of Game and Inland Fisheries (VDGIF). 2016a. Fish and Wildlife Information Service (VAFWIS). Web. http://vafwis.org/fwis/. Retrieved October 10, 2016.

VDGIF. 2016b. VDGIF Time of Year Restrictions (TOYR) Table. Retrieved On: November 11, 2016. Available Online: https://www.dgif.virginia.gov/wp-content/uploads/VDGIF-Time-of-Year-Restrictions-Table.pdf

Virginia Electric and Power Company (VEPCO). 2000. Section 316(a) Demonstration. VPDES Permit Number VA0004146 - Chesterfield Power Station. Virginia Electric and Power Company, Environmental Policy and Compliance, Glen Allen, Virginia.

Welsh, S., M. Mangold, J. Skjeveland, and A. Spells. 2002. Distribution and movement of shortnose sturgeon (*Acipenser brevirostrum*) in the Chesapeake Bay. Estuaries 25:101-104.

Zydlewski, G.B., M.T. Kinnison, P.E. Dionne, J. Zydlewski, and G.S. Wippelhauser. 2011. Shortnose sturgeon use small coastal rivers: the importance of habitat connectivity. J. Appl. Ichthyol. 27:41–44

Appendix A: Entrainment Characterization Study Plan -

DRAFT Entrainment - Characterization Study Plan -

Prepared for: -
Dominion Resources Services, Inc. -

Prepared by: -
HDR Engineering, Inc. -

May 29, 2016

Chesterfield Power Station

Chester, VA 23836

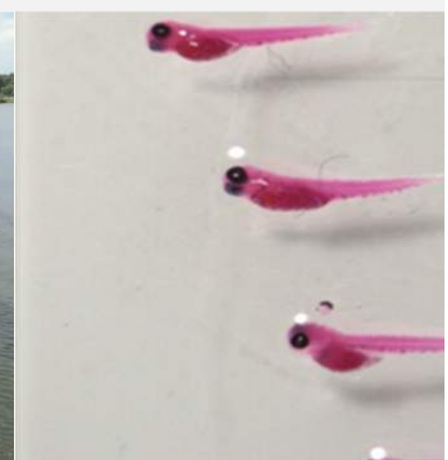


Table of Contents -

1 Introduction ... 1 -
1.1 Regulatory Background ... 1 -
1.2 Study Plan Objectives and Document Organization ... 3 -
2 Generating Station Description ... 3 -
2.1 Site and Environmental Description ... 3 -
2.2 Station Description ... 10 -
2.2.1 Station Operational History ... 10 -
2.2.2 Intake Structure ... 10 -
3 Historical Studies ... 14 -
3.1 Entrainment Study, 2005-2006 ... 14 -
3.2 Ambient Ichthyoplankton Bongo Net Sampling, 2005-2006 ... 17 -
4 Threatened and Endangered Species ... 21 -
5 Basis for Sampling Design ... 27 -
6 Entrainment Characterization Study Plan ... 30 -
6.1 Introduction ... 30 -
6.2 Safety Policy ... 30 -
6.3 Field Collection Procedures ... 31 -
6.3.1 Location ... 31 -
6.3.2 Equipment ... 34 -
6.3.3 Sampling Schedule ... 36 -
6.3.4 Entrainment Sample Collection Procedures ... 36 -
6.3.5 Pump Flow Rate Check Procedures ... 38 -
6.3.6 Water Quality Measurements ... 39 -
6.4 Laboratory Procedures ... 39 -
6.4.1 Equipment ... 39 -
6.4.2 - Laboratory Analysis ... 40 -
Sample Sorting ... 40 -
Sort Sub-sampling Procedure ... 41 -
Sample Identification ... 41 -
Morphometrics ... 41 -
Taxonomic Resolution Monitoring ... 42 -
Methods for Identifying Atlantic Sturgeon ... 42 -
6.4.3 Laboratory Quality Control (QC) Procedures ... 43 -

7 References ... 44 -

List of Appendices

Appendix A. Atlantic Sturgeon Life History Information

Appendix B. Field Instrumentation: Calibrations and Standardizations

Appendix C. Lists of Data to be Collected and Recorded for Field Collection and Laboratory Analysis

List of Tables

Table 1-1. §316(b) Rule for Existing Facilities Submittal Requirements Summary ... 2 -

Table 3-1. Chesterfield Power Station June 2005 – May 2006 Entrainment Sampling Methods Summary - ... 14 -

Table 3-2. Average Density and Percent Composition of Ichthyoplankton and Macroinvertebrates - Entrained at Chesterfield Power Station, June 2005 – May 2006 ... 15 -

Table 3-3. Monthly Densities (No./100 m^3) of Common Ichthyoplankton Entrained at Chesterfield Power - Station, June 2005 – May 2006 ... 17 -

Table 3-4. Average Density of Selected Species Entrained at Chesterfield Power Station During Different - Diel Periods ... 17 -

Table 3-5. Density (No./100 m^3) of Ichthyoplankton in James River Ambient Ichthyoplankton Samples at - Chesterfield Power Station, June 2005 – May 2006 ... 19 -

Table 3-6. Density (No./100 m^3) of Ichthyoplankton in Entrainment Samples at Chesterfield Power - Station, June 2005 – May 2006 ... 20 -

Table 4-1. Federal and State Threatened, Endangered, and Proposed Species with the Potential to Occur - within 2 miles of the Cooling Water Intake of Chesterfield Power Station ... 22 -

Table 5-1. Summary of Approach for Development of §122.21(r)(9) Required Entrainment - Characterizations ... 29 -

Table 6-1. Entrainment Sampling Details ... 31 -

List of Figures

Figure 2-1. Chesterfield Power Station Regional Location Map ... 4 -

Figure 2-2. Chesterfield Power Station Area Map ... 5 -

Figure 2-3. The James River Watershed ... 6 -

Figure 2-4. Aerial View of Chesterfield Power Station with Cooling Water Intake Location ... 7 -

Figure 2-5. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at - Mean Lower Low Water) ... 8 -

Figure 2-6. Survey of James River Depths in Vicinity of Chesterfield Power Station CWISs ... 9 -

Figure 2-7. Chesterfield Power Station CWIS Configuration ..... 11 -

Figure 2-8. Typical Plan View of Chesterfield Power Station CWIS ..... 12 -

Figure 2-9. Typical Section View of Chesterfield Power Station CWIS ..... 13 -

Figure 3-1. Ambient Ichthyoplankton Sampling Locations Near Chesterfield Power Station, June 2005 - May 2006 ..... 18 -

Figure 6-1. Proposed Location of Chesterfield Power Station Entrainment Sampling, 2015 – 2017 ..... 32 -

Figure 6-2. Conceptual Design of Intake Piping for Entrainment Sampling ..... 33 -

Figure 6-3. Entrainment Pump Sampling System Configuration ..... 35 -

1 Introduction

1.1 Regulatory Background

Clean Water Act §316(b) was enacted under the 1972 Clean Water Act, which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program. Facilities with NPDES permits are subject to §316(b), which requires that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. Cooling water intakes can cause adverse environmental impacts by drawing early life-stage fish and shellfish into and through cooling water systems (entrainment), or trapping juvenile or adult fish against the screens at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) Rule for existing facilities was published in the Federal Register. The Rule applies to existing facilities that withdraw more than 2 million gallons per day (MGD) from Waters of the United States, use at least 25 percent of that water exclusively for cooling purposes, and have or require an NPDES permit. The Rule supersedes the Phase II Rule, which regulated large electrical generating facilities until it was remanded in 2007, and the remanded existing-facility portion of the previously promulgated Phase III Rule.

Facilities subject to the new Rule are required to develop and submit technical material, identified at §122.21(r)(2)-(13), that will be used by the NPDES Director (Director) to make a BTA determination for the facility (Table 1-1). The specific material required to be submitted and compliance schedule are dependent on actual intake flow rates at the facility and NPDES permit renewal date, respectively. Facilities are to submit their §316(b) application material to their Director along with their next permit renewal, unless that permit renewal takes place prior to July 14, 2018, in which case an alternate schedule may be negotiated.

Dominion's Chesterfield Power Station (CPS) is subject to the existing facility Rule and based on its current configuration and operation is anticipated to be required to develop and submit each of the §122.21(r)(2)-(13) submittal requirements with its next permit renewal in accordance with the Rule's technical and schedule requirements. Within the §122.21(r)(2)-(13) requirements, (r)(4), (7), (9) and (11) have specific requirements related to entrainment data and evaluations (refer to Table 1-1 for additional detail). This document provides an Entrainment Characterization Study Plan to support §316(b) compliance at the facility with consideration of these specific requirements.

Table 1-1. §316(b) Rule for Existing Facilities Submittal Requirements Summary -

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source Water Physical Data	Characterization of the source water body including intake area of influence
(3)	Cooling Water Intake Structure Data	Characterization of cooling water system; includes drawings and narrative; description of operation; water balance
(4)	Source Water Baseline Biological Characterization data	Characterization of biological community in the vicinity of the intake; life history summaries; susceptibility to impingement and entrainment; must include existing data; identification of missing data; threatened and endangered species and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival)
(5)	Cooling Water System Data	Narrative description of cooling water system and intake structure; proportion of design flow used; water reuse summary; proportion of source water body withdrawn (monthly); seasonal operation summary; existing impingement mortality and entrainment reduction measures; flow/MW efficiency
(6)	Chosen Method of Compliance with Impingement Mortality Standard	Provides facility's proposed approach to meet the impingement mortality requirement (chosen from seven available options); provides detailed study plan for monitoring compliance, if required by selected compliance option; addresses entrapment where required
(7)	Entrainment Performance studies	Provides summary of relevant entrainment studies (latent mortality, technology efficacy); can be from the facility or elsewhere with justification; studies should not be more than 10 years old without justification; new studies are not required.
(8)	Operational Status	Provides operational status for each unit; age and capacity utilizations for the past five years; upgrades within last 15 years; uprates and Nuclear Regulatory Committee relicensing status for nuclear facilities; decommissioning and replacement plans; current and future operation as it relates to actual and design intake flow
(9)	Entrainment Characterization Study	Requires at least two years of data to sufficiently characterize annual, seasonal, and diel variations in entrainment, including variations related to climate, weather, spawning, feeding, and water column migration; facilities may use historical data that are representative of current operation of the facility and conditions at the site with documentation regarding the continued relevance of the data to document total entrainment and entrainment mortality; includes identifications to the lowest taxon possible; data must be representative of each intake; must document how the location of the intake in the water body and water column are accounted for; must document intake flows associated with the data collection; documentation in the study must include the method in which latent mortality would be identified (including QAQC); sampling and data must be appropriate for a quantitative survey
(10)	Comprehensive Technical Feasibility & Cost Evaluation Study	Provides an evaluation of technical feasibility and incremental costs of entrainment technologies; Net Present Value of facility compliance costs and social costs to be provided; requires peer review
(11)	Benefits Valuation Study	Provides a discussion of monetized and non-monetized water quality benefits of candidate entrainment technologies from (r)(10) using data in (r)(9); benefits to be quantified physical or biological units and monetized using appropriate economic valuation methods; includes changes in fish stock and harvest levels and description of monetization; must evaluate thermal discharges, facility capacity, operations, and reliability; discussion of previous mitigation efforts and affects; benefits to environment and community; social benefits analysis based on principle of willingness-to-pay; requires peer review
(12)	Non-Water Quality Environmental and Other Impacts Assessment	Provides a discussion of non-water quality factors (air emissions and their health and environmental impacts, energy penalty, thermal discharge, noise, safety, grid reliability, consumptive water use, etc.) attributable to the entrainment technologies; requires peer review
(13)	Peer Review	Documentation of external peer review, by qualified experts, of submittals (r) (10), (11), and (12). Peer Reviews must be approved by the NPDES Director and present their credentials. The applicant must explain why it disregarded any significant peer reviewer recommendations.

1.2 Study Plan Objectives and Document Organization

The Entrainment Characterization Study Plan provided in this report was developed to create a site-specific entrainment study plan that meets and exceeds the requirements of the §316(b) Rule with the following key objectives in mind:

1. - Collect data to supplement the submission of data required under §122.21(r)(4), including a list of species and life stages most susceptible to entrainment at the facility[1];
2. - Collect data to support development of §122.21(r)(7) which allows for summaries of relevant technology efficacy studies conducted at the facility[2];
3. - Collect data to support development of §122.21(r)(9) which requires at least two years of entrainment studies be conducted at the facility;
4. - Collect data to support Dominion's objective of having data sufficient to evaluate biological efficacy of potential alternative intake technologies that may require site specific evaluation at the facility as a part of the §122.21(r)(10)-(13) compliance evaluations.

To meet these objectives, this document provides summaries of the station's configuration and operations (Section 2), historical biological sampling efforts conducted at the facility that are relevant to cooling water intake evaluations (Section 3), a summary of Threatened and Endangered Species identified in the vicinity of the facility (Section 4), a sampling program design justification based on this information (Section 5), and the recommended study methods including key parameters of gear, schedule, frequency, and quality control procedures (Section 6).

2 Generating Station Description

2.1 Site and Environmental Description

Chesterfield Power Station (CPS) is located in the upper tidal portion of the James River, approximately 13 miles downstream of the fall line in the City of Richmond (Figure 2-1). The CPS is located in the Lower James River section in the Coastal Uplands Physiographic Province. In the area of the Station, the James River begins the transition from a higher gradient straight channel with generally steep banks to a meandering channel with oxbow features. The CPS is located near Hatcher Island and Farrar Gut which are two of the first oxbows in the river (Figure 2-2). The river is channelized and dredged to maintain passage for barge and vessel travel to the Port of Richmond.

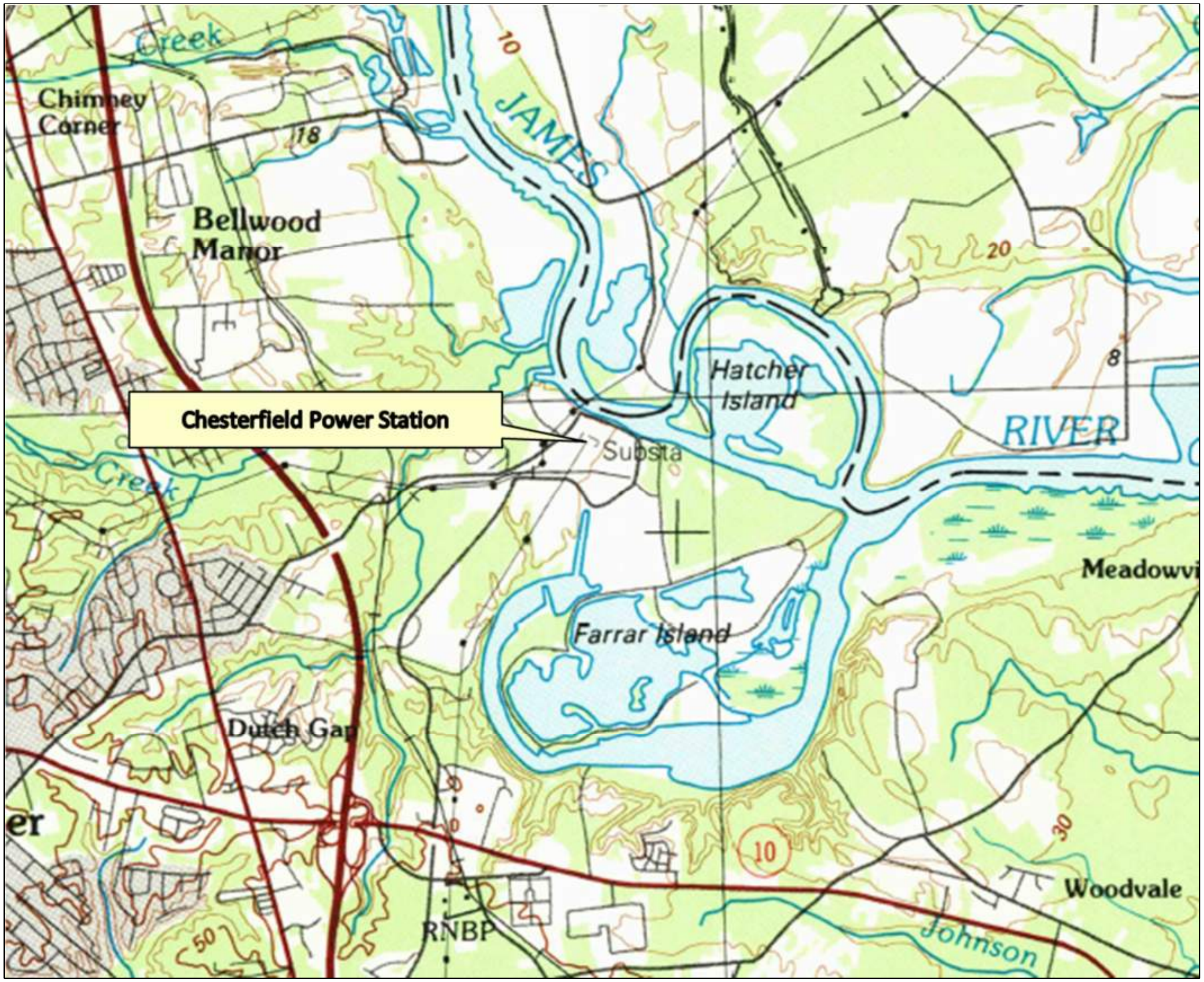
---

[1] 40 C.F.R. §122.21(r)(4) requires applicant to submit available Source Water Baseline Biological Characterization data.

[2] CPS is expected to reduce entrainment at the facility due to flow reduction relative to design flow and potentially other factors. This study plan will collect data to support calculation of this and potentially other entrainment reduction attributes at the facility.

Map Source: USGS Topographic Map of Petersburg, VA; Map ID #37077-A1-TM-100 (1984)

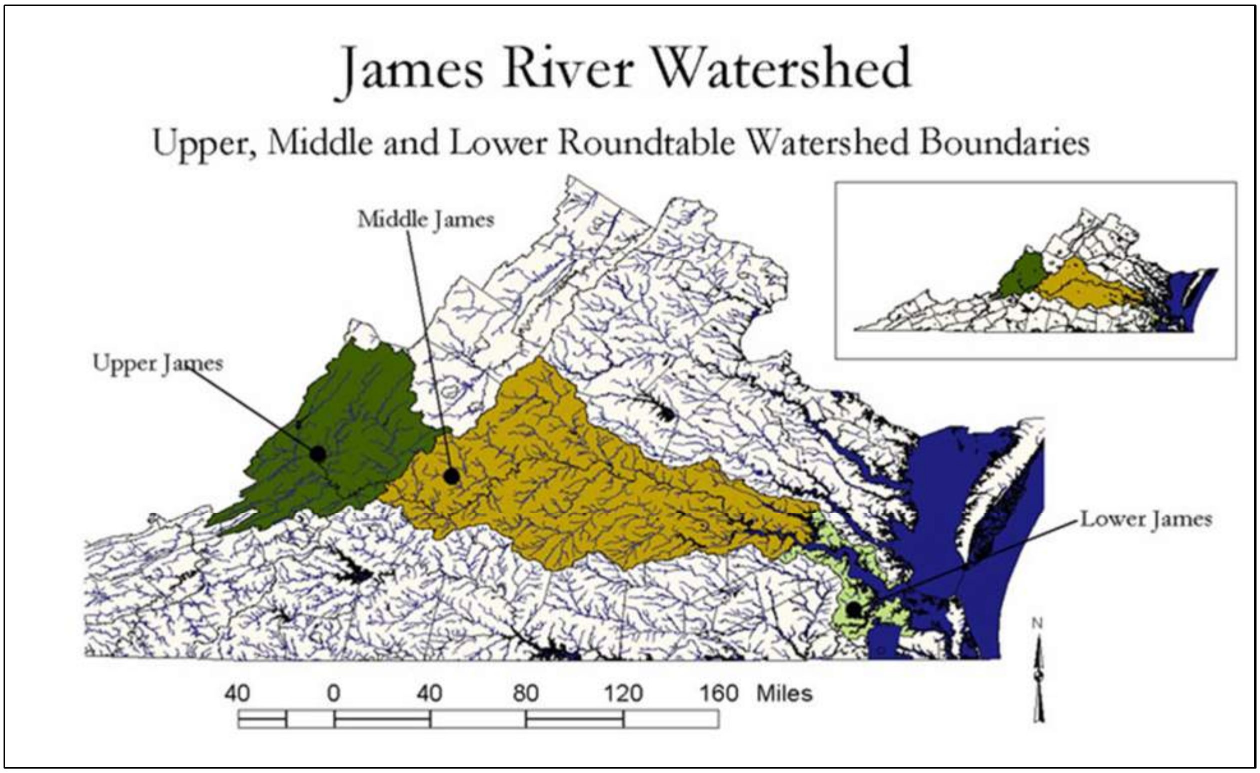
Figure 2-1. Chesterfield Power Station Regional Location Map



Map Source: USGS Topographic Map of Petersburg, VA; Map ID #37077-A1-TM-100 (1984)

Figure 2-2. Chesterfield Power Station Area Map

The James River watershed encompasses approximately 10,000 square miles, which makes up almost 25 percent of the state. The James River watershed covers about one-third of the Chesapeake Bay drainage area in Virginia. The river flows approximately 340 miles from the Alleghany Mountains of western Virginia to the Chesapeake Bay. The watershed is comprised of three sections: the Upper James watershed begins in Allegheny County and travels through the Allegheny and Blue Ridge Mountains until Lynchburg, the Middle James watershed runs from Lynchburg to Richmond, while the Lower James watershed stretches from Richmond to the Chesapeake Bay (Figure 2-3).



Source: Middle James Roundtable

Figure 2-3. The James River Watershed

The six power-generating units at CPS use a once-through cooling water system. Cooling water is withdrawn from the James River through five submerged CWISs oriented parallel to, and flush with, the south shoreline of the river (Figure 2-4).

The CWISs for the six units are located on the south side of the river on a bluff. The intakes are located immediately downstream from the Chesterfield County's Proctors Creek Wastewater Treatment Plant. In the vicinity of the CWIS, the river has an abbreviated littoral or shoreline zone as a result of steep bank elevations and the channelized river bottom. At the station, the river is approximately 500 feet wide and flows in a generally southeasterly direction. Water depths in front of the intakes range from 29 feet to 33 feet with a normal depth of approximately 31 feet.

Image Source: Google Earth, Retrieved 9/25/2014

Figure 2-4. Aerial View of Chesterfield Power Station with Cooling Water Intake Location

General river depths in the region of the Station are provided in the navigational chart provided in Figure 2-5. Surveyed river bottom depths are provided in the topographical survey provided in Figure 2-6.

The James River at the station experiences a mean tidal amplitude of approximately 2.0 feet. The water level in this portion of the James River fluctuates greatly with an extreme high of elevation 19.0 feet and an extreme low of elevation -3.5 feet. The mean high and low water differ by 5.2 feet; the mean high water is at grade elevation (El.) 3.5 feet and the mean low water is at El. -1.7 feet. Maximum tidal current is approximately 2.8 ft/s with average maximum ebb and flood tidal currents of 1.34 ft/s and 1.5 ft/s, respectively. The James River in the vicinity of the station is a temperate zone river with average temperatures generally ranging from 0.0 ˚C in February to 34 ˚C in August.

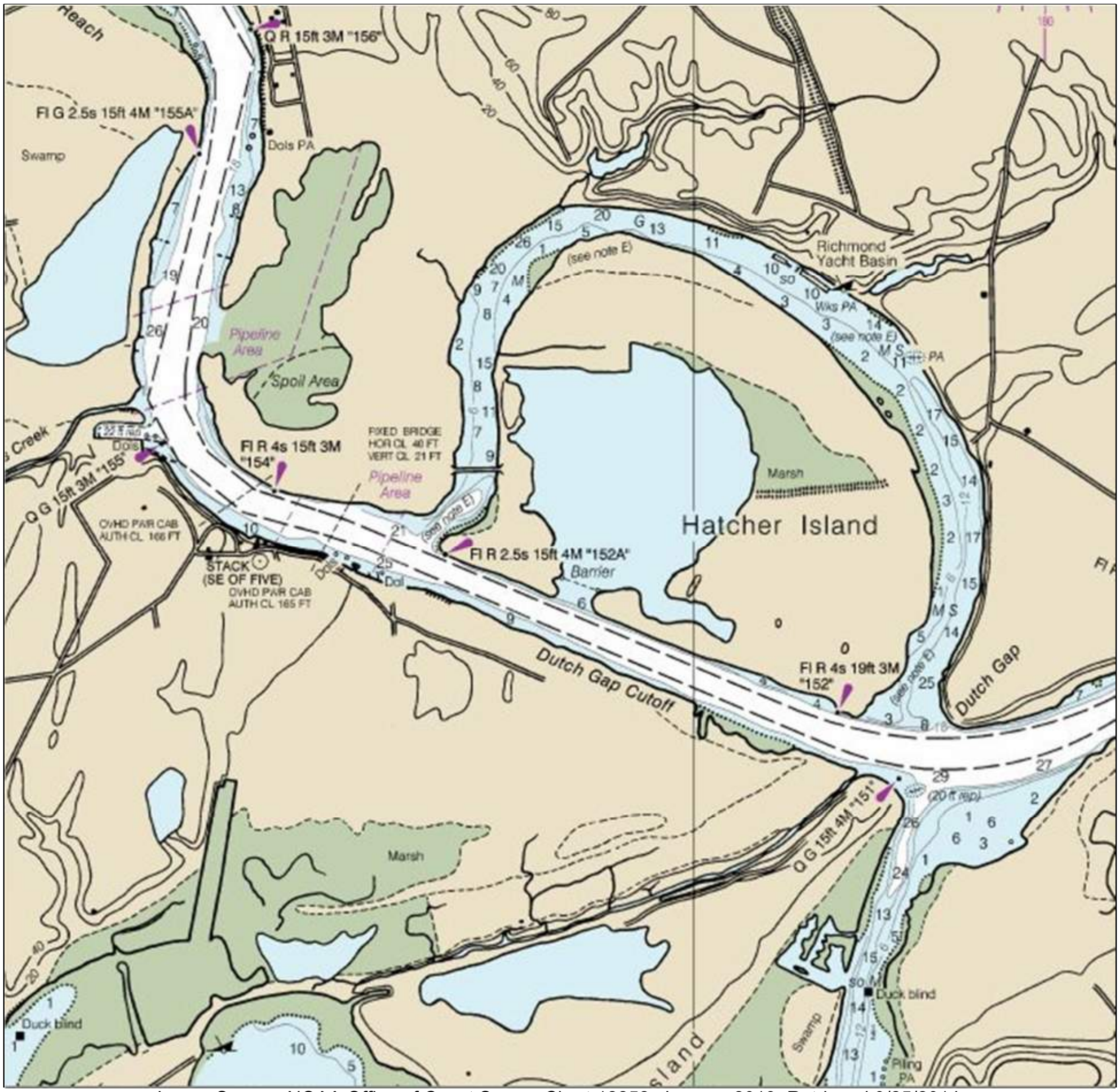


Image Source: NOAA Office of Coast Survey Chart 12252, January 2013, Retrieved 9/25/2014

Figure 2-5. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at Mean Lower Low Water)

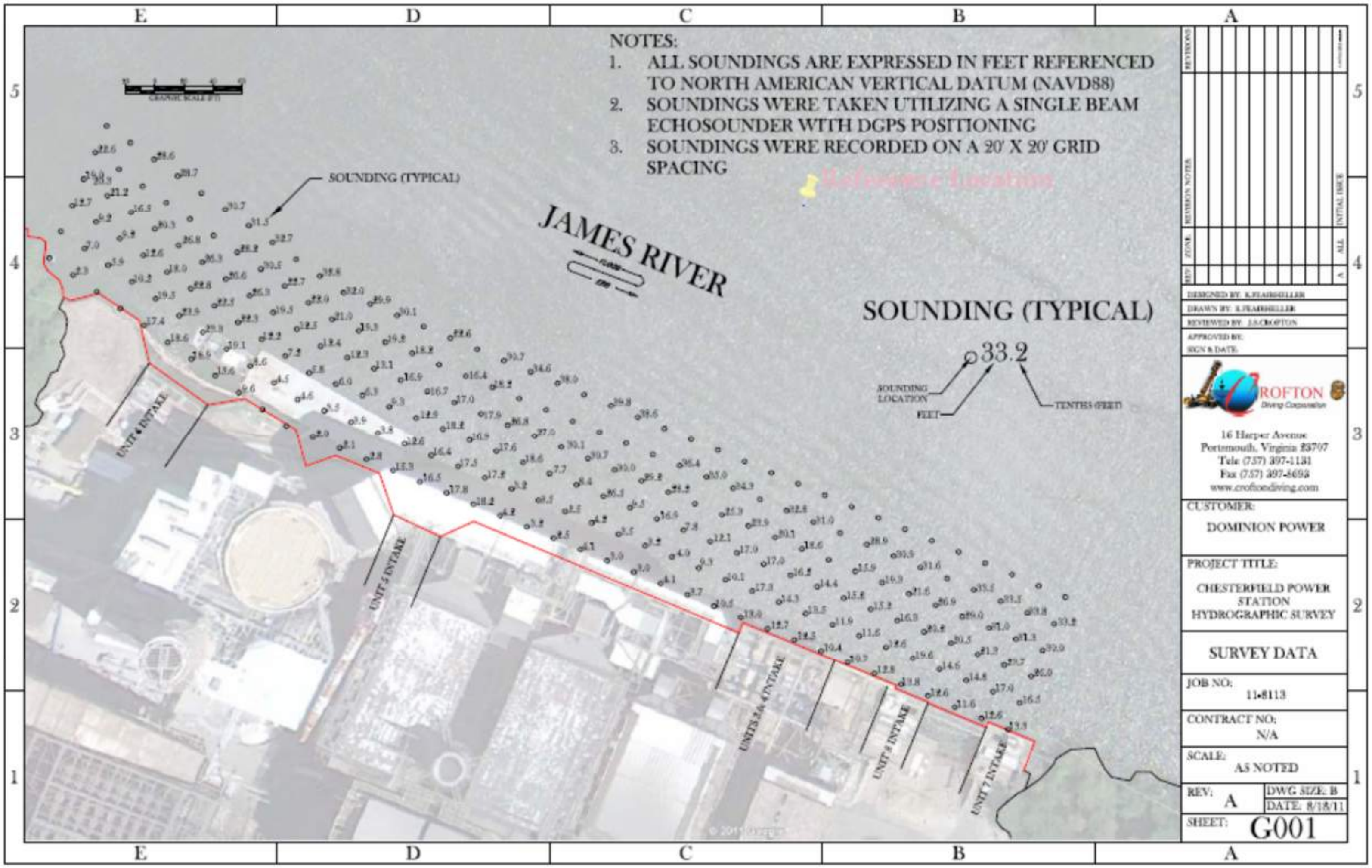


Figure 2-6. Survey of James River Depths in Vicinity of Chesterfield Power Station Cooling Water Intake Structure -

2.2 Station Description

2.2.1 Station Operational History

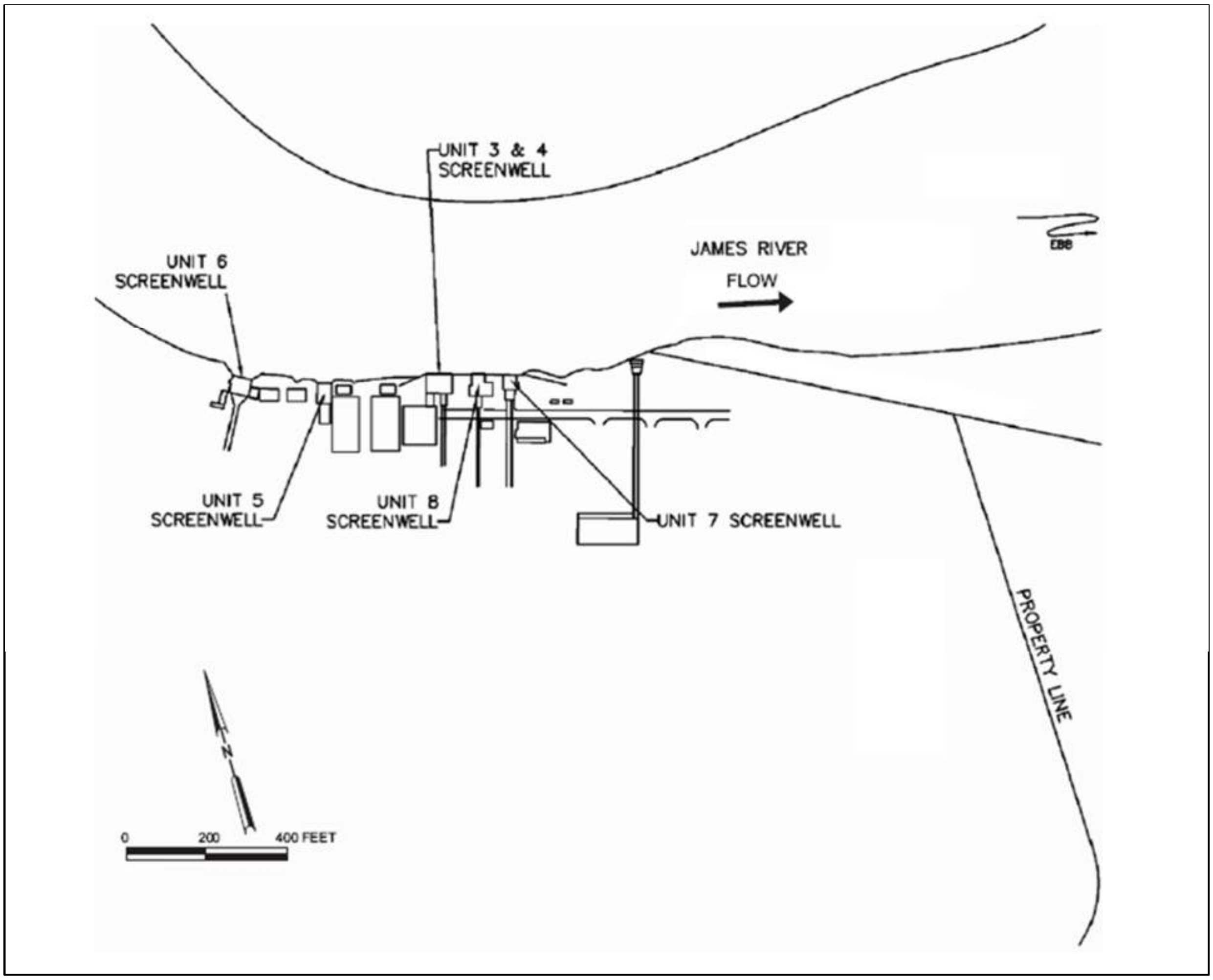
CPS contains six power-generating units: Units 3, 4, 5, and 6 are coal-fired units while Units 7 and 8 are combined-cycle units. The station is a base-load facility which means the facility serves as one of Dominion's primary means of generating the minimum amount of power necessary to meet customer demands. Accordingly, the facility generally operates on a twenty-four hour per day, seven days per week basis, although there is seasonal variation in its operations and maintenance (O&M). In the summer months, all pumps are in operation to meet thermal transfer requirements. There are times in the winter months when all of the pumps are in operation, usually in January and February, which is the winter peaking season. Major outages on the generating units are scheduled for the spring and fall months after the end of the winter peaking season. The duration of the maintenance outages depends on the scheduled work that needs to be done on the units.

2.2.2 Intake Structure

The six power-generating units at CPS utilize a once-through cooling water system that withdraws cooling water from the tidal portion of the James River through five CWISs. When the facility is generating power, the circulating cooling water system is in operation. All the CWISs are submerged and flush with and parallel to the south shoreline. See Figure 2-7 for the unit configuration layout. The total design flow at CPS with all pumps working to capacity is approximately 1,017.7 million gallons per day (MGD) [i.e., 1,574.5 cubic feet per second (cfs)]. Over 98 percent of the water withdrawn from the James River is used for cooling water purposes.

The James River in the vicinity of CPS CWISs is approximately 500 feet wide and 31 feet deep and flows in a generally southeasterly direction. The intake structures are designed to operate at river levels ranging from 3.5 feet below mean sea level (MSL) to 19.0 feet above MSL. The mean high and low water differ by approximately 5.2 feet with the mean high water at 3.5 feet above MSL while the mean low water is 1.7 feet below MSL. All elevations in this report refer to MSL.

Upon approach, the river water encounters a curtain wall that extends beyond the low water level. The curtain walls for Units 3, 4, 7, and 8 extend to 4.5 feet below MSL while the curtain wall for Units 5 and 6 drops down to approximately 4.0 feet below MSL. Downstream of the curtain wall are the trash racks which are installed across the intake structures upstream of the screen bays. Trash racks extend across the entire length of each intake structure (i.e. from the intake structure invert to the intake deck) and prevent debris from entering the screen houses. The trash racks for Units 3 and 4 are approximately 14.5 feet tall by 9.9 feet wide with 0.375-inch bars on 4.0-inch centers. The Unit 5 trash rack is approximately 16.5 feet tall by 12.5 feet wide with 0.375-inch bars on 4.5-inch centers. The Unit 6 trash rack is approximately 19.0 feet high by 15.0 feet wide with 0.375-inch bars on 4.0-inch centers. Units 7 and 8 have trash racks that are approximately 14.5 feet high by 11.0 feet wide with 0.375-inch bars on 3.0-inch centers.



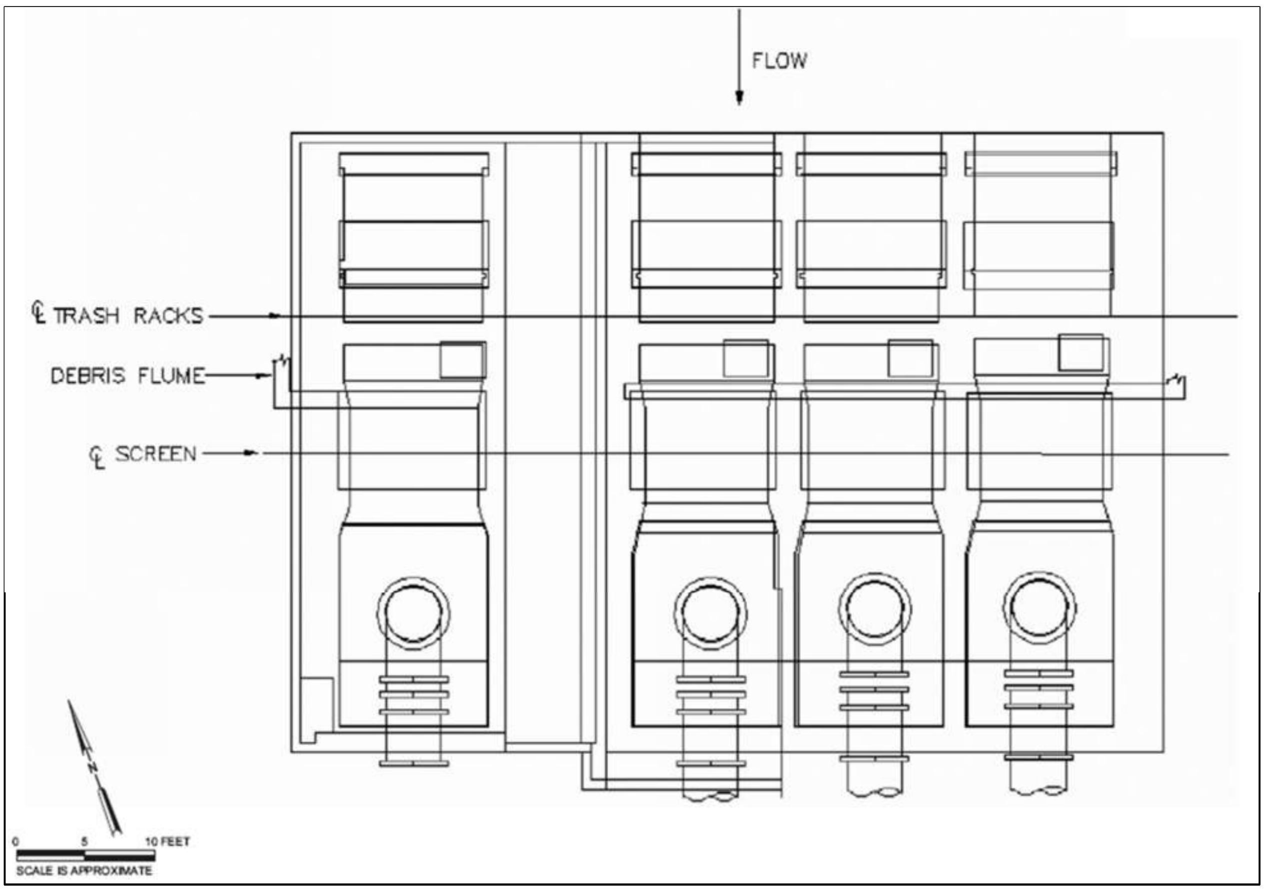
Source: CH2M HILL (2007)

Figure 2-7. Chesterfield Power Station Cooling Water Intake Structure Configuration

The traveling water screens are located between 10 and 20 feet downstream of the trash racks. Each of the power-generating units contains two traveling water screens except Unit 6, which has three traveling water screens, for a total of 13 traveling water screens. Units 3, 4, 7, and 8 have 8-foot wide screens, and Units 5 and 6 have 10-foot-wide screens, all with standard 3/8-inch mesh. Each of the vertical traveling screens is designed for continuous operation. Units 4, 5, and 6 rotate at a single speed of approximately 10 feet per minute (ft/min), while Unit 3 can rotate at 3 ft/min or 10 ft/min in automatic mode. Units 7 and 8 can rotate at either approximately 5 ft/min or 10 ft/min depending on loading. During normal operation, the screens are typically manually controlled for all units.

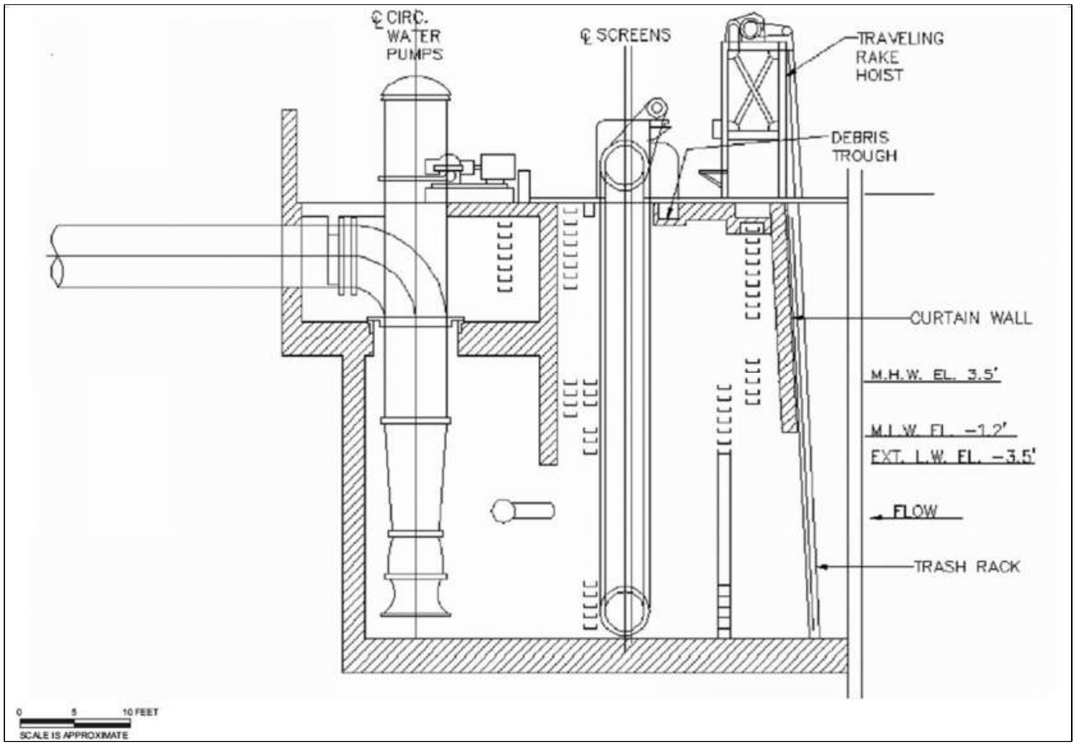
The screens have front spray wash systems and the debris collection trough located on the upstream side of the screens. Screen wash pumps for Units 7 and 8 draw water from the pump house. Units 3 through 6 do not have operating screen wash pumps, and the wash water for these screens is fed from the ash sluice water system from each unit. As the intake screens rotate, debris impinged on the screens is drawn upward and washed off by a wash water spray into a water-filled wash water trough. This water-filled trough conveys organisms and debris back into the James River. These discharges are permitted in the Virginia Discharge Elimination System (VPDES) Permit (VA0004146).

Screened cooling water is conveyed to the circulating water pumps, located at 12 to 18 feet downstream of the traveling water screens, through individual bays. Each unit has a separate circulating water system comprised of thirteen vertical shaft, wet-pit, circulating cooling water pumps, two each for Units 3, 4, 5, 7, and 8 and three for Unit 6. The circulating pumps are located in the respective Unit's pump house. Upon exiting the circulating cooling water system, the water is returned to the James River via one of three cooling water discharge points: one for Unit 3, one for Units 7 and 8, and one for Units 4, 5, and 6. The discharge for Units 3, 7, and 8 discharge directly into the James River, approximately 100 feet downstream from the CWIS (via outfalls 001 and 002). Units 4, 5, and 6 discharge into a discharge canal and then into Farrar Gut, an oxbow that flows into the James River approximately 1.2 miles downstream from the intake structures (via outfall 003). A satellite image of the outfall configuration is provided previously in Figure 2-4. Plan and section drawings of typical portions of the CPS CWIS are provided in Figures 2-8 and 2-9, respectively.



Source: CH2M HILL (2007)

Figure 2-8. Typical Plan View of Chesterfield Power Station Cooling Water Intake - Structure -



Source: CH2M HILL (2007)

Figure 2-9. Typical Section View of Chesterfield Power Station Cooling Water Intake Structure

3 Historical Studies

Past fisheries studies conducted at CPS which are pertinent to §316(b) include the following:

- June 2005 – May 2006 Impingement and Entrainment Studies (EA 2007)
- June 2005 – May 2006 Ambient Adult and Juvenile Finfish Sampled by Electrofishing and Gillnets; Ambient Ichthyoplankton Sampling by Towed Plankton Net (EA 2007)
- April 1997 – February 1999 Adult and Juvenile Finfish Sampled by Electrofishing and Gillnets (VEPCO 2000)
- January – December 1977 Impingement and Entrainment Studies (VEPCO 1977)

For the purposes of development of this Study Plan, the June 2005 – May 2006 entrainment and ambient ichthyoplankton studies (EA 2007) are summarized below.

3.1 Entrainment Study, 2005-2006

Results of this study, conducted in June 2005 to May 2006, were used to identify the species and life stages that would be most susceptible to entrainment. This generally includes only the youngest life stages (eggs, larvae and early juveniles). This study addressed species comprising the forage base, as well as those most important in terms of significance to commercial and recreational fisheries. Details of June 2005 – May 2006 entrainment sampling program are presented in Table 3-1.

Table 3-1. Chesterfield Power Station June 2005 – May 2006 Entrainment Sampling - Methods Summary -

Entrainment	Details
Units Sampled	Unit 6
Sampling Location	In front of CPS Unit 6
Surveys from June 2005 to May 2006	2 surveys per month for 12 months
Daily Collection Schedule	Every 6 hours in a 24-hr period (4 collections / 24-hr period) centered around 1000, 1600, 2200 and 0400 hours
Depths Sampled	Near surface, mid-depth and near bottom
Number of Samples Collected per Depth	2 samples per depth using paired bongo nets (duplicate samples at each depth)
Sample Duration	10 minutes
Sampling Gear	0.5-m diameter mouth plankton nets constructed of 505-µm mesh netting, each affixed in a double-net bongo frame; General Oceanics 2030R or 2030R6 (low flow) mechanical flowmeter suspended in the mouth of each net
Water Quality Measurements	Temperature, dissolved oxygen, pH, and conductivity measured with YSI Model 556 water quality analyzer at mid-depth during each entrainment sampling event

A total of 40 taxa and life stages were collected in entrainment samples collected at CPS (Table 3-2). Most entrained organisms were young life stages of fish. Larvae of River Herring (a collective term for Alewife and Blueback Herring), *Dorosoma* sp. eggs and larvae, Gizzard Shad larvae, and Bay Anchovy eggs were most abundant. Young bivalves and, to a lesser extent, shrimp were fairly common.

Identification and evaluation of the primary seasonal periods of reproduction, larval recruitment, and peak abundance for relevant taxa were based on results of this entrainment sampling. As mentioned above, the most commonly entrained organisms were the young life stages of fish - eggs and larvae (Table 3-2). With the exception of Bay Anchovy eggs (peak in August 2005) and *Dorosoma sp.* eggs (common in June and July 2005), other common egg and larval forms were most often entrained during April and May 2006 (Table 3-3). All of the common species shown are typical spring spawners, except that Bay Anchovy spawn over an extended period, as evidenced by their peak egg density in August 2005.

Densities of common species/life stages entrained at CPS also varied with time of day (Table 3-4). Both River Herring larvae and *Dorosoma* sp. eggs were more abundant in early morning (0400 hrs) samples. Gizzard Shad larvae were more abundant in late morning samples, whereas White Perch larvae exhibited no particular trend or pattern. Based on this evaluation, entrainment rates are higher at night, and particularly in the early morning, for the most abundant species entrained.

Table 3-2. Average Density and Percent Composition of Ichthyoplankton and - Macroinvertebrates Entrained at Chesterfield Power Station, June 2005 – May 2006 -

Species/Taxon	Life Stage	No./100 m^3	Percent	Cumulative Percent
River Herring	larvae	31.61	23.27	23.27
Bivalve	young	26.78	19.72	42.99
Dorsoma sp.	egg	18.07	13.30	56.29
Gizzard Shad	larvae	10.55	7.77	64.06
Bay Anchovy	egg	8.43	6.21	70.26
Shrimp		6.93	5.10	75.37
Dorsoma sp.	larvae	6.00	4.42	79.78
Fish eggs	undetermined/damaged	4.21	3.10	82.88
River Herring	egg	3.42	2.52	85.40
White Perch	larvae	3.20	2.36	87.76
White Perch	egg	2.36	1.74	89.49
Alewife	larvae	2.28	1.68	91.17
Hickory Shad	larvae	2.19	1.61	92.79
Other crab	zoea	2.07	1.52	94.31
Clupeidae	larvae	2.07	1.52	95.83

Species/Taxon	Life Stage	No./100 m^3	Percent	Cumulative Percent
Tessellated Darter	larvae	0.95	0.70	96.53
Fish larvae	undetermined/damaged	0.57	0.42	96.95
Inland Silverside	larvae	0.55	0.40	97.36
Hickory Shad	egg	0.41	0.30	97.66
Blueback Herring	larvae	0.40	0.29	97.95
American Shad	egg	0.36	0.27	98.22
Lepomis sp.	larvae	0.29	0.21	98.43
Hogchoker	egg	0.27	0.20	98.63
Spottail Shiner	larvae	0.24	0.18	98.81
Inland Silverside	egg	0.23	0.17	98.98
Dorsoma sp.	undetermined/damaged	0.22	0.16	99.14
Blueback Herring	egg	0.21	0.15	99.29
Pomoxis sp.	larvae	0.18	0.13	99.43
Centrarchidae	egg	0.15	0.11	99.54
Bluegill	larvae	0.15	0.11	99.65
Centrarchidae	larvae	0.10	0.07	99.72
Bay Anchovy	larvae	0.08	0.06	99.78
Centrarchidae	juvenile	0.07	0.05	99.83
Atherinopsidae	egg	0.04	0.03	99.86
Common Carp	larvae	0.04	0.03	99.89
Threadfin Shad	larvae	0.04	0.03	99.92
Naked Goby	larvae	0.02	0.01	99.93
Channel Catfish	larvae	0.02	0.01	99.95
Atlantic Silverside	larvae	0.01	0.01	99.96
Blue Crab	megalopae	0.01	0.01	99.96
American Shad	larvae	0.01	0.01	99.97
Blue Catfish	larvae	0.01	0.01	99.98
Atherinopsidae	larvae	0.01	0.01	99.99
Bay Anchovy	juvenile	0.01	0.01	99.99
Black Crappie	larvae	0.01	0.01	100.00
Source: Table 10 of EA 2007				

Table 3-3. Monthly Densities (No./100 m^3) of Common Ichthyoplankton Entrained at Chesterfield Power Station, June 2005 – May 2006

Species/Taxon	Life Stage	2005							2006				
		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Bay Anchovy	egg	0.0	9.1	90.1	0.2	0.1	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Bay Anchovy	larvae	0.0	0.0	0.0	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
River Herring	egg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	51.5
River Herring	larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	17.2	393.4
Gizzard Shad	larvae	1.2	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	21.7	103.3
Hickory Shad	larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	14.0	12.2
Dorsoma sp.	egg	24.5	39.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	29.8	122.8
White Perch	egg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	16.6	11.7
White Perch	larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	8.4	29.6
Tessellated Darter	larvae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	8.1	3.3
Source: Table 12 of EA 2007													

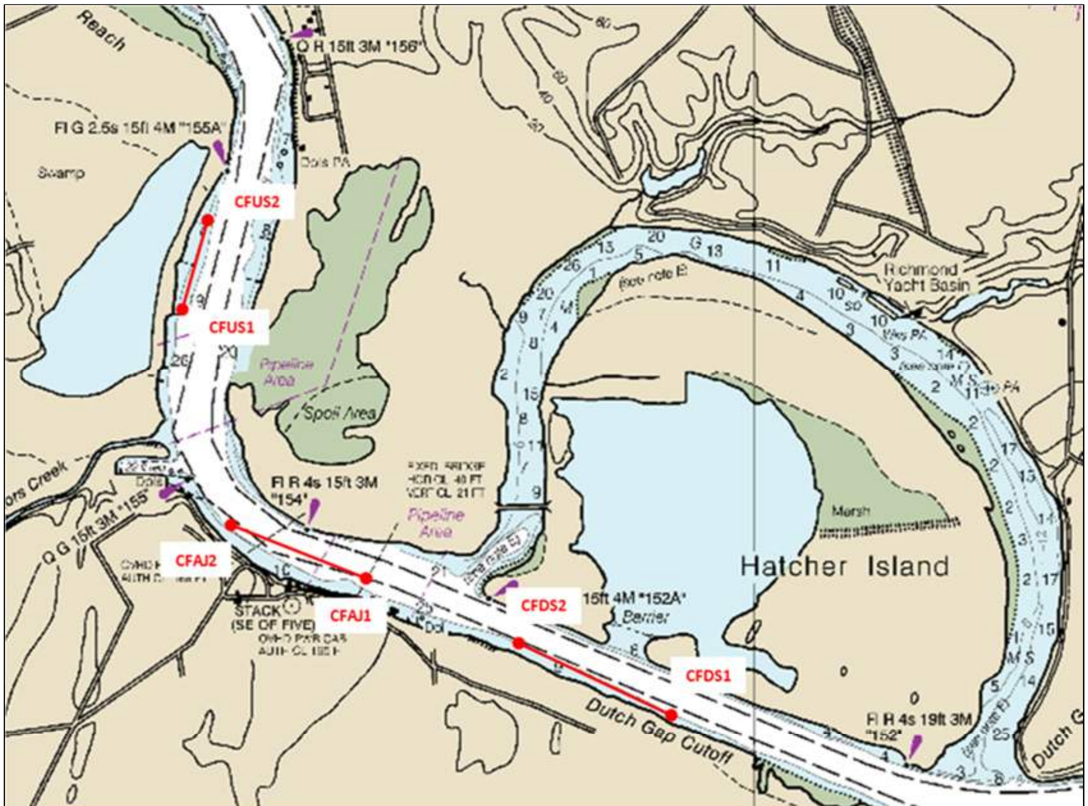
Table 3-4. Average Density of Selected Species Entrained at Chesterfield Power Station - during Different Diel Periods -

Time of Day	Average Density Collected per 100 m^3				
	River Herring Larvae	*Dorosma sp.* Egg	Gizzard Shad Larvae	Bay Anchovy Egg	White Perch Larvae
Late AM	334	31	311	221	23
Early PM	597	28	135	197	59
Late PM	413	86	66	528	19
Early AM	1079	318	95	25	53
Source: EA 2007					

3.2 - Ambient Ichthyoplankton Bongo Net Sampling, 2005-2006

Ambient ichthyoplankton sampling conducted on a biweekly basis June 2005 - May 2006 provided information on larval fish and pelagic invertebrates in the vicinity of the CPS CWISs. The James River upstream, downstream, and adjacent to the intake was sampled at 1000, 1600, 2200 and 0400 hours on a biweekly basis (Figure 3-1). These samples were collected with a single 0.5-meter diameter plankton net consisting of 0.505-mm netting, and with a GO 2030R flowmeter affixed in the net mouth. Stepped-oblique tows were made from a boat for 4.5 minutes against the prevailing tide, i.e., 1.5 minutes near bottom, 1.5 minutes at mid-depth, and 1.5 minutes near the surface.

Five taxa were collected in ambient ichthyoplankton samples collected June 2005 - May 2006. These were, in order of abundance, River Herring larvae, Gizzard Shad larvae, *Dorosoma* sp. eggs, White Perch larvae and Bay Anchovy eggs (Table 3-5). The River Herring category included Alewife and Blueback Herring, and indeterminate larvae of either species. All ichthyoplankton, except for a single collection of Bay Anchovy eggs in December 2005, were collected between the months of May and August. Table 3-6 presents the density of ichthyoplankton entrained on the same days of ambient ichthyoplankton samples collected during June 2005 – May 2006 for the side-by-side comparison.



Map Source: NOAA Coast Survey Chart of James River, Jordan Pt. to Richmond (Jan. 2013);
Chart #12252, Retrieved September 25, 2014

Note: Tow tracks shown as red lines with red dots marking either end.
Endpoints designated as: CFUS1 (Upstream), CFUS2 (Upstream);
CFAJ1 (Adjacent), CFAJ2 (Adjacent);
CFDS1 (Downstream), CFDS2 (Downstream)

Source: CH2M HILL (2007)

Figure 3-1. Ambient Ichthyoplankton Sampling Locations near Chesterfield Power Station, June 2005 - May 2006

Table 3-5. Density (No./100 m^3) of Ichthyoplankton in James River Ambient - Ichthyoplankton Samples at Chesterfield Power Station, June 2005 – May 2006 -

Sample Date	Bay Anchovy	*Dorsoma sp.*	River Herring	Gizzard Shad	White Perch
	egg	egg	larvae	larvae	larvae
06/21/05	0.0 -	467.8 -	0.0 -	5.1 -	0.0 -
06/27/05	0.0 -	91.3 -	0.3 -	13.3 -	0.0 -
07/11/05	0.0 -	0.2 -	0.0 -	0.0 -	0.0 -
07/25/05	0.1 -	0.0 -	0.0 -	0.0 -	0.0 -
08/08/05	0.3 -	0.0 -	0.0 -	0.0 -	0.0 -
08/22/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
09/12/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
09/26/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
10/10/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
10/24/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
11/07/05	0.6 -	0.0 -	0.0 -	0.0 -	0.0 -
11/20/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
12/07/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
12/21/05	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
01/09/06	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
01/23/06	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
02/08/06	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
02/22/06	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
03/06/06	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
03/20/06	0.0 -	0.0 -	1.6 -	0.0 -	1.6 -
04/03/06	0.0 -	0.7 -	4.7 -	0.0 -	12.0 -
04/17/06	0.0 -	101.1 -	12.5 -	58.9 -	12.9 -
05/01/06	0.0 -	29.6 -	26.0 -	144.2 -	9.1 -
05/15/06	0.0 -	98.1 -	2292.6 -	737.4 -	114.2 -

Note: "River Herring" is a combination of three taxa: River Herring, Alewife and Blueback Herring

Source: Table 17 of EA 2007

Table 3-6. Density (No./100 m^3) of Ichthyoplankton in Entrainment Samples at Chesterfield Power Station, June 2005 – May 2006

Sample Date	Bay Anchovy	*Dorsoma sp.*	River Herring	Gizzard Shad	White Perch
	egg	egg	larvae	larvae	larvae
06/21/05	0.0	44.3	0.0	2.4	0.0
06/27/05	0.0	4.8	0.0	0.0	0.0
07/11/05	2.9	74.8	0.0	0.0	0.0
07/25/05	15.3	4.3	0.0	0.6	0.0
08/08/05	34.5	0.0	0.0	0.0	0.0
08/22/05	145.7	0.0	0.0	0.0	0.0
09/12/05	0.0	0.0	0.0	0.5	0.0
09/26/05	0.3	0.0	0.0	0.0	0.0
10/10/05	0.2	0.0	0.0	0.0	0.0
10/24/05	0.0	0.0	0.0	0.0	0.0
11/07/05	0.0	0.0	0.0	0.0	0.0
11/20/05	0.0	0.0	0.0	0.0	0.0
12/07/05	3.4	0.0	0.0	0.0	0.0
12/21/05	0.0	0.0	0.0	0.0	0.0
01/09/06	0.0	0.0	0.0	0.0	0.0
01/23/06	0.0	0.0	0.0	0.0	0.0
02/08/06	0.0	0.0	0.0	0.0	0.0
02/22/06	0.0	0.0	0.0	0.0	0.0
03/06/06	0.0	0.0	0.0	0.0	0.0
03/20/06	0.0	0.0	1.6	0.0	0.6
04/03/06	0.0	0.6	9.1	0.0	6.6
04/17/06	0.0	59.1	25.2	43.3	10.2
05/01/06	0.0	170.4	33.2	56.5	7.8
05/15/06	0.0	75.2	753.6	150.0	51.5

Note: "River Herring" is a combination of three taxa: River Herring, Alewife and Blueback Herring

Source: Table 16 of EA 2007

4 Threatened and Endangered Species

The EPA consulted with the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) (or collectively, Services) under the Endangered Species Act (ESA) during development of the existing facilities §316(b) Rule. The Services concluded that the Rule is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. Among other requirements, §122.21(r)(4) requires that facilities submit, to the extent such data is available, "*a list of species (or relevant taxa) for all life stages and their relative abundance in the vicinity of the cooling water intake structure*" and identify "*all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at your cooling water intake structure*." In addition, §122.21(r)(9) requires facilities to develop an Entrainment Characterization Study "*that includes a minimum of two years of entrainment data collection.*" The text below provides a review of listed species associated with CPS to support compliance with these provisions and development of this Entrainment Characterization Study Plan.

The Virginia Fish and Wildlife Information Service (VAFWIS) database, managed by the Virginia Department of Game and Inland Fisheries (VDGIF), and the USFWS Information, Planning, and Conservation System were consulted on June 20, 2015 to develop a list of Federal and state of Virginia endangered and threatened species known or likely to occur within a 2-mile radius of CPS (See Table 4-1)[3]. Additionally, the complete list of threatened and endangered species that occur in the state of Virginia (VDGIF 2015a) was reviewed and compared against the list of threatened and endangered species under NMFS jurisdiction (NMFS 2015) to confirm that NMFS species were not omitted from the list. A review of scientific literature and other documents was also conducted, including a NMFS Biological Opinion and Letter of Concurrence for projects proposed to occur near the vicinity of the CWIS; those documents were used to confirm that marine species under the jurisdiction of NMFS were appropriately considered. Additionally, for each species with the potential to occur in the vicinity of the CWIS, the USFWS or NMFS species profile was reviewed to confirm that no critical habitat was designated. A review of the following resources was used to develop the species list in Table 4-1.

- VAFWIS (http://vafwis.org/fwis/)
- IPAC (http://ecos.fws.gov/ipac/)
- USFWS Listings and Occurrence for Virginia (http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=VA&s8fid=112761032792&s8fid=112762573902)
- Endangered and Threatened Species Under NMFS' Jurisdiction - (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm) -

[3] Using the VAFWIS, the minimum radius that can be screened for is a 2-mile radius from the center of the power station. There is no determination that species found within a 2-mile radius of CPS are susceptible to entrainment. Similarly, the occurrence of a species on the Service's Information, Planning, and Conservation System, which provides a search area encompassing both terrestrial and aquatic habitats, does not necessarily indicate that the species is likely to be present in the source water body.

Table 4-1. Federal and State Threatened, Endangered, and Proposed Species with the Potential to Occur within 2 miles of the Cooling Water Intake of Chesterfield Power Station

Common Name	Scientific Name	Status*	Tier**	Potential to Occur within 2 Miles of the Intake	Potential for Entrainment of Early Life Stages
FISH					
Atlantic Sturgeon[a]	*Acipenser oxyrinchus*	FE, SE	II	Likely	Unlikely[4]
MOLLUSKS					
Atlantic Pigtoe[a]	*Fusconaia masoni*	FS, ST	II	Adults, juveniles, and glochidia –Unlikely, preferred habitat is upstream of the fall line Host fish – likely to occur in the vicinity of the CWIS	Highly improbable
Green Floater[a]	*Lasmigona subviridis*	ST	II	Unlikely – This species has not been documented in Henrico or Chesterfield counties[e]. Host fish have not been documented for this species and may not be needed due to hermaphroditic nature.	Highly improbable
AMPHIBIANS					
Barking Treefrog[a]	*Hyla gratiosa*	ST	II	No - breeds in cypress ponds and bays, and in pine barren ponds; open canopied ponds; all Virginia breeding sites were found in graminoid dominated temporary ponds.[c]	No
BIRDS					
Upland Sandpiper[a]	*Bartramia longicauda*	ST	I	No – terrestrial	No

[4] Based on the demersal nature of sturgeon eggs and larvae, entrainment of the early life stages of Atlantic Sturgeon is considered to be unlikely. Although two Atlantic Sturgeon yolk sac larvae were collected during a single 24-hour sampling period on October 7-8, 2015, this sturgeon encounter was a rare and unique occurrence. The collection may have been the result of a severe storm that had recently occurred in the area. No other sturgeon larvae were identified in entrainment samples collected between July and December 2015, and there have been no other known collections of sturgeon larvae during prior entrainment sampling at CPS.

Common Name	Scientific Name	Status*	Tier**	Potential to Occur within 2 Miles of the Intake	Potential for Entrainment of Early Life Stages
Loggerhead Shrike[a]	*Lanius ludovicianus*	ST	I	No – terrestrial	No
Migrant Loggerhead Shrike[a]	*Lanius ludovicianus migrans*	ST	–	No – terrestrial	No
Peregrine Falcon[a]	*Falco peregrinus*	ST	I	No – terrestrial	No
MAMMALS					
Northern Long-Eared bat[a,b]	*Myotis septentrionalis -*	FP	–	No – terrestrial	No
Rafineque's Bat[a]	*Corynorhinus - rafineesqui macrotis*	SE	I	No – terrestrial	No
PLANTS					
Sensitive Joint-Vetch[b]	*Aeschynomene virginica*	FT	–	No - typically grows in the intertidal zone of coastal marshes[d]	No
Status*		**Tier** for State-listed Species**			
FE= Federally Endangered FT= Federally Threatened SE= State Endangered ST= State Threatened FS= Federal Species of Concern		I=VA Wildlife Action Plan - Tier I – Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need			

Source
[a]Virginia Department of Game and Inland Fisheries; Fish and Wildlife Information Service
[b]U.S. Fish and Wildlife Service; Information, Planning, and Conservation System
[c]VGDIF 2014
[d]USFWS 2012

- Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).
- Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.
- USFWS or NMFS Species Profile (http://www.fws.gov/endangered/, or - http://www.nmfs.noaa.gov/pr/species/esa/listed.htm) -

Note that only Federal and State threatened and endangered species were included in Table 4-1. Federal species of concern and candidate species were omitted from the list (unless they were also State Threatened or Endangered), because there are no requirements to address those species under Section 7 of the ESA.

The majority of the species in Table 4-1 are terrestrial species or occur in habitats that are not in the vicinity of the CPS CWISs and thus would not be subject to entrainment or impingement at the facility. Additional literature was reviewed to identify aquatic species that do not occur near the CWIS and thus should be eliminated from further consideration; these documents are cited in Table 4-1.

Atlantic Sturgeon (listed as both endangered and threatened)[5] spawn in the James River. Benthic substrates that provide suitable sturgeon spawning habitat (i.e., rock and cobble gravel) occur in the vicinity of CPS; however, these areas might not have viable spawning conditions (e.g., hydrodynamic characteristics) (Bilkovic et al. 1999). Bushnoe et al. (2005) indicate that the Turkey Island and Jones Neck oxbows, which are approximately 3 - 7 miles downstream from CPS, are considered potential spawning habitat due to their hydrodynamic characteristics and benthic substrate (i.e., rock and gravel/cobble/pebble) (Bilkovic et al. 2009, NMFS 2012a). A second area of potentially suitable habitat is located approximately 30 miles downstream of CPS (NMFS 2012b).

In a telemetry study, Hager (2011) observed two seasonal migrations by adult Atlantic Sturgeon in the James River; in the spring from April through May and in the late summer and early fall from August through October. No fish passed above river mile 67 in the spring (downstream of CPS). During the late summer to early fall residency (August-October), fish ascended the river rapidly and congregated in upriver sites between river mile 48 and the fall line near Richmond, VA. During late summer, Atlantic Sturgeon exhibited a preference for the river section where the upper James and Appomattox rivers meet, approximately 9 miles downriver from CPS (Hager

---

[5] - Atlantic Sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina Distinct Population Segments (DPSs) are listed as endangered. Those originating from the Gulf of Maine DPS are listed as threatened. Atlantic Sturgeon from these five DPSs have the potential to occur in the James River and the vicinity of the Chesterfield cooling water intake; however, the majority of the spawning adults are likely to originate from the James River and thus, the Chesapeake Bay DPS (NMFS 2012a).

2011). Appendix A provides additional detail on Atlantic Sturgeon spawning migrations in the James River.

Atlantic Sturgeon eggs are adhesive and demersal and are expected to attach to the substrate within 20 minutes; therefore, sturgeon eggs occur only on the spawning grounds (Hildebrand and Schroeder 1928, Jones et al. 1978). Spawning is expected to occur during April through June (temperatures for spawning can range from 13-26°C); and recent studies suggest that spawning might occur in the fall as well, with high adult usage in the river from August through November (Balazik et al. 2012, Secor et al. 2012). Eggs typically hatch in 4-7 days depending on temperature (Gilbert 1989; Hildebrand and Schroeder 1928). At hatching, Atlantic Sturgeon larvae are large bodied and are assumed to undertake a demersal existence in the same areas where they were spawned (ASMFC 2012, Bath et al. 1981). Yolk-sac larvae are expected to inhabit the same areas where they were spawned (Bain et al. 2000; ASMFC 2012). Bath et al. (1981) only collected sturgeon larvae in bottom samples. Larvae are also active swimmers and leave the bottom when 8 to 10 days old to swim in the water column (Kynard and Horgan 2002). The yolk-sac larval stage is completed in about 8 to12 days (Jones et al. [1978] reports 6 days), at which time the larvae move downstream to the rearing grounds (Kynard and Horgan 2002). During the first half of this migration, larvae move only at night and use benthic structure (e.g., gravel matrix) as refuge during the day (Kynard and Horgan 2002). During the latter half of migration to the rearing grounds, when larvae are more fully developed, movement occurs during both day and night. Larvae transition into the juvenile phase at approximately 30 mm total length (TL) and move further downstream into brackish waters, developing a tolerance to salinity. Eventually they become residents in estuarine waters for months to years before emigrating to open ocean (ASSRT 2007, ASMFC 2012). ASMFC (2012) notes that some Atlantic Sturgeon occupy freshwater habitats for two or more years, while others move downstream to brackish waters when the water temperature drops. Bain et al. (2000) report that early juveniles were collected from salinities ranging from 0-5 ppt from April through October in the Hudson River and from 3-18 ppt from October through March. However, temperature and dissolved oxygen are likely key habitat parameters (ASMFC 2012). Bain et al. (1997) report that from July through September juvenile sturgeon use deep channels in the Hudson River. Juvenile Atlantic Sturgeon in North Carolina use deep and cool areas as thermal refuges, particularly in the summertime (Moser and Ross 1995 as cited in ASMFC 2012).

Based on the demersal nature of sturgeon eggs and larvae, entrainment of the early life stages of Atlantic Sturgeon is considered to be unlikely. Although two Atlantic Sturgeon yolk sac larvae were collected during a single 24-hour sampling period on October 7-8, this was a rare and unique occurrence. The collection may have been the result of a severe storm that had recently occurred in the area. No other sturgeon larvae were identified in entrainment samples collected between July and December 2015, and there have been no other known collections of sturgeon larvae during prior entrainment sampling at CPS. Similarly, sturgeon researchers that have targeted collection of Atlantic Sturgeon eggs and larvae in the vicinity of CPS in the James River have been unsuccessful. Because of its protected status, this study plan includes explicit methods that are focused on maximizing the potential of identifying early life stage Atlantic Sturgeon in the unlikely event that they are collected in entrainment samples (refer to Methods for Identifying Atlantic Sturgeon section for additional details).

The freshwater bivalve Atlantic Pigtoe (*Fusconaia masoni*) is a state threatened species and a Federal species of concern, currently under review for listing under the ESA, that may inhabit the James River near CPS. However, this species typically inhabits the upper parts of rivers, above the fall line, in clean, swift-moving waters and is often found in gravel or gravel-sand substrata (VAFWIS 2014, Terwilliger 1991). The species has been documented in the James River, near Richmond in Henrico County, however, Terwilliger (1990) indicates that the species might no longer be present in the James. In 2011 and 2012, Virginia Department of Game and Inland Fisheries (VGDIF) conducted extensive mussel surveys on the James River upstream of the Richmond (and the project site). No Atlantic Pigtoe were encountered in this survey. In the vicinity of CPS, sediments are described as gravel/cobble/pebble, rock, and sand with complex bottom (Bilkovic et al. 2009). The navigation channel near the CPS is maintained via dredging (NMFS 2012a, Bushnoe et al. 2005).

This species is thought to be a tachytictic (i.e., short-term) brooder, with gravid females collected from the James River from May to June and glochidia most likely released before September (VAFWIS 2014, Terwilliger 1991, Johnson 1970). Once attached to a suitable host fish, the time it takes for glochidia to metamorphose into juveniles and drop off the fish has been documented at 19 – 24 days (Rash 2005), depending on water temperature, fish species and other factors. Once juveniles excyst from the host fish they must settle into suitable substrate to survive.

Knowledge is incomplete as to which fish species provides the most suitable host for the Atlantic Pigtoe (Wolf 2010). Results of laboratory research indicate that host fish for Atlantic Pigtoe include Bluegill Sunfish (*Lepomis macrochirus*), Shield Darter (*Percina peltata*), White Shiner (*Luxilus albeolus*) and Satinfin Shiner (*Cyprinella analostana*), Longnose Dace (*Rhinichthys cataractae*) and Creek Chub (*Semotilus atromaculatus*) (Dee and Watters 2000; Rash 2005, Wolf and Emrick 2011). Of these, the White Shiner is not expected to occur in the James River. Longnose Dace and Creek Chub were the primary hosts of the fish tested by Wolf and Emrick (2012), but habitat in the main stem of the tidal James River is not suitable for these species.

Based on the habitat preferred by Atlantic Pigtoe adults, juveniles, and larvae, the probability for entrainment of infected host fish is highly improbable. As a result, this study plan includes no specific studies of Atlantic Pigtoe entrainment.

The Green Floater (*Lasmigona subviridis*) is state-listed as a threatened species, currently under review for listing under the ESA, which has been collected from the James River Drainage (VDGIF 2015b). In Virginia, the Green Floater is known to occur in the several tributaries of the James River (NatureServe 2014). The VAFWIS database does not indicate that there is a confirmed occurrence of this species within the search area and it has not been observed in Henrico or Chesterfield counties (VDGIF 2015b).

In 2011 and 2012, VDGIF conducted extensive mussel surveys on the James River upstream of Richmond and the fall line (and CPS) (Watson 2012). Five specimens of Green Floater were collected during this survey; however, the location is not provided. Green Floaters were also documented during a survey at Bremo Power Station, upriver from CPS. These specimens were relocated upriver of Bremo Power Station (CH2MHILL 2011).

This species occupies very small to medium-sized streams, quiet pools with eddies with gravel and sand bottoms, and cannot tolerate very strong currents. Host fish for the Green Floater have not been identified. The Green Floater is known to be a rare hermaphroditic mussel with fully transformed juvenile mussels held within the female marsupia collected from tributaries to the Neuse River in North Carolina and Susquehanna River in Pennsylvania (Barfield and Watters 1998, Lellis and King 1998).

While this species has been documented upriver of CPS, it has not been documented near CPS or in Chesterfield or Henrico counties. Considering the benthic nature of this species, it is unlikely to be impinged or entrained at CPS even if present in the vicinity of the facility. Therefore, collection of this species in entrainment collections is highly improbable. As a result, this study plan includes no specific studies of Green Floater entrainment.

5 Basis for Sampling Design

HDR performed a site visit at CPS on August 19, 2014 to evaluate potential entrainment sampling options for the CWISs, the point of §316(b) compliance at the facility, and determined that collection locations are greatly limited for the following reasons:

- As shown in Figure 2-7 (in Section 2 of this Study Plan), there are 5 separate intake structures at this power station. Units 7 and 8 are adjacent to each other at the east end of the intake area. Units 3 and 4 have a common intake in the center section of the intake area. Units 5 and 6 are adjacent to each other at the west end of the intake structure area. There is no common access between the intake structures. All of the Units have conventional traveling screens.

- Unit 6 withdraws almost 40% of the total water volume for the CPS. Unit 5 withdraws 18% of the total water volume and each of the remaining Units withdraws less than 13% of the water volume for the station. It is not feasible to collect entrainment samples at more than one intake structure concurrently since there is no common access between the intake structures.

- There is limited access to the water between the screens and the circulating water pumps for the collection of pumped or streamed net entrainment samples.

- There is limited access to the water between the bar racks and screens from most of the intake deck level such that collection of pumped or streamed net entrainment samples is not feasible.

- Streamed net sampling from the intake channel in front of the bar racks requires the use of a boat anchored in front of the intake structures, which introduces weather related safety concerns and potential for missed sampling events and limited control over volume sampled (subject to intake velocity rather than pump capacity).

Based on these findings, it was determined that pumped samples taken from the river side of the bar racks were the preferred location for entrainment sample collections. Based on the water volume at the five intake structures at the CPS, Unit 6 was selected as the primary sampling location, and Unit 3 as the secondary location in the event Unit 6 is not operating. Specifically, entrainment samples are to be collected by using a gas-powered 4-inch trash pump to pump water through a 335-µm mesh plankton net suspended in a water buffering tank. Entrainment samples will be collected concurrently from three depth intervals (near surface, mid-depth, and near bottom).

Entrainment sampling surveys will be conducted twice per month over a 24-month interval from July 1, 2015 – June 30, 2017. Each sample collection event will be conducted over a 24-hour period with sample sets collected every 6 hours. The sample frequency selected for this entrainment study will provide finfish and invertebrate (shellfish) taxa, density distribution and seasonal/diel variation data over a two year period. Shellfish, for the purposes of this study, will be inclusive of shrimp, crabs (including horseshoe), lobsters, crayfish, and motile stages of bivalves and gastropods.

This methodology includes the following significant changes relative to the June 2005 - May 2006 entrainment study (refer to Section 3.1 for details):

1) Use of a pump to collect samples directly in front of the bar racks at Unit 6 rather than a streamed net approximately 50 feet in front of the bar racks at Unit 6;
2) Use of 335-µm mesh targeted for the current study rather than 505-µm mesh;
3) Collection of detailed morphometric data is included to support alternative technology evaluations;
4) Inclusion of methods and evaluations to maximize resolution of the taxonomic identifications with regard to Atlantic Sturgeon and other species; and
5) Collection of 24 months of entrainment data rather than 12 months.

The approach for development of the specific entrainment characterizations required in §122.21(r)(9) is summarized in Table 5-1.

Table 5-1. Summary of Approach for Development of §122.21(r)(9) Required Entrainment Characterizations

122.21(r)(9) Requirement	Basis for Meeting the Requirement
Two years of data and annual variation	Evaluation of species and life stage composition and densities based on July 2015 – June 2016 (Year 1) and July 2016 – June 2017 (Year 2) entrainment studies
Seasonal variation	Evaluation of monthly species and life stage compositions based on the Year 1 and Year 2 studies
Diel variation	Evaluation of densities in 6-hour sample collections in the Year 1 and Year 2 studies
Variation related to climate and weather	Evaluation of Year 1 and Year 2 data relative to water temperature and weather events (e.g., rain events)
Variation related to spawning, feeding and water column migrations	Evaluation of Year 1 and Year 2 data to determine species and life stage period of occurrence for spawning and feeding variation; Evaluation of differences among near surface, mid-depth and near bottom collections for water column migrations
Identification of lowest taxon possible	The resolution of taxonomic and life stage designations will be monitored through regular evaluations of catch data with the goal of reducing percent of unidentified organisms and increasing resolution of genera and higher taxonomic designations
Data must be representative of each intake	Sampling in front of Unit 6 would be representative of “average” intake water because this Unit withdraws almost 40% of the total volume of the cooling water withdrawn at the CPS
How the location of the intake in the water body are accounted for	Sampling of near surface, mid-depth and near bottom at the bar racks assumed to be the best method to account for intake location
Document flow associated with the data collections	Facility will monitor flows for period of sampling for use in the final report produced after sampling
Methods in which latent mortality will be identified	Assume 100% mortality
Data must be appropriate for a quantitative survey	Data will be expressed as taxon and life stage specific densities which can be multiplied by flow to support quantification of entrainment

6 Entrainment Characterization Study Plan

6.1 Introduction

This section of the Study Plan provides methods, materials, and procedures for entrainment sample collection and processing. Any failures at the sampling or laboratory analysis stage are often uncorrectable because design-specified sampling times cannot be repeated once they have passed. Therefore, Standard Operating Procedures (SOPs) and a Quality Assurance (QA) Plan will be developed by the contractor performing the field studies for the entrainment sample collection and processing based on this Study Plan and the contractors preferred methods, datasheets and equipment to eliminate, reduce, and/or quantify those errors.

Adherence to sample collection and lab analysis SOPs will be observed and documented through regular technical assessments/audits. These technical assessments/audits will be conducted by a QA officer, who is independent of those individuals collecting and generating the data during the study and has experience in performing QA/QC programs for aquatic monitoring surveys, and will be scheduled to occur at least quarterly throughout the course of the study. The specific requirements are to be developed by the contractor performing the work, will incorporate a checklist of items to be inspected based on the SOPs, and will include observations relevant to performance of sampling that may not be covered by the SOP. Careful attention will be paid to the initiation of the study when staff may be less familiar with the SOPs.

Entrainment sampling will be carried out at CPS twice per month from July 1, 2015 – June 30, 2017. The sampling will start in July 2015. This month was selected to expedite the start date for sampling to the extent possible as required within the larger §316(b) compliance timeframe and with a goal of minimizing the potential for disjoining year classes of anadromous fishes where the period of occurrence for entrainment of these species is generally over by July. Entrainment samples will be collected directly from in front of the bar racks at the Unit 6 CWIS. During each 24-hr sampling event, concurrent samples will be collected from near surface, mid-water and near bottom depths four times, centered around 0400, 1000, 1600, and 2200 hours. Samples will be collected by pumping water through a 0.5-m diameter mouth plankton net constructed of 335-μm netting suspended in a buffering tank. A total of four, 6-hour samples will be collected from each depth over a 24-hr period sampling event. Table 6-1 provides the details of entrainment sampling.

6.2 Safety Policy

All work performed under the direction of Dominion Environmental Services (DES) and/or Dominion Business Units (BU) on Dominion properties and/or on properties owned or operated by third parties (i.e., not owned or operated by the contractor or Dominion) is to be performed using safe work practices that are at least equivalent to those required for Dominion personnel and of any third party owner or operator. At a minimum, all contractors are expected to be aware of, and adhere to, Dominion's Corporate Safety Policy, DES Safety Work Practices and any BU or other location-specific safety policies and procedures.

Table 6-1. Entrainment Sampling Details -

Entrainment	Details
Units to be Sampled	Unit 6 (Primary Location) and Unit 3 (Secondary Location)
July 1, 2015 – June 30, 2017 Sampling Events	Twice per month sampling events (within the first and third week of each month) for 24 months (2/month x 24 months = 48 sampling events)
Daily Collection Schedule	Samples collected every 6 hours in a 24-hr period (4 collections / 24-hr period)
Targeted Organisms	Fish eggs, larvae, and juveniles; shellfish life stages
Depths	Near surface, mid-depth, near bottom for a total of 3 depths
Number of Samples Collected per Depth	1 sample per depth by pumping water through a 335-μm net suspended in a buffering tank (Three sub-samples for each depth will be combined)
Sample Duration	~100 minutes per depth per 6-hour sample (or time required to get 100 m^3 per depth per 6-hour sample)
Number of Samples per Sampling Event	4 collections/survey x 3 depths/collection x 1 sample/depth = 12 samples/survey
Total Number of Samples	12 samples/survey x 2 surveys/month x 24 months = 576 samples

6.3 Field Collection Procedures

6.3.1 Location

Entrainment samples will be collected in front of bar racks at the Unit 6 CWIS from near surface, mid-water and near bottom depths. The primary sample location will be at Unit 6 in front of the bar rack (See Figure 6-1). The deck space is limited at this Unit. It may be necessary to stage the pumps on the deck and the buffering tanks on the concrete apron adjacent to the east side of the intake structure. If Unit 6 is not operating, it is unsafe or infeasible to sample at Unit 6 for other reasons, the secondary location will be at Unit 3 in front of the bar rack (Figure 6-1). At this location the pumps and buffering tanks will need to be staged on the deck in front of the bar racks. Changes or variations in the sampling location over the duration of the 24-month study will require Dominion notification and approval.

Near surface, mid-water and near bottom pumped samples will be collected from intake piping installed along the front of the bar racks with the face of bar racks used to stabilize the temporary intake piping. The near bottom sample will be collected approximately 3 feet above the bottom, the mid depth sample will be collected at the mid-depth of the water column at Mean Sea Level (MSL), and the surface sample intake will be positioned 3 feet below the surface at Mean Low Water (MLW) in order to make sure that the intake piping of the surface sample is low enough to stay below the water surface and the system keeps its prime. Figure 6-2 presents the conceptual design of intake piping for the entrainment sampling at three depths.

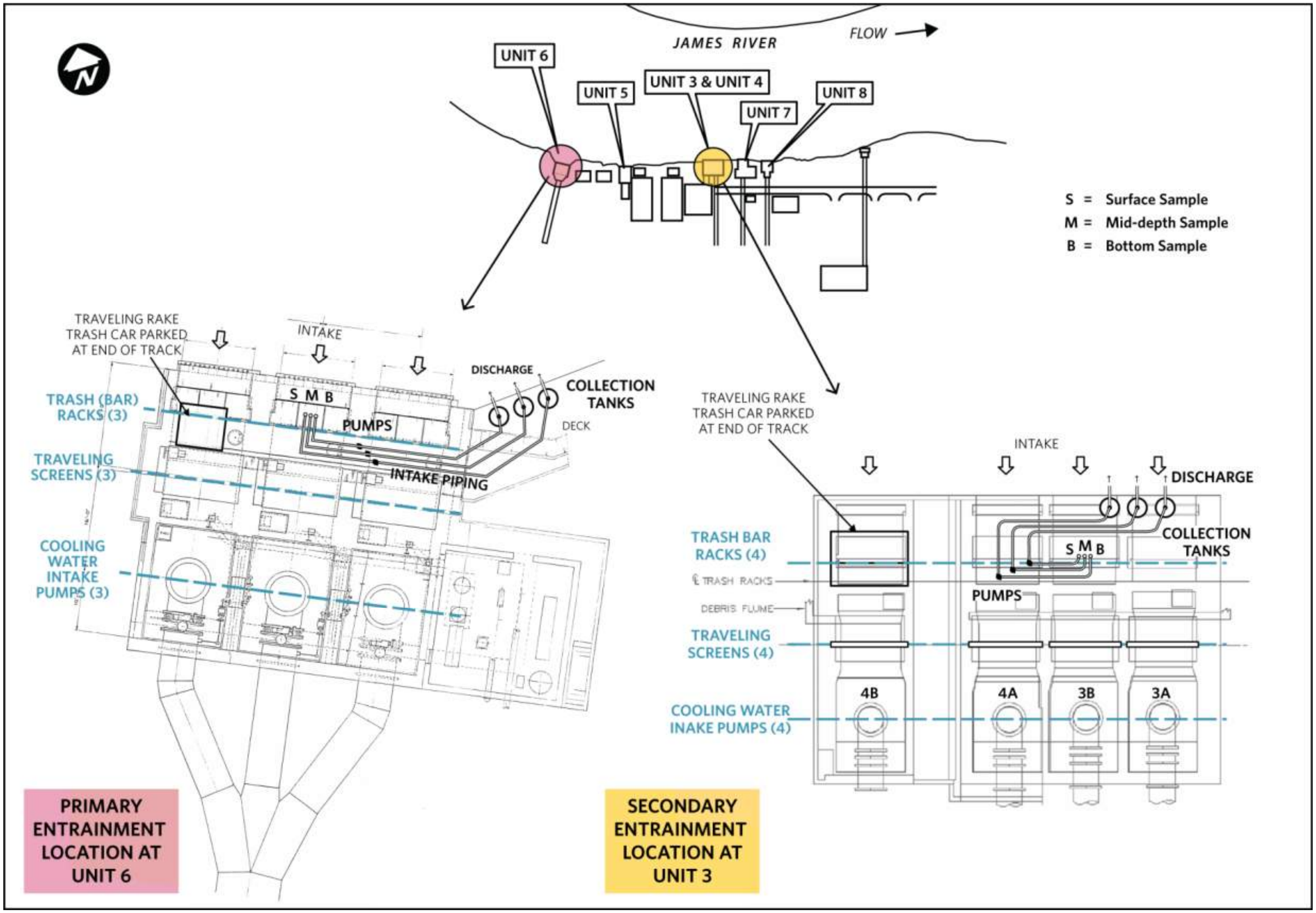
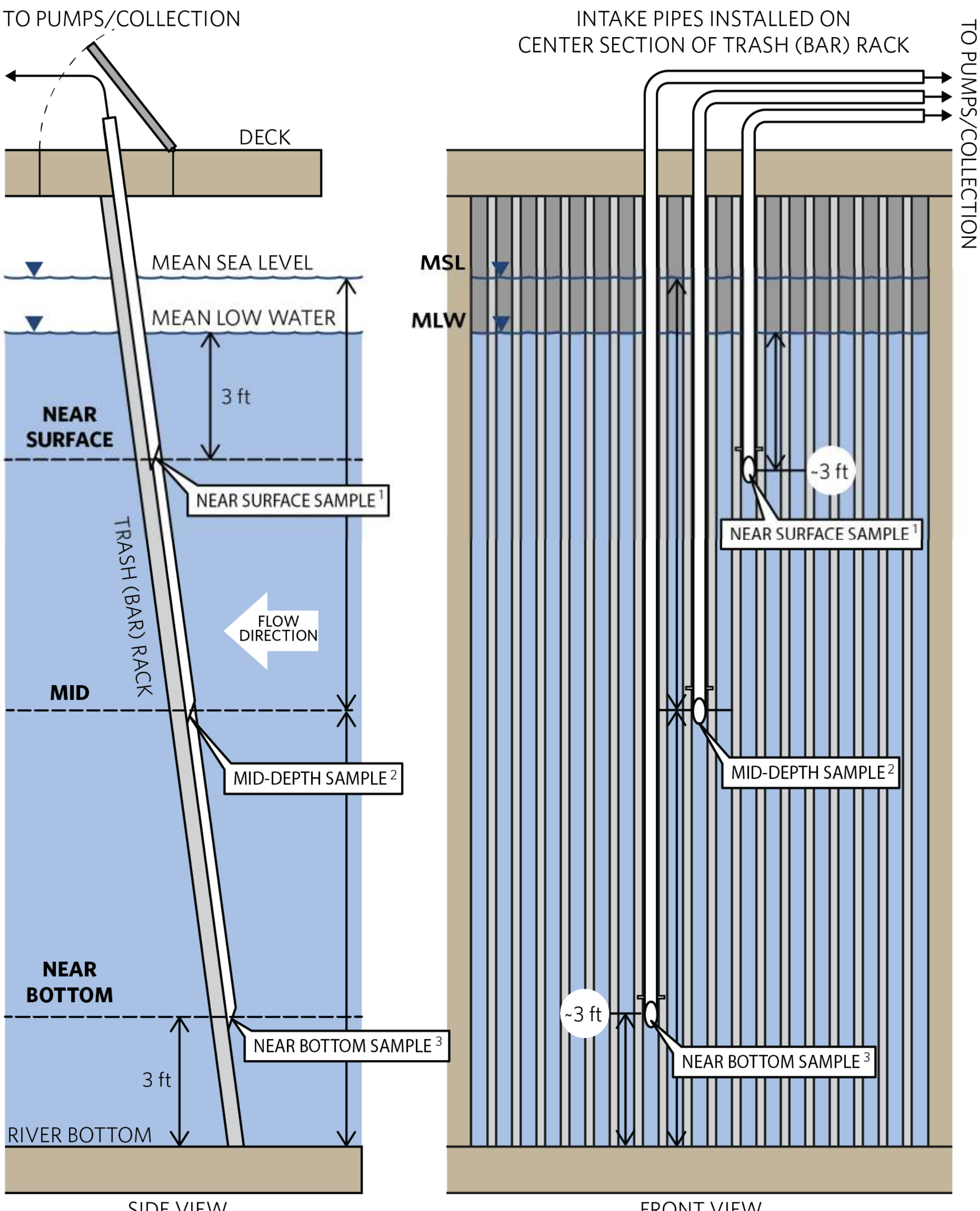


Figure 6-1. Proposed Location of Chesterfield Power Station Entrainment Sampling, 2015 – 2017 -



NOTES

[1] Based on Mean Low Water (MLW) elevation.

[2] Based on Mean Sea Level (MSL) elevation.

[3] If it is determined the bottom sediments are soft and being pulled in with the samples the intake may need to be pulled up enough to avoid pulling up the bottom sediments.

SCHEMATIC - NOT TO SCALE

Figure 6-2. Conceptual Design of Intake Piping for Entrainment Sampling -

6.3.2 Equipment -

Sampling equipment will be acquired and/or constructed according to specifications in this Study Plan. Adequate backup equipment will be provided to ensure the study design can be followed in the event of equipment failure or loss. Prior to initiation of sampling, equipment will be tested or otherwise confirmed to meet specifications. A calibration program will be instituted for equipment requiring calibration that must be consistent with Dominion's instrumentation calibration and maintenance practice document (See Appendix B).

Cooling water at the CWIS will be pumped using temporary gas-powered four-inch centrifugal pumps (trash pump) and four-inch diameter intake piping installed at the face of bar racks. The pumped intake water will be filtered through a 335-micron mesh conical plankton net suspended in a 200-gallon polyethylene sample buffering tank (See Figure 6-3).

The following list includes the minimum items expected to be required for entrainment sample collection:

- 94 x 102-cm, 335-µm mesh hoop plankton nets (9) with 335-µm mesh PVC cod-end buckets (9)
- 94 x 102-cm, 505-µm mesh hoop plankton nets (9) with 505-µm mesh PVC cod-end buckets (9)[6]
- 4-Inch trash pumps with open head design/gas cans (4 pumps)
- 200-gallon buffering tanks (3)
- Intake hoses (surface, mid, and bottom)
- 4-inch Schedule 40 PVC pipe of various lengths and configurations
- 4-inch PVC flex hose of various lengths and configurations
- In-line flowmeter (3)
- 120 VAC submersible wash down pump with 25 feet of ¾-inch diameter hose and waterproof switch
- 1-L wide-mouth sample jars with labels
- 10% Formalin/Rose Bengal stain solution
- PPE: hard hats, safety glasses, steel toe boots, ear muffs/plugs, PFD's
- First-aid kit
- Flashlights
- Disposable Nitrile gloves
- Plastic buckets (assorted capacities)
- 335-µm sieves (3), squirt bottles, spoons
- Field Binder w/pens, pencils, SOP, data sheets, calibration sheets, QC sheets, etc.
- Clipboard
- Stopwatch
- Niskin water sampler
- Extra 5-gal buckets or similar for sample transportation

[6] - It is anticipated that during certain periods, 335-µm mesh may result in clogging of the net with a potential to compromise sample collections; 505-µm mesh may be used during these periods. Dominion is to be notified prior to, or immediately after, a net mesh large than 335-um is required to be used.

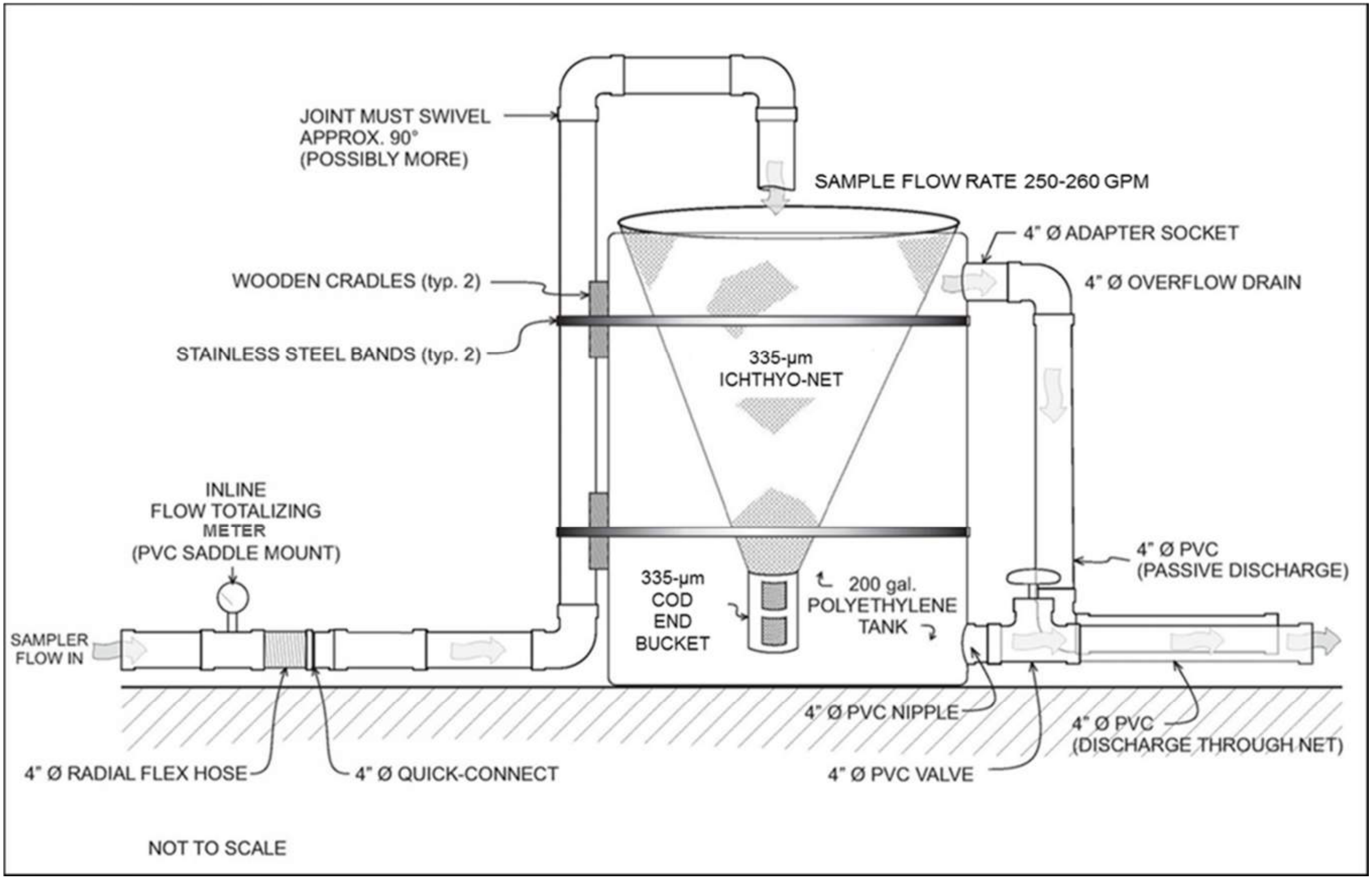


Figure 6-3. Entrainment Pump Sampling System Configuration -

- Portable water quality meters (2) as described below[7]
  - Handheld Salinity, Conductivity & Temperature meters (2) with autoranging scales (e.g., YSI Model 30 or equivalent) with the following minimum specifications:
    - Conductivity ranges of 0 to 500 µS/cm and 0-200 mS/cm with an accuracy of +/- 0.5 % full scale
    - Salinity range of 0 to 80 ppt with an accuracy of +/- 2 % or +/- 0.1 ppt
      - Temperature range of -5 to 45 ˚C with an accuracy of +/- 0.2 ˚C
  - Handheld Dissolved Oxygen & Temperature meters (2) with autoranging scales (e.g. YSI Model 55 or equivalent) with the following minimum specifications:
    - Dissolved Oxygen % Saturation ranging from 0 to 200 % with an accuracy of +/- 2 %
    - Dissolved Oxygen mg/L ranging from 0 to 2 mg/L with an accuracy of +/- 0.3 mg/L
    - Temperature range of -5 to 45 ˚C with an accuracy of +/- 0.2 ˚C
  - Portable pH meters (2) with the following minimum specifications:
    - pH range of 0 to 14 units with an accuracy of +/- 0.2 units
- Calibration solutions as required for the water quality instrumentation

6.3.3 Sampling Schedule

The program anticipates sampling for 24 consecutive months with 48 sampling events (two sampling events per month) conducted over the July 1, 2015 – June 30, 2017 period. Sampling events will be distributed within the first and third week of each month for the 24-month period. Each sampling event will encompass a 24-hour period divided into four, 6-hour subsampling periods centered around 0400, 1000, 1600, and 2200 hours. If a sampling event is missed due to weather or other unforeseen events, the scheduled sampling event will be conducted within 96-hours of resolution of the complicating event.

6.3.4 Entrainment Sample Collection Procedures

The first shift crew will check in with the facility operations engineer or designee and security personnel to notify them of the initiation of the survey and the crew's arrival on site. Prior to initiating entrainment sampling, the crew will install the intake piping at the three depths along the bar rack (refer to Section 6.3.1 for details). Stabilizers will be used to keep the pipes in place and orient them to the intake flow. Once the intake pipes are secured in place, the intake piping will be connected to trash pumps with 4-inch flexible hoses and then the hoses will be connected to the buffering tanks. All connections will be checked. All sampling pumps will be placed in secondary containments with oil/fuel sorbent pads in the event there is a fuel or oil spill[8]. The discharge hoses from the tanks will be directed over the bulkhead back into the river.

---

[7] A multiple parameter water quality meter may be used provided it meets the minimum specifications outlined for the individual meters.

[8] All pumps will be shut down and allowed to cool prior to refueling. Gasoline storage cans will be Type I UL-approved containers outfitted with flame arrestors; the gas cans will be stored in secondary containments. A dry chemical (ABC) fire extinguisher will be available in the area of the pumps.

In the case of the secondary sampling location, the discharge hoses may be directed into an adjacent intake bay.

The gas-powered pump head will be primed (filled with water) before starting the pump. Once the pump has begun to discharge water and a stable flow has been established the engine throttle will be adjusted and/or the throttling valve located at the terminal end of the flow metering pipe will be adjusted slowly to achieve a flow rate of approximately 250-275 gallons per minute (gpm). A pump flow rate check is to be conducted for each pump prior to commencing the 24-hour sampling event (refer to Section 6.3.5 for details). To commence sampling, the buffering tank discharge valve should be closed to fill to the level of the tank to the upper overflow drain. The discharge valve is then partially opened to balance the level in the buffering tank to the point where water is just spilling into the upper overflow drain (and not overflowing the top).

Once the flow in the system is balanced, the sample net is inserted into the buffering tank and the start time, pump flow and flow totalizer readings are recorded on the appropriate data sheet. The crew should observe the sampler to ensure that the water level is maintained at the correct level throughout the collection period. This is particularly important as the river is tidally influenced and a rising river level will result in higher pump flows while a dropping river level will result in lower pump flows.

Flow rates will be monitored and adjusted as necessary; a maximum flow rate of 250-275 gpm has been selected to minimize potential damage to the organisms in the net during the sample collection interval. An inline flowmeter will be used to monitor and maintain the flow rate for each sample. The target water volume for each entrainment sample is 100 m^3 (26,418 gallons). Contractor's SOP must include methods for tracking sample volumes in the field with potential to adjust sample times as may be required to achieve 100 m^3 sample volume per depth. Systematic deviation from this target sample volume will require Dominion's prior approval.

In addition, three sub-samples of approximately 35 m^3 each (~35 minutes) will be collected from each depth interval. After approximately 35 minutes (or a volume of ~35 m^3; ~9,246 gallons), the net will be removed from the buffer tank and switched with a second net (this is to be performed without shutting down the pump). The removed net containing the first sub-sample will then be washed down from the outside of the net into the cod-end bucket and the sample will be transferred to a 1-liter wide-mouth polyethylene sample jar labeled with the pertinent sample information. Label information shall include: sample number/ID, date, time (start and end), sample location, sample depth, and crew member initials. The second and third sub-samples will be washed down and transferred to the same 1-liter sample jar which contains the first sub-sample for each depth interval. The near surface, mid-depth, and near bottom samples will be collected concurrently using three pairs of pumps and buffering tanks.

The sample jar(s) will be preserved to a 5% Formalin solution with a "vital stain", such as rose bengal and labeled appropriately. Each sample jar will be filled no more than halfway (50%) with the sample so that at least 500 ml of a 10% Formalin solution can be mixed with the sample to properly preserve it. All preserved samples will be packaged and transported to the laboratory for processing.

All pertinent information for each sample will be recorded on the appropriate data sheet to document the samples collected and ensure they are correctly identified and labeled for sampling processing. This information shall include but is not limited to: sample number/ID, year, date, time (start and end), sample location, sample depth, pumping duration (min), total volume filtered (m^3), water quality measurements, cooling water pump status, crew member initials.

At the completion of the 24-hr sampling period and final pump flow calibrations, the entrainment sampling apparatus will be broken down. The intake piping will be removed from the bar racks and all equipment (pumps. hoses, and buffering tanks) will be removed from the intake structure and stored in the designated location. The second shift crew will check in with the facility operations engineer or designee and security personnel to notify them of the surveys completion and the crew's departure from the site. The number and rated capacity of circulating pumps in operation during the sampling interval will be verified and recorded.

Measures must be made to ensure the sampling event does not interfere with plant operation nor result in risk to health and safety of field personnel. The contractor must contact the facility to provide them a weeks' notice prior to each sampling event. The contractor should coordinate with the facility personnel to ensure sampling activities will not interfere with any scheduled maintenance activities at the intake structure of the station. If there are required activities that could conflict with plant maintenance operations the sampling event will be postponed as necessary so it does not interfere with plant operations. Prior to the sampling events, the contractor shall request that the facility personnel observe the bar racks and clean them of debris prior to the installation of the sampling equipment to minimize the possibility that the bar racks will need to be cleaned during the sampling event. In the event the station is required to access the bar racks during the sampling event due to unscheduled maintenance activities the sampling equipment can be removed if necessary. All open grates will be protected with barricades during the sampling events.

6.3.5 Pump Flow Rate Check Procedures

Prior to commencing with the first sampling period and again at the beginning of the second crew shift a pump flow rate check will be conducted for each pump according to the flow rate check procedure outlined as follows:

- With the sample net removed from the tank the crew will lower the water level of the buffering tank to the 50-gal mark on the side of the tank (or a known volume between 50 and 125 gallons if the level will not drop to 50-gal) by opening the discharge regulating valve on the lower discharge line from the tank.
- When the water level is at the 50-gal line on the tank, the valve will be quickly closed.
- The start flow from the flowmeter will be recorded immediately following valve closure.

- The crew will time, and record, how long it takes the rising water level in the tank to reach the 150-gal level line (100 gal pumped).[9]
- The end flow from the flowmeter will be recorded immediately after the 150-gal level line is reached.

The flow rate check will be calculated by the following equation:

$$100 \text{ gal}/t = X \text{ gal}/60 \text{ sec} \quad \text{or} \quad X = 6000/t$$

Where t is the time in seconds to fill 100 gal, and X is the calculated gpm.

This procedure will be run three times, and the average compared to the observed flow rate from the flowmeter. If there is a discrepancy of more than 20% the flow meter setup and pipe connections will be checked and the flow rate check procedure will be conducted again until the results are within 20% of the flowmeter results. All flow rate check data will be recorded on the appropriate data sheet.

6.3.6 Water Quality Measurements

During each 6-hour sample period, water quality data will be collected twice, targeted for the start and end of each sampling period, at surface, mid, and bottom depths using a calibrated water quality meter (see instrument specifications above). The meter will be attached to a weight and lowered from the intake deck in front of the face of the dividing wall between the intake screens. Parameters that will be collected are: temperature (˚C), dissolved oxygen (mg/L), specific conductance (µS/cm), salinity (ppt) and pH.

Quality control for water quality data collection will be performed twice per sampling event (once per 12-hour shift) using either a second calibrated water quality meter or by collecting water samples for wet chemistry analysis. Calibration of water quality equipment will be consistent with the *Field Instrumentation: Calibration and Standardizations* requirements in Appendix B.

6.4 Laboratory Procedures

The entrainment samples collected during this study will be transported to the laboratory for sorting and analysis using the equipment and procedures identified below.

6.4.1 Equipment

The following list includes the expected minimum items required for laboratory analysis:

[9] If the level in the tank will not drop to 50-gal, the start level may be increased. Additionally, the volume of water pumped may be decreased if the water level in the buffering tanks does not drop low enough to achieve a volume of 100 gals in a reasonable period of time. For example, the water level may be lowered to 100 gallons and the total volume pumped decreased to 50-gal. In this case, the end flow from the flowmeter will be recorded immediately after the 150-gal level is reach and 50 gal would be substituted for 100 gal in the formula above, hence the final equation would be *X = 3000/t.*

- Light boxes
- Pyrex trays
- 335µm sieves
- Plastic buckets (2 qt)
- Folsom Plankton Splitter (or equivalent)
- Binocular dissecting microscope with ocular micrometer
- Computer with ImageTool™ Software (or equivalent)
- Measuring board (accurate to the nearest millimeter)
- Featherweight forceps, dissecting forceps, eyedroppers, probes, spoons
- Petri dishes and covers
- Pencils, data sheets
- Vials (assorted capacities: 8 to 120 ml), vial holders
- Multiple and single mechanical hand counters
- Labels, Scotch tape
- 5% Formalin solution
- Safety glasses
- Squirt bottles (assorted sizes), plastic beakers (2 L)
- Nitrile gloves, paper towels
- SOP
- Taxonomic keys.

6.4.2 Laboratory Analysis

After collected samples are transported to the laboratory for processing, following major activities will be accomplished:

1) - For very abundant samples, the total sample may be carefully mixed and split as needed to obtain a reliable and representative estimate of the total sample collection (refer to Sort Sub-sampling Procedure section for more information).
2) - Identify each fish and shellfish to the lowest practicable taxon including life stage designation.
3) - Determine the number and size of fish and shellfish collected (refer to Morphometrics section for more information).
4) - Enter field sheet information and laboratory analysis data into Dominion approved database format.

Chronological sample processing will be performed for the duration of the study. Samples will be stored for a minimum of five years after the completion of the data collection effort. Protocols for managing and storing samples from multiple facilities, should a contractor be working at multiple facilities, will be required.

Sample Sorting

The following sample sorting protocol is to be followed:

- After a sample number has been assigned, the sample will be gently rinsed through a mesh of 335 µm or smaller to remove excess formalin.

- The rinsed sample will be placed in a sorting tray with adequate water to cover the sample. If the sample is thick with detritus, it may be split into several trays using a Motodo™ plankton splitter to improve visibility and sorting effectiveness.
- The organisms will be removed with forceps or eyedroppers and sorted into their respective groups of fish larvae, eggs, or shellfish larvae and enumerated. Each group will be placed in a separate glass vial with 5% buffered formalin and labeled externally with the sample number to await identification. Tops of vials will be taped to reduce loss of fluid. Samples that are estimated to contain more than 400 fish eggs or 400 larvae will be sub-sampled.
- All samples (sorted organisms and not detritus) will be stored as appropriate to protect from freezing, breakage, or other sample damage.

Sort Sub-sampling Procedure

The preservative-free washed sample will be transferred to the Motodo™ plankton splitter. A sufficient quantity of water will be added to the box to ensure thorough mixing and dispersal of the sample. The box will be tilted until the sample has moved into the two separate chambers. Then, half of the sample will be carefully drained from the box. Samples will be split in half, and then the halves will be split in quarters, and so on, until the approximate number of organisms that were the target of the split is ≥200 in the final split portion.

The final split portion will be analyzed for whichever group was the target of the subsampling procedure. If a minimum of 200 eggs or larvae is reached, sorting for that group ends with that split portion. The whole sample, including the final split, will be analyzed for the other group of ichthyoplankton. The split fraction will be recorded on the data sheet for each taxon and life stage to which the split applies.

Sample Identification

After sorting, the fish and shellfish will be identified to the lowest practical taxon and enumerated. All fish will be assigned a life stage: viable egg, non-viable egg, yolk sac larvae, post yolk sac larvae, juvenile, or unidentified larval stage. Only whole larvae, parts of larvae with a head and a majority portion of the body present (more than half), or pieces of larvae with an extensive portion of the body present (more than three quarters) will be counted. All fish and shellfish will be preserved in 5% formalin and stored in properly labeled vials. All shellfish will be identified to the lowest practical taxon, enumerated and assigned to a life stage.

Morphometrics

For each 24-hr sampling event, the following morphometric data will be collected and recorded for each life stage of fish and shellfish (i.e., larval fish, fish egg, and blue crab):

- Up to 5 individuals from each fish taxon and life stage will be measured for total length and notochord length, greatest body depth and width, and head capsule depth and width, all to the nearest 0.1 mm;
- Up to 5 eggs of each taxon will be measured for minimum and maximum diameter;

- Up to 5 Blue Crab (*Callinectes sapidus*) individuals from each life stage will be measured for greatest body length, width, and depth to the nearest 0.1 mm; megalopa and later life stage measurement maximum widths and depths will be based on carapace.

Only whole organisms will be subject to morphometric evaluations. Organisms subject to the morphometric evaluation should be selected at random from within each taxonomic category (i.e., each taxon and life stage). Length measurements will be performed with a calibrated ocular micrometer or other calibrated tool (e.g., ImageTool™ Software).

Taxonomic Resolution Monitoring

The resolution of taxonomic and life stage designations will be monitored through regular evaluations of catch data with the goal of reducing percent of unidentified organisms and increasing resolution of genera and higher taxonomic designations. These evaluations will occur on a quarterly basis. Density data will be reported to Dominion within one month of the close of each three month period, as number of organisms per 100 m^3 by month, for each taxon and life stage.

Methods for Identifying Atlantic Sturgeon

In the unlikely event of identification of Atlantic Sturgeon in entrainment samples, the VDGIF will be contacted by Dominion (i.e., DES) within 24-hours of the event as per the requirements of the Scientific Collection Permit that will be obtained prior to any sampling. The following method will be used to maximize the potential identification of this species in entrainment samples in the unlikely event that they are collected:

1. Because of their large size and distinctive morphology, it is unlikely that sturgeon eggs and larvae would remain unidentified. Regardless, unidentified eggs and larvae and split fraction samples collected from March through November will be subject to an additional visual scan for eggs ranging in size from 2-3 mm and for larvae 6 mm or greater. This range of months is meant to be inclusive because of the uncertainty associated with spawning period of the James River Atlantic Sturgeon. The range of sizes is also meant to be inclusive to allow for slight variation from the descriptions.

2. This subset of eggs will be scanned for an apparent germinal disc and pigmentation. All pigmented eggs will be examined for consistency with the description of eggs provided in Appendix A.

3. The subset of yolk-sac larvae will be viewed for consistency with the description of yolk-sac larvae provided in Appendix A, distinguishing characteristics will include size, color and a continuous finfold extending from behind the head dorsally around the notochord and ventrally to the posterior end of the yolk sac.

4. Larvae will be examined for consistency with size and developmental stage (see Snyder 1988). Bath et al. (1988) provides an extensive description of Atlantic and Shortnose Sturgeon (*Acipenser brevirostrum*), that can be used as an aid in identifying Atlantic Sturgeon.

For Quality Control purposes, any eggs and larvae identified as potential sturgeon specimens will be preserved separately and provided to an appropriate third party for taxonomic identification. The third party will provide a “blind” taxonomic identification wherein they will not be provided the results from the original taxonomic designation.

See Appendix C for a list of data to be collected and recorded during field collection and processing.

6.4.3 Laboratory Quality Control (QC) Procedures

Quality control methods for split, sort and identification of ichthyoplankton will be checked using a continuous sampling plan (CSP) to assure an Average Outgoing Quality Limit (AOQL) of 0.1 (≥90% accuracy). Specific methods for quality control will be provided in the SOP developed by the contractor performing the work. Quality control checks will be recorded on appropriate datasheets and these records will be maintained for review.

7 References

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Habitat Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. *Environmental Biology of Fishes* 48: 347-358.

Bain, M.B., N. Haley, D. Peterson, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic Sturgeon, *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River estuary: Lessons for sturgeon conservation. *Boletin-Instituto Español de Oceanografía* 16: 43-53.

Balazik, G., C. Garman, and J.P. Van Eenennaam. 2012. Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia. Transactions of the American Fisheries Society 141: 1465-1471.

Barfield, M.L. and E.T. Watters. 1998. Non-parasitic life cycle in the green floater, *Lasmigona subviridis* (Conrad, 1835). Triannual Unionid Report, 16: 22.

Bath, D.W., J.M. O'Conner, J.B. Alber, and L.G. Arvidson. 1981. Development and identification of larval Atlantic Sturgeon (*Acipenser oxyrhynchus*) and Shortnose Sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. Copeia 1981: 711–717.

Bilkovic, DM, K Angstadt, and D Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia. Final report to NOAA Chesapeake Bay Office, Award Number NA06NMF4570303. Virginia Institute of Marine Science, Center for Coastal Resources Management, Gloucester Point, Virginia.

Bushnoe, T.M., J.A. Musick, and D.S. Ha. 2005. Essential Spawning and Nursery Habitat of Atlantic Sturgeon (*Acipenser oxyrinchus*) in Virginia. Appendix 1 of Essential Fish Habitat of Atlantic Sturgeon *Acipenser Oxyrinchus* in the Southern Chesapeake Bay. Principal Investigator: Jasck Musick. VIMS Scientific Report #145.

CH2MHILL. 2007. Draft Comprehensive Demonstration Study for Chesterfield Power Station. 2006.

CH2MHILL. 2011. Best Technology Available Determination for Reducing Impingement Mortality, Bremo Power Station.

Chesapeake Bay Journal. May 2011. Blue catfish boom threatens region's river ecosystems. The Bay Journal 22(3).

Dee, S.O. and T. Watters. 2000. New or confirmed host identifications for ten freshwater mussels. Proceedings of the Conservation, Captive Care, and Propagation of Freshwater Mussels Symposium. Pages 77-82. Ohio Biological Society.

EA Engineering, Science, and Technology (EA) 2007. Impingement Mortality and Entrainment Characterization Report, Chesterfield Power Station, June 2005 – 2006. EA Engineering, Science, and Technology, Inc., Sparks, Maryland.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and Shortnose Sturgeons. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28 pp.

Hager, C. 2011. Atlantic Sturgeon review: Gather data on reproducing subpopulation of Atlantic Sturgeon in the James River. Contract EA133FIOCN0317.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Department of Commerce, Bulletin of the United States Bureau of Fisheries, Volume XLIII.

Johnson, R.I. 1970. The systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the southern Atlantic slope region. *Bulletin of the Museum of Comparative Zoology* 140(6):263-449.

Jones, P. W., F.D. Martin,. and J.D. Hardy Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, and Shortnose Sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

Lellis, W.A. and T.L. King. 1998. Release of metamorphosed juveniles by the green floater, *Lasmigona subviridis*. Triannual Unionid Report, 16: 23.

Lung, W.S. 1991. Trends in BOD/DO modeling for wasteload allocations of the James River estuary. Technical memorandum prepared under subcontract for Tetra Tech, Inc., Fairfax, VA.

Moser, M. L. and S. W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the lower Cape Fear River, North Carolina. Transactions of the American Fisheries Society 124: 225-234.

National Marine Fisheries Service (NMFS). 2015. Endangered and Threatened Species Under NMFS' Jurisdiction (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm).

NMFS 2012a. Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).

NMFS. 2012b. Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission, that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.

NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: October 21, 2014).

Rash, J.M. 2005. Life history characteristics of the Atlantic Pigtoe (*Fusconaia mason*i). Abstract of Papers 83rd Annual Meeting of the Virginia Academy of Science, May 17-20, 2005. James Madison University, Harrisonburg, VA.

Secor, D.H., E.J. Niklitschek, J.T. Stevenson, T.E. Gunderson, S.P. Minkkinen, B. Richardson, B. Florence, M. Mangold, J. Skjeveland, and A. Henderson-Arzapalo. 2000. Dispersal and growth of yearling Atlantic Sturgeon, *Acipenser oxyrinchus*, released into Chesapeake Bay. Fishery Bulletin 98: 800-810.

Terwiliger, K. 1991. Virginia's Endangered Species: Proceedings of a Symposium. Virginia Department of Game and Inland Fisheries, McDonald and Woodward Publishing Company, Blacksburg, VA.

U.S. Fish and Wildlife Service (USFWS), Raleigh Ecological Services Field Office. 2012. Sensitive Joint-vetch (*Aeschynomene virginica*). Retrieved September 7, 2014. http://www.fws.gov/raleigh/species/es_sensitive_joint-vetch.html

Virginia Electric Power Company (VEPCO). 2000. Section 316(a) Demonstration. VPDES Permit Number VA0004146 - Chesterfield Power Station. Virginia Electric and Power Company, Environmental Policy and Compliance, Glen Allen, Virginia.

VEPCO. 1977. Chesterfield Power Station Impingement and Entrainment Study. Final report. Prepared by Virginia Electric and Power, Environmental Services Department, Richmond, VA.

Virginia Fish and Wildlife Information System (VAFWIS). 2014. Virginia Wildlife and Information Service. Atlantic Pigtoe Chapters. Available online. Retrieved October 7, 2014. *http://vafwis.org/fwis/booklet.html?Menu=_.All+Chapters&bova=060173&version=16350*

VDGIF. 2015a. Fish and Wildlife Information Service (VAFWIS). Web. http://vafwis.org/fwis/. Retrieved June 20, 2015.

VDGIF. 2015b. VAFWIS Chapters for Green Floater. Available online: https://vafwis.dgif.virginia.gov/fwis/booklet.html?Menu=_.Occurrence&bova=060081&version=16606. Retrieved July 27, 2015.

Virginia Department of Game and Inland Fisheries (VDGIF). 2014. Barking treefrog (*Hyla gratiosa*). Available online. Retrieved September 7, 2014. *http://www.dgif.virginia.gov/wildlife/information/?s=020002*

Watson, J. 2012. James River Mainstem Freshwater Mussel Surveys. Virginia Department of Game & Inland Fisheries, Bureau of Wildlife Resources. Accessed on November 13, 2013. Available online: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CC8QFjAD&url=http%3A%2F%2Fncmollusks.wikispaces.com%2Ffile%2Fview%2FJamesRiverSurveys.pdf&ei=1QVmVIfDH_TesASBvICgBg&usg=AFQjCNHoLbYHINRMh89V_2H6BPNyEZT8cA&sig2=NR_T2jFIdgg2ucIZqnJn_w&bvm=bv.79142246,d.cWc.

Wolf, E.D. 2010. Propagation and Culture of Species at Risk Atlantic Pigtoe. Department of Defense Legacy Program. Project #09-450.

Wolf, E.D. and V. Emrick. 2011. Propagation and Culture of Species at Risk Atlantic Pigtoe. Department of Defense Legacy Program. Project #10-450.

Appendix A -

Atlantic Sturgeon Life History Information -

Atlantic Sturgeon Life History Information

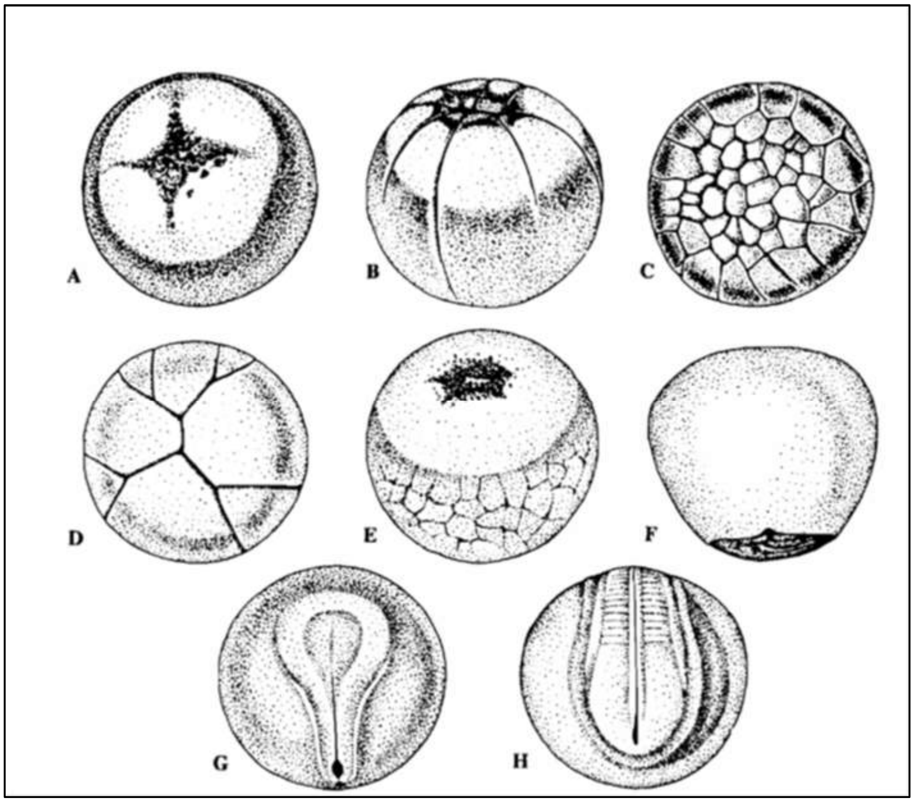
Atlantic Sturgeon (*Acipenser oxyrinchus*) originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina Distinct Population Segments (DPSs) are listed as endangered. Those originating from the Gulf of Maine DPS are listed as threatened. Atlantic Sturgeon from these five DPSs have the potential to occur in the James River and the vicinity of the cooling water CWIS of the CPS. The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida (NMFS 2012a).

The James River historically provided the largest stock of Atlantic Sturgeon in the Chesapeake and the majority of the adults in the river are likely to originate from the James River and thus, the Chesapeake Bay DPS (Hildebrand and Shroeder 1928; ASSRT 2007; Hager 2011; NMFS 2012a). Because early life stages (eggs and larvae), yearlings, and juveniles do not leave their natal river or estuary, any Atlantic Sturgeon from these life stages in the James River would have originated from the Chesapeake Bay DPS. Subadult Atlantic Sturgeon (greater than 50 cm but not yet sexually mature), move outside their natal rivers. Therefore, subadult Atlantic Sturgeon present in the James River and in the vicinity of the CWIS could be from any of the five DPSs.

Atlantic Sturgeon spawn in the James River. Benthic substrates that provide suitable sturgeon spawning habitat (i.e., rock and cobble gravel) occur in the vicinity of CPS; however, some of these areas might not have viable spawning conditions (e.g., hydrodynamic characteristics) (Bilkovic et al. 1999). Bushnoe et al. (2005) indicate that the Turkey Island and Jones Neck oxbows, which are approximately 3 -7 miles downstream CPS are considered potential spawning habitat due to their hydrodynamic characteristics and also benthic substrate, including rock and gravel/cobble/pebble (Bilkovic et al. 2009, NMFS 2012a). Spawning is expected to occur from the April through June; evidence exists that spawning might occur in the fall as well, with high adult usage in the river from August through November (Balazik et al. 2012, Secor et al. 2000). Virginia Marine Resources Commission restricts dredging in the James River from March 15 through June 30 to accommodate spring-spawning anadromous fish (Balazik et al. 2012) and NMFS (2012b) recently restricted dredging in the lower James River from February 15 to June 15th and in the rest of the river from February 15 to June 30 to protect anadromous fish during migration and spawning periods.

Eggs can hatch in 4 - 7 days depending on temperature (Gilbert 1989; Hildebrand and Schroeder 1928). Eggs are strongly adhesive and demersal, and occur only on the spawning grounds attaching to the substrate in 20 minutes (Jones et al. 1978). Atlantic Sturgeon eggs are approximately 2.6 mm in diameter (Hildebrand and Schroeder 1928) and hatch approximately 94, 140, and 168 hours after egg deposition at temperatures of 20°C, 18°C, and 17.8 °C, respectively (Gilbert 1989; Hildebrand and Schroeder 1928).

Ripe (unfertilized) Atlantic Sturgeon eggs are reported to be 2.5 - 2.6 mm in diameter, globular in shape, and of a light to dark brown color. Fertilized eggs are up to 2.9 mm in diameter, slate gray or light to dark brown, and become oval as development proceeds (Jones et al. 1978) (see Figure A-1). The germinal disc is evident in the unfertilized egg. A cross- or star-shaped pigment patch is apparent in the animal pole of the fertilized egg. The eggs are distinctly two-layered with the outer layer being a viscous substance.



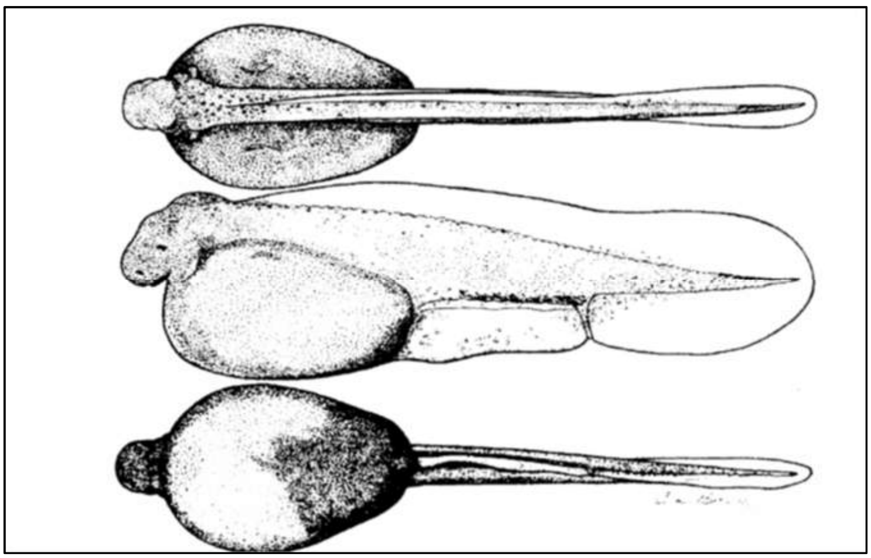
Source: Jones et al. 1978 as presented in Gilbert 1989

Figure A-1. Atlantic Sturgeon Egg Development from Unfertilized Egg to 48-hour Stage

Yolk-sac larvae are expected to inhabit the same areas where they were spawned (Bain et al. 2000; ASMFC 2012). Smith et al. (1980 in Gilbert 1989) also reported that the yolk-sac larvae were darkly pigmented and active swimmers. Hard substrate is important to larval Atlantic Sturgeon as it provides refuge from predators (Kieffer and Kynard 1996 and Fox et al. 2000 as cited in ASMFC 2012). Bath et al. (1981) only collected sturgeon larvae in bottom samples. Larvae are also active swimmers and leave the bottom when 8 to 10 days old to swim in the water column (Kynard and Horgan 2002).

The yolk-sac larval stage is completed in about 8 to12 days (Jones et al. [1978] reports 6 days), at which time the larvae move downstream to the rearing grounds (Kynard and Horgan 2002). During the first half of this migration, larvae move only at night and use benthic structure (e.g., gravel matrix) as refuge during the day (Kynard and Horgan 2002). During the latter half of migration to the rearing grounds, when larvae are more fully developed, movement occurs during both day and night. Larvae transition into the juvenile phase at approximately 30 mm total length (TL) and move further downstream into brackish waters, developing a tolerance to salinity. Eventually they become residents in estuarine waters for months to years before emigrating to open ocean (ASSRT 2007, ASMFC 2012).

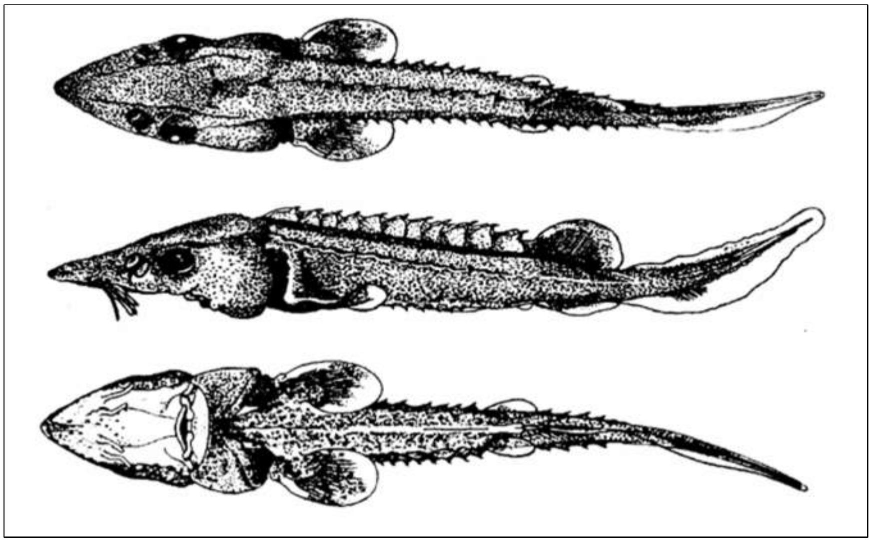
Atlantic Sturgeon larvae are expected to be approximately 7 - 9 mm TL at hatching (Bath et al. 1981, Smith 1980 as cited in Bain et al. 2000, Gilbert 1989, Snyder 1988), although Jones et al. (1978) describe a newly hatched Atlantic Sturgeon larvae at 11.5 mm TL. The head width is 8% of standard length (SL) with a depth of 11 % of SL (behind the posterior margin of the eye). The yolk-sac maxima is 23 % of SL and the yolk-sac depth is 20% of SL (Snyder 1988). Jones et al. (1978) describes the newly hatched Atlantic Sturgeon larvae with a head and the tail that is darkly pigmented and a yolk that is a large "dirty yellow," vascular oval. The head is not deflected over the yolk (bent around the yolk). The mouth is formed. The eye is relatively small and is about the same size as the round auditory vesicles. The branchial arches are concealed by the opercular folds, the barbels are lacking, pectoral buds are present, and the origin of the dorsal finfold is in the occipital region. Bath et al. (1981) reports that a continuous finfold extends from behind the head dorsally around the notochord and ventrally to the posterior end of the yolk sac, a dorsal wedge-shaped cavity at the fourth ventricle in the posterior of the blunt head, and a vent extended through the finfold at 0.6 to 0.7 of the TL from the snout. The spiral valve was distinguishable, even in small specimens.



Source: Snyder 1988

Figure A-2. Atlantic Sturgeon Yolk Sac Larvae Just Hatched

Snyder (1988) reports that Atlantic Sturgeon complete yolk absorption by 13 - 14 mm SL in 6 - 7 days, acquire their first scutes between 17 and 20 mm SL at 13 - 29 days, acquire their first fin rays at 21 mm SL (13 - 29 days), and acquire a full complement of fin rays, except the caudal fin, between 47 and 58 mm SL at 29 - 100 days. A 29-day hatchery-reared larva is presented in Figure A-3.



Source: Snyder 1988

Figure A-3. Atlantic Sturgeon, 28.9 mm SL, 29.3 MM TL, 29 Days After Hatching

Mean myomere counts for Shortnose and Atlantic Sturgeon are 38 preanal and 22 or 23 postanal. Snyder (1988) presents a detailed comparison of shortnose and Atlantic Sturgeon and provides details on the age and length of the onset of certain developmental events.

Juvenile Atlantic Sturgeon demonstrate a lot of variation with regard to salinity tolerance (ASMFC 2012). Atlantic Sturgeon spawn in their natal river and remain in the river until approximately age two and at lengths of approximately 76 - 92 cm (30 - 36 inches; ASSRT 2007). Yearlings are known to occupy freshwater portions of their natal river (Secor et al. 2000) and their distribution in the James River is expected to follow this pattern. Juveniles in the river are also restricted to low salinity areas, with overwintering known to occur in deep water areas near river mile 25 (NMFS 2012a).

Hager (2011) used telemetry to establish movement patterns of adult and subadult Atlantic Sturgeon in the James River. Thirty-two adults and thirty-three subadults were outfitted with telemetry tags and telemetry receivers were placed throughout the river to record the presence of tagged fish when they are within approximately one kilometer of the receivers.

Results of Hager (2011) indicate that adult Atlantic Sturgeon enter the James River in spring when water temperatures are around 17°C, and occur from river mile 29 to river mile 67 before departing from the river in June when water temperatures are around 24° C. Data collected in 2010 demonstrated a congregation of sturgeon in freshwater areas near river mile 48, suggesting the possibility of spawning in this area (Hager 2011). Adult Sturgeon appear to be absent from the James River for most of the summer until late August when tagged fish are once again detected in the river (Hager 2011). During the late summer-early fall residency (August-October), fish ascend the river rapidly and congregate in upriver sites between river mile 48 and the fall line near Richmond, VA; possibly in response to physiologically stressful conditions (e.g., low dissolved oxygen and elevated water temperature) in the lower James River and Chesapeake Bay (Hager 2011). During late summer, Atlantic Sturgeon exhibited a preference for the river section where the upper James and Appomattox rivers meet, approximately 9 miles downstream from CPS (Hager 2011). As temperature declines in late September or early October, adults disperse through downriver sites and begin to move out of the river (Hager 2011). By November, adults occupy only lower river sites (Hager 2011). By December, adults are undetected on the tracking array and, thus, are presumed to be out of the river (Hager 2011).

The highest number of subadults are present in the river in the spring and fall with the lowest numbers present in August when ambient water temperatures in the river are the highest. At this time of year, most subadults leave the river and any Atlantic Sturgeon remaining in the river are holding in cool water refugia (Hager 2011). The number of subadults in the river peaks in October. Many subadults leave the river for overwintering with some known to overwinter off the coast of North Carolina. Subadults overwintering within the river are located downstream of Hog Island.

Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Habitat Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status Review of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Balazik, G., C. Garman, and J.P. Van Eenennaam. 2012. Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia. Transactions of the American Fisheries Society 141: 1465-1471.

Bain, M.B., N. Haley, D. Peterson, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic Sturgeon, *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River estuary: Lessons for sturgeon conservation. Boletin-Instituto Español de Oceanografía 16: 43-53.

Bath, D.W., J.M. O'Conner, J.B. Alber, and L.G. Arvidson. 1981. Development and identification of larval Atlantic Sturgeon (*Acipenser oxyrhynchus*) and Shortnose Sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. Copeia 1981: 711–717.

Bilkovic, DM, K Angstadt, and D Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia. Final report to NOAA Chesapeake Bay Office, Award Number NA06NMF4570303. Virginia Institute of Marine Science, Center for Coastal Resources Management, Gloucester Point, Virginia.

Bushnoe, T.M., J.A. Musick, and D.S. Ha. 2005. Essential Spawning and Nursery Habitat of Atlantic Sturgeon (*Acipenser oxyrinchus*) in Virginia. Appendix 1 of Essential Fish Habitat of Atlantic Sturgeon *Acipenser Oxyrinchus* in the Southern Chesapeake Bay. Principal Investigator: Jasck Musick. VIMS Scientific Report #145.

Fox, D. 2006. History of Atlantic Sturgeon Fishery. Power Point presentation presented to Delaware Department of Natural Resources, courtesy of Greg Murphy (DEDNR) April 13, 2006.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and Shortnose Sturgeons. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28 pp.

Hager, C. 2011. Atlantic Sturgeon review: Gather data on reproducing subpopulation of Atlantic Sturgeon in the James River. Contract EA133FIOCN0317.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Department of Commerce, Bulletin of the United States Bureau of Fisheries, Volume XLIII.

Jones, P.W., F.D. Martin, and J.D. Hardy Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

Kieffer, M. C. and B. Kynard. 1993. Annual movements of Shortnose and Atlantic Sturgeons in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 122: 1088-1103.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, and Shortnose Sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

National Marine Fisheries Service (NMFS). 2012a. Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission, that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.

NMFS. 2012b. Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).

Smith, T.I.J., E.K. Dingley and D.E. Marchette. 1980. Induced spawning and culture of the Atlantic Sturgeon, *Acipenser oxyrinchus* (Mitchill). Progressive Fish-Culturist 42: 147-151.

Secor, D.H., E.J. Niklitschek, J.T. Stevenson, T.E. Gunderson, S.P. Minkkinen, B. Richardson, B. Florence, M. Mangold, J. Skjeveland, and A. Henderson-Arzapalo. 2000. Dispersal and growth of yearling Atlantic Sturgeon, *Acipenser oxyrinchus*, released into Chesapeake Bay. Fishery Bulletin 98: 800-810.

Snyder, D.E. 1988. Description and Identification of Shortnose and Atlantic Sturgeon Larvae. American Fisheries Society Symposium 5: 7-30.

Appendix B -

Field Instrumentation: -
Calibrations and Standardizations -

WORK PRACTICE DOCUMENT

Field Instrumentation:

Calibrations and Standardizations

Dominion Environmental Services

Table of Contents

1.0 Introduction 2
2.0 Scope 2
3.0 Dominion Employees Covered 2
4.0 Work Practice Description 3
5.0 Safety 3
6.0 Work Practice Requirements 3
7.0 Electric Environmental Biology Calibration and Standardization Protocols 5
- **7.1 Chlorine 5**
- **7.2 Conductivity/Salinity 5**
- **7.3 Dissolved Oxygen (D.O) 7**
- **7.4 pH Meters 8**
- **7.5 Flowmeters 10**
- **7.6 Temperature 10**
- **7.7 Turbidity 10**
- **7.8 Weight 11**
- **7.9 Oxidation/Reduction Potential ORP 12**

8.0 Contacts 13
9.0 Tables 14
11.0 Distribution List 21

WORK PRACTICE DOCUMENT

Calibrations and Standardizations

Electric Environmental Biology

Written Date: 8/16/2011

Revision Date:

Document Owner: Casey Seelig

1.0 Introduction

Dominion is required to monitor a variety of physicochemical parameters in the environment. These parameters are monitored with various types and models of scientific instrumentation. Instruments must be either calibrated or standardized and properly maintained to ensure the accuracy and precision of the data being collected. **Calibration** is a process of physically adjusting an instrument to accurately read a known standard or series of standards. **Standardization** is a process of checking an instrument against a known standard or series of standards to document its accuracy. Standardization, without a physical adjustment to the instrument, checks that the instrument is functioning to its design specifications and, if not the instrument can either be calibrated, serviced by the operator, or sent back to the manufacturer for repair. The manufacturer's recommended calibration and maintenance procedures for a particular instrument are designed to keep the equipment performing to the manufacturer's specifications. Every instrument's accuracy should be verified and documented to ensure it meets the acceptability criteria established for the work.

2.0 Scope

The purpose of this work practice document is to provide the protocols necessary to ensure all field instrumentation and test methods, which are used to measure environmental parameters, are providing data of acceptable accuracy. This work practice document defines the proper methods, frequencies, and acceptance criteria for documenting field instrument and test kit accuracy using calibrations and standardizations. The procedures in this document are general in nature. Due to the number and variety of field instrumentation used, specific calibration procedures for each instrument are beyond the scope of this document. The user's manual should be consulted for specific calibration and standardization procedures.

3.0 Dominion Employees Covered

This work practice applies to all Dominion Environmental Services (DES) employees using field instrumentation to monitor environmental parameters as well as any contractors employed by DES that conduct environmental analyses for monitoring studies. The guidelines and procedures listed in this work practice document apply to instruments used in the field. This does not cover the calibration or standardization of laboratory equipment.

4.0 Work Practice Description

The field instrumentation calibrations and standardizations work practice provides guidance on how to prepare for and safely conduct calibrations and equipment accuracy checks on field instrumentation. This work practice is intended for experienced field technicians or for those under the direct supervision of employees trained in proper calibration and standardization methods used for equipment and reagents required in the collection of environmental data.

5.0 Safety

Safety is a core Dominion principle and all calibration and standardization work must incorporate safe work practices. It is the responsibility of every employee and contractor to work safely. Safety of each employee, contractor, their co-workers and the general public are the first priority of every job. The conduct of all work should conform to the expectations described in the Dominion Safety Policy, the Safety Work Practice for Dominion Environmental Services, the Safety Work Practice for Biology, and the policies of the business unit where the work is being done. The types of Personal Protective Equipment (PPE) necessary for calibrating and standardizing field instruments must be reviewed prior to starting calibrations or standardizations to identify and mitigate any hazards.

1. Specific hazards associated with the type of instruments to be calibrated or standardized must be known prior to the start of the calibration or standardization. Examples of such hazards might include: health and safety concerns associated with the use of pH standards as identified by the Material Safety Data Sheet (MSDS).

2. Where the mitigation of hazards is not possible, Personal Protective Equipment (PPE) must be worn to safely complete the calibration/standardization. A hazard assessment must be performed to evaluate each calibration or standardization task and the proper PPE needs to be worn as outlined in the MSDS and any governing Laboratory Chemical Hygiene Plan. The need for safety glasses, gloves, and appropriate clothing should be considered in every hazard assessment.

3. All employees are required, at a minimum, to be familiar with the Hazard Communication Program for their business unit. The Hazard Communication Program outlines safety expectations when handling and using chemical products, including employee training, chemical labeling, and access to MSDS.

6.0 Work Practice Requirements

1. Personnel that will be calibrating or standardizing instruments or test kits for readings will, at a minimum:

a) Be cognizant of the safe handling and waste disposal of calibration or standardization chemicals.
b) Have training in the use of instrumentation;
c) Have training for the proper use of required PPE;
d) Have a thorough understanding of the proper methods outlined by the manufacturer to maintain, calibrate or standardize the instrument or test kit.

2. Verify state and federal protocols for accuracy and precision of measurements:
a) Review acceptance criteria required by the state and agencies (current acceptance criteria are listed in calibration procedures below and in Table1);
b) Document all calibrations and standardizations of monitoring instruments and test kits.

3. Pre-Calibration/Standardization Preparation
a) Review the manufacturer's recommendations and procedures;
b) Locate and fill out the appropriate calibration/standardization log sheet;
c) Verify the expiration/certification date of all standards to be used in the calibration/standardization process;
d) Verify the instrument's or test kit's make, model, and serial number or unique identifier and record it on the log sheet;

4. Instrument or Test kit Calibration/Standardization
a) Document the date, time, and the person(s) conducting the calibration/standardization;
b) Select a range of standards to be used for calibration or to be checked for the instrument/test kit's accuracy, which will bracket expected field/laboratory survey results;
c) Document the results (standard verses reading) and verify that they meet the acceptance criteria;
e) If the equipment fails calibration/standardization, service and clean the equipment and re-calibrate/standardize;
f) If the equipment continues to fail, label "Inactive Status" and remove the equipment from service (send the equipment back to the manufacturer for servicing) and document this on the log sheet;

Note: If an instrument or test kit does not comply with the established acceptance criteria, it must not be used for collecting data and must be removed from service.

g) Properly label and dispose of all waste chemicals and materials. Dispose of any hazardous wastes according to the Hazard Waste Management Guidance Document.

5. Verification
a) DES personnel must record the instrument/test kit identifier (e.g., serial number) on field and boat log sheets to provide a traceable accuracy for every measurement collected;
b) Annual reviews of calibration/standardization logs should be performed to verify compliance. Calibration/standardization logs should be checked to verify that records are complete, legible, and up to date.

7.0 Calibration and Standardization Protocols

Many instruments and test kits are not able to be calibrated in the field or by the user. These instruments and test kits need to be checked routinely using known standards to establish and document their accuracy. For example it is not possible to adjust a capillary thermometer; therefore accuracy needs to be compared to a reference thermometer of certified accuracy. In many cases checking standards and documenting the instrument's accuracy in the range of conditions it will be used can be more efficient than calibration procedures. In all cases, follow the manufacturer's recommended maintenance and calibration directives.

The following frequencies (Table 1) established for documenting calibrations and standardizations are for instruments and test kits routinely being used for weekly or monthly monitoring studies. If equipment is being used daily for recording large amounts of data, calibration/standardization frequencies must be increased (see Table 1) or standards must be run with samples. For infrequently used equipment (once a quarter or year), calibrations and standardizations should occur prior to use. Data loggers which are being deployed for extended periods of time (>1 month) must be calibrated/standardized immediately prior to and following deployment in the field.

Prior to calibration, all instrument probes must be cleaned according to the manufacturers instructions. Failure to perform this step (proper maintenance) can lead to erratic measurements. When calibrating instruments care must be taken to insure that the volume of the calibration solutions is sufficient to cover both the probe and temperature sensor and be free of air bubbles (see manufacturer's instructions for additional information).

A record of each calibration must be made in the calibration log. The record needs to include at a minimum:

- serial number of the instrument
- parameters which were calibrated
- standards used in calibration
- date and time of calibration
- initials of technician

7.1 Chlorine

Chlorine testing in the field is usually done using a colorimeter. There are two methods of standardization: 1) gel standards (once a week or prior to use) and 2) ampule standards (recommended every 13 weeks). Prior to reading the standards, zero the colorimeter with a blank (deionized water) and record measurements to 0.01 mg/L. Acceptance criterion for the gel standards (0.20, 0.83, and 1.53 mg/L) is ±15% and for the ampule standards (0.12, 0.60, 1.20 mg/L) is ±20%. If expected chlorine levels are higher than the range of these standards, select standards that bracket the expected field results.

7.2 Conductivity and Salinity

Conductivity is used to measure the ability of an aqueous solution to carry an electrical current. Specific conductance is the conductivity value corrected to 25°C. There are a variety of instruments available to measure conductivity, specific conductance, salinity, and temperature. Most instruments are calibrated against a single standard which is near, but below the specific conductance of the environmental samples. A second standard which is above the environmental sample specific conductance is used to check the linearity of the instrument in the range of measurements.

If cleaning electrical connections, changing batteries (recharging), or changing sensors does not correct standardization failures, then the unit should be sent back to the manufacturer for servicing. Freshwater standards (0.05-1.00 mS/cm) or Seawater standards (40-60 mS/cm) are recommended for standardizations checks every 13 weeks. These standardizations should be conducted at a temperature of 25°C±1°C. The acceptance criterion is ±5%. The temperature probes of these meters should be checked for accuracy (acceptance criterion ±0.5°C) at the same time because temperature is factored into the meters program for calculating conductivity, specific conductance and salinity. Standardizations can be done with a specifically designated and labeled "Reference Meter", which must be standardized with standard water samples every 4 weeks. Refractometers (salinity/density) must be standardized (acceptance criterion ±1.0 ppt) every 13 weeks or prior to use with a "Reference Meter." Before using a refractometer for recording salinity data, verify that it meets or exceeds the precision requirements for the data being collected.

Calibration Procedure

1. Allow the calibration standard to equilibrate to the ambient temperature.

2. Remove probe from its storage container, rinse the probe with a small amount of the conductivity/specific conductance standard (discard the rinsate), and place the probe into the conductivity/specific conductance standard.

3. Select monitoring/run mode. Wait until the probe temperature has stabilized.

4. Look up the conductivity value at this temperature from the conductivity versus temperature correction table usually found on the standard bottle or on the standard instruction sheet. You may need to interpolate the conductivity value between temperatures. Select calibration mode, then conductivity. Enter the temperature corrected conductivity value into the instrument.

5. Select monitoring/run mode. The reading should remain within manufacturer's specifications. If it does not, re-calibrate. If readings continue to change after recalibration, consult manufacturer.

6. Read the specific conductance on the instrument and compare the value to the specific conductance value on the standard. The instrument value should agree with the standard within the manufacturer's specifications. If not, re-calibrate. If the re-calibration does not correct the problem, the probe may need to be cleaned or serviced by the instrument manufacturer.

7. Remove probe from the standard, rinse the probe with a small amount of the second conductivity/specific conductance standard (discard the rinsate), and place the probe into the second conductivity/specific conductance standard. The second standard will serve to verify the linearity of the instrument. Read the specific conductance value from the instrument and compare the value to the specific conductance on the standard. The two values should agree within the specifications of the instrument. If they do not agree, recalibrate. If readings do not compare, then the second standard may be outside the linear range of the instrument. Use a standard that is closer, but above the first standard and repeat the verification. If values still do not compare, try cleaning the probe or consult the manufacturer.

8. When monitoring groundwater or surface water, use the specific conductance readings.

7.3 Dissolved Oxygen (D.O.)

Dissolved oxygen (DO) content in water is measured using a membrane electrode. The DO probe's membrane and electrolyte solution should be replaced prior to the sampling period. Failure to perform this step may lead to erratic measurements. There are a variety of instruments available to measure dissolved oxygen (% saturation & mg/L) and temperature.

If cleaning electrical connections, changing batteries (recharging), or changing the permeable membrane on the sensor does not correct standardization failures, then the unit should be sent back to the manufacturer for servicing. If the unit has an air calibration function, air calibrate (100% saturation) the meter prior to use or follow manufacture's directives. Newer instruments utilize a luminescent dissolved oxygen probe (LDO). LDO sensor caps need to be replaced based on the manufacturer's maintenance schedule. LDO sensors are calibrated using air saturated water.

Calibration Procedure

1. Gently dry the temperature sensor according to manufacturer's instructions.

2. Place a wet sponge or a wet paper towel on the bottom of the DO calibration container.

3. Place the DO probe into the container without the probe coming in contact with the wet sponge or paper towel. The probe must fit tightly into the container to prevent the escape of moisture evaporating from the sponge or towel.

4. Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn-on the instrument to allow the DO probe to warm-up. Select monitoring/run mode. Check temperature readings. Temperature readings must stabilize before continuing to the next step.

5. Select calibration mode; then select "DO %".

6. Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement must be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location. [Note: inches of mercury times 25.4 mm/inch equals mm of mercury or consult Oxygen Solubility at Indicated Pressure, Table 2].

7. The instrument should indicate that the calibration is in progress. The instrument will take approximately one minute to calibrate. After calibration, the instrument should display percent saturated DO.

8. Select monitoring/run mode. Compare the DO mg/l reading to the Oxygen Solubility at Indicated Pressure chart (Table 2). The numbers should agree. If they do not agree to the accuracy of the instrument (usually ± 0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution. Insure that there are no air bubbles trapped below the membrane.

9. Remove the probe from the container and place it into a 0.0 mg/L DO standard. The standard must be filled to the top of its container and the DO probe must fit tightly into the standard's container (no head space). Check temperature readings. They must stabilize before continuing.

10. Wait until the "mg/l DO" readings have stabilized. The instrument should read 0.0 mg/L or to the accuracy of the instrument (usually ± 0.2 mg/L). If the instrument cannot reach these values, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, prepare a new 0.0 mg/L DO standard. If these measures do not work, contact manufacturer.

Note: To prepare a zero mg/L DO standard follow the procedure stated in Standard Methods (4500-O G; 18th edition). The method states to add excess sodium sulfite (until no more dissolves) and a trace amount of cobalt chloride to water. The standard container must be completely filled (no head space). This solution is prepared prior to the sampling event. If some of the solution is lost during instrument calibration, add more water to the container so that the standard is stored with no head space.

7.4 pH Meters

The pH of a sample is determined electrometrically using a glass electrode. There are a variety of instruments available to measure pH and temperature. There are pH test strips, indicator solutions, data loggers (e.g., Hydrolab minisonde) with pH sensors and hand-held DC powered pH meters. A pH meter must be calibrated/standardized daily prior to use (Standard Methods 4500-H^+ B; 18th Edition). If standardizing, select standard buffer solutions that bracket the pH range of the samples to be measured. The acceptance criterion is ±0.1 su. If pH standards 2 and 10 are used, pH 7 should be used as a check. When calibrating (two point calibration), use fresh (unused) buffer standards. The temperature probes of pH meters (if there is a readout displayed) should be checked for accuracy (acceptance criterion (±0.5°C) at the same time as pH calibration/standardization because temperature adjustments are made by the meters program in calculating the pH value. Properly label and dispose of all waste chemicals and materials. Dispose of hazardous wastes according with the Hazard Waste Management Guidance Document.

Calibration Procedure

1. Allow the fresh buffered standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the fresh buffered standards so each standard will cover the pH probe and temperature sensor.

3. Remove probe from its storage container, rinse with distilled water, and blot dry with soft tissue.

4. Select monitoring/run mode. Immerse probe into the initial standard (e.g., pH 7).

5. Stir the standard until the readings stabilize. If the reading does not change within 30 seconds, select calibration mode and then select "pH". Enter the buffered standard value into instrument. Select monitoring/run mode. The readings should remain within manufacturer's specifications; if they change, re-calibrate. If readings continue to change after re-calibration, consult manufacturer.

6. Remove probe from the initial standard, rinse with distilled water, and blot dry.

7. Immerse probe into the second standard (e.g., pH 4). Repeat step 5.

8. Remove probe from the second standard, rinse with distilled water, and blot dry. If instrument only accepts two standards, the calibration is complete. Go to step 11. Otherwise continue.

9. Immerse probe in third buffered standard (e.g., pH 10) and repeat step 5.

10. Remove probe from the third standard, rinse with distilled water, and blot dry.

11. Select monitoring/run mode, if not already selected. To ensure that the initial calibration standard (e.g., pH 7) has not changed; immerse the probe into the initial standard. Wait for the readings to stabilize. The reading should read the initial standard value within the manufacturer's specifications. If not, re-calibrate the instrument. If recalibration does not help, the calibration range may be too great. Reduce calibration range by using standards that are closer together.

12. The calibration is complete. Place pH probe in its storage container.

7.5 Flowmeters

Flowmeters (e.g., General Oceanics, Inc.) are used in the openings of plankton nets to estimate the volume of water passing through the net during sampling. These mechanical meters record the revolutions of the impellers; the revolutions per unit time are used to calculate flow through the net. Flowmeters must be standardized once every 52 weeks. The accuracy of these meters is based on how freely the impeller spins, which is verified using a General Oceanics, Inc. Calibration Frame. The frame imparts a torsionally precise spin to the rotor and a count difference is noted in the flowmeter window. A minimum count is necessary for the flowmeter to be within calibration. The acceptance criterion for a General Oceanics, Inc. flowmeter is 80 revolutions per standard spin.

7.6 Temperature

Temperature data are collected with data loggers, thermometers, and thermistors in a variety of multiparameter meters (e.g., pH, D.O., and Conductivity/Salinity). Each instrument must have the accuracy of its temperature component verified because many of the other parameters change with temperature. "Reference Thermometers" are glass, capillary thermometers that have a read out accuracy 0.1°C and they have their accuracy verified with a certified thermometer once every 52 weeks. The acceptance criterion for Reference Thermometers is ±0.2°C. All other capillary thermometers used in the collection of data are standardized to the Reference Thermometers every 52 weeks (the acceptance criterion is ±0.5°C). Data loggers are standardized every 26 weeks (the acceptance criterion is ±0.5°C). Thermistors in multimeters are standardized every 13 weeks (the acceptance criterion is ±0.5°C).

Verification Procedure

1. Allow a container filled with water to come to room temperature.

2. Place a thermometer that is traceable to the National Institute of Standards and Technology (NIST) and the instrument's temperature sensor into the water and wait for both temperature readings to stabilize.

3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (usually ±0.15°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

7.7 Turbidity

Turbidity meters are standardized with primary standards once every 13 weeks and with secondary standards prior to use. The meters are zeroed with de-ionized water prior to standardization and use. Primary standards are made up from mixing a powder in de-ionized water (4 standards are measured: <1, 20, 100, & 800 NTU) and the acceptance criterion is ±5%. Secondary standards are gels in the range of 5, 50, 500

NTU and the acceptance criterion is ±10%. De-ionized water is measured three times prior to measuring the gel standards.

The turbidity is based upon a comparison of intensity of light scattered by a sample under defined conditions with the intensity of light scattered by a standard reference suspension. A turbidimeter is a nephelometer with a visible light source for illuminating the sample and one or more photo-electric detectors placed ninety degrees to the path of the light source. Some instruments will only accept one standard. For these instruments, the standards will serve as check points.

Calibration Procedures

1. Allow the calibration standards to equilibrate at the ambient temperature. The use of commercially available polymer primary standards (AMCO-AEPA-1) is preferred, however, the standards can be prepared using Formazin according to the EPA analytical Method 180.1.

2. If the standard cuvette is not sealed, rinse a cuvette with deionized water. Shake the cuvette to remove as much water as possible. Do not wipe dry the inside of the cuvette because lint from the wipe may remain in the cuvette. Add the standard to the cuvette.

3. Before performing the calibration procedure, make sure the cuvettes are not scratched and the outside surfaces are dry, free from fingerprints and dust. If the cuvette is scratched or dirty, discard or clean the cuvette respectively.

4. Zero the instrument by using either a zero or 0.02 NTU standard. A zero standard (approximately 0 NTU) can be prepared by passing distilled water through a 0.45 micron pore size membrane filter.

5. Using a standard in the range of 5 - 20 NTUs, calibrate according to manufacturer's instructions or verify calibration if instrument will not accept a second standard. If verifying, the instrument should read standard value to within the specifications of the instrument. If the instrument has range of scales, check each range that will be used during the sampling event with a standard that falls within that range.

7. Using a standard between 20 and 100 NTUs, calibrate according to manufacturer's instructions or verify calibration if instrument does not accept a third standard. If verifying, the instrument should read standard value to within the specifications of the instrument. If the instrument has range of scales, check each range that will be used with the proper standard for that scale.

7.8 Weight

Precision balances with an accuracy of 0.001 to 0.00001 grams are calibrated once every 52 weeks by a vendor. All scales and balances used for collecting environmental data are standardized with a minimum of three standard weights (Class 4 or better) every 4 weeks. Personnel using balances to collect weight data need to check the calibration sticker for the standardization expiration date and the range of the standardization. If weight measurements are being made outside the documented standardization range, a new weight range bracketing the expected measurements needs to be used in standardizing the balance.

7.9 Oxidation/Reduction Potential (ORP)

The oxidation/reduction potential is the electrometric difference measured in a solution between an inert indicator electrode and a suitable reference electrode. The electrometric difference is measured in millivolts (mV) and is temperature dependent. ORP is calibrated using one-point calibration with a Zobell solution. The acceptance criteria for ORP standard potential should be within ±10 mV at a defined temperature.

Calibration Procedure

1. Allow the calibration standard (a Zobell solution) to equilibrate to ambient temperature.

2. Remove the probe from its storage container, and place it into the standard.

3. Select monitoring/run mode.

4. While stirring the standard, wait for the probe temperature to stabilize, and then read the temperature.

5. Look up the millivolt (mv) value at this temperature from the millivolt versus Temperature (Table 3) correction table usually found on the standard bottle or on the standard instruction sheet. You may need to interpolate millivolt value between temperatures. Select "calibration mode", then "ORP". Enter the temperature-corrected ORP value into the instrument.

6. Select monitoring/run mode. The readings should remain unchanged within manufacturer's specifications. If they change, re-calibrate. If readings continue to change after re-calibration, consult manufacturer.

7. If the instrument instruction manual states that the instrument is factory calibrated, then verify the factory calibration against the standard. If they do not agree within the specifications of the instrument, the instrument will need to be re-calibrated by the manufacturer.

8.0 Contacts

Name	Office	Cell
Karen Canody (Manager Biology)	804-273-3893 804-271-5304	804-627-3262
Casey Seelig (EB)	804-271-5312	804-385-6655
Raymond Heller (EB Millstone)	860-447-1791 ext. 5054	860-333-3832
Keith German (GES)	304-627-3947 ext. 4836	412-736-2983
Jim Levin (Cove Point)	410-286-5136	443-532-0912

9.0 Tables

Table 1. Calibration and Standardization Protocols

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Chlorine	Test Kit (gel standard)	Weekly	0.20 mg/L, 0.83 mg/L, 1.53 mg/L	±15%	Standardization	Zero meter to blank prior to measuring gel standards.
	Test Kit (ampule standard)	13 wks	Total Chlorine 0.12 (0.02 to 0.22) mg/L 0.60 (0.40 to 0.80) mg/L 1.20 (0.90 to 1.50) mg/L	±20%	Standardization	Record concentrations to 0.01 mg/L. Zero meter to blank prior to measuring standards.
Conductivity (specific conductance)	Instrument/Meter	13 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	If standard temperature is 25°C±1, standardize to specific conductance or conductivity.
			Seawater 40-60 mS/cm	±5%	Standardization	
	Reference Meter	4 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	
			Seawater 40-60 mS/cm	±5%	Standardization	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Dissolved Oxygen	Reference/Instrument/Meter	4 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L	±0.05 mg/L	Standardization	For dissolved oxygen, air calibrate prior to comparing to standard and record the temperature of standard.
	Optical DO Meter	4 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
	Test Kit	52 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
	Test Kit Instrument/Meter	Air calibrate prior to use	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
ORP	Instrument/Meter	Prior to use	Zobell's Solution	±10mV	Calibration	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
pH	AC Counter Top Units	Daily/Weekly	4.0, 7.0, and 10.0 Buffers	±0.1 su	Two Point Calibration or Standardization	Daily when meter is first turned on or weekly if meter remains on
	Battery Powered Portable Units	Day-of-Use	4.0, 7.0, and 10.0 Buffers	±0.1 su	Two Point Calibration or Standardization	Day-of-Use = 24 hour period following the last meter calibration or standardization
Flowmeter	Calibration Fame	52 wks	Standard spin	at least 80 revolutions	Standardization	General Oceanics Inc. Method
Salinity (specific conductance)	Visual Inspection	13 wks	Manufacturer's recommendations	Good condition	Equipment Check	Batteries are replaced every 13 weeks
	Reference Meter	4 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	If standard temperature is 25°C±1, standardize to specific conductance or conductivity.
	Instrument/Meter	13 wks	Seawater 40-60 mS/cm	±5%	Standardization	
	Instrument/Meter	13 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	
	Instrument/Meter	13 wks	Seawater 40-60 mS/cm	±5%	Standardization	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Temperature	Reference Thermometer	52 wks	Certified Thermometer	±0.2°C	Three Temperatures to 0.1 °C accuracy	If deviation is greater than 0.1 °C, attach a tag with the correction factor to 0.1 °C or replace the thermometer
	Thermistor	13 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	
	Thermometer	52 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	For thermometers with 1 °C increments, record temperature to 0.2 °C and for thermometers with 0.1 °C increments to 0.1 °C
	Data Logger	26 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	
Turbidity	Primary Standard	13 wks	4 Standards (<1, 20, 100, & 800 NTU)	±5%	Standardization	Zero meter to de-ionized water.
	Secondary Standard	Prior to Use	Gel Standards (0-10, 10-100, 100-1000 NTU)	±10%	Standardization	Measure de-ionized water three times prior to measuring gel standards.
Weight	Balance	4 wks	Minimum of three reference weights	±5% Reference Weight	Standardization	Two weights should bracket the expected range for which the balance will be used and the third weight should be at an approximate mid-range.

Table 2. Oxygen Solubility (mg/L) at Indicated Pressure

	Atmospheric Pressure (mm Hg)						
Temp. °C	760	755	750	745	740	735	730
0	14.57	14.47	14.38	14.28	14.18	14.09	13.99
1	14.17	14.08	13.98	13.89	13.79	13.70	13.61
2	13.79	13.70	13.61	13.52	13.42	13.33	13.24
3	13.43	13.34	13.25	13.16	13.07	12.98	12.90
4	13.08	12.99	12.91	12.82	12.73	12.65	12.56
5	12.74	12.66	12.57	12.49	12.40	12.32	12.23
6	12.42	12.34	12.26	12.17	12.09	12.01	11.93
7	12.11	12.03	11.95	11.87	11.79	11.71	11.63
8	11.81	11.73	11.65	11.57	11.50	11.42	11.34
9	11.53	11.45	11.38	11.30	11.22	11.15	11.07
10	11.28	11.19	11.11	11.04	10.96	10.89	10.81
11	10.99	10.92	10.84	10.77	10.70	10.62	10.55
12	10.74	10.67	10.60	10.53	10.45	10.38	10.31
13	10.50	10.43	10.36	10.29	10.22	10.15	10.08
14	10.27	10.20	10.13	10.06	10.00	9.93	9.86
15	10.05	9.98	9.92	9.85	9.78	9.71	9.65
16	9.83	9.76	9.70	9.63	9.57	9.50	9.43
17	9.63	9.57	9.50	9.44	9.37	9.31	9.24
18	9.43	9.37	9.30	9.24	9.18	9.11	9.05
19	9.24	9.18	9.12	9.05	8.99	8.93	8.87
20	9.06	9.00	8.94	8.88	8.82	8.75	8.69
21	8.88	8.82	8.76	8.70	8.64	8.58	8.52
22	8.71	8.65	8.59	8.53	8.47	8.42	8.36
23	8.55	8.49	8.43	8.38	8.32	8.26	8.20
24	8.39	8.33	8.28	8.22	8.16	8.11	8.05
25	8.24	8.18	8.13	8.07	8.02	7.96	7.90
26	8.09	8.03	7.98	7.92	7.87	7.81	7.76
27	7.95	7.90	7.84	7.79	7.73	7.68	7.62
28	7.81	7.76	7.70	7.65	7.60	7.54	7.49
29	7.68	7.63	7.57	7.52	7.47	7.42	7.36
30	7.55	7.50	7.45	7.39	7.34	7.29	7.24
31	7.42	7.37	7.32	7.27	7.22	7.16	7.11
32	7.30	7.25	7.20	7.15	7.10	7.05	7.00
33	7.08	7.13	7.08	7.03	6.98	6.93	6.88

18

34	7.07	7.02	6.97	6.92	6.87	6.82	6.78
35	6.95	6.90	6.85	6.80	6.76	6.71	6.66
36	6.84	6.79	6.76	6.70	6.65	6.60	6.55
37	6.73	6.68	6.64	6.59	6.54	6.49	6.45
38	6.63	6.58	6.54	6.49	6.44	6.40	6.35
39	6.52	6.47	6.43	6.38	6.35	6.29	6.24
40	6.42	6.37	6.33	6.28	6.24	6.19	6.15
41	6.32	6.27	6.23	6.18	6.14	6.09	6.05
42	6.22	6.18	6.13	6.09	6.04	6.00	5.95
43	6.13	6.09	6.04	6.00	5.95	5.91	5.87
44	6.03	5.99	5.94	5.90	5.86	5.81	5.77
45	5.94	5.90	5.85	5.81	5.77	5.72	5.68

Table 2 (cont'd). Oxygen Solubility (mg/L) at Indicated Pressure

	Atmospheric Pressure (mm Hg)							
Temp. °C	725	720	715	710	705	700	695	690
0	13.89	13.80	13.70	13.61	13.51	13.41	13.32	13.22
1	13.51	13.42	13.33	13.23	13.14	13.04	12.95	12.86
2	13.15	13.06	12.07	12.88	12.79	12.69	12.60	12.51
3	12.81	12.72	12.63	12.54	12.45	12.36	12.27	12.18
4	12.47	12.39	12.30	12.21	12.13	12.04	11.95	11.87
5	12.15	12.06	11.98	11.89	11.81	11.73	11.64	11.56
6	11.84	11.73	11.68	11.60	11.51	11.43	11.35	11.27
7	11.55	11.47	11.39	11.31	11.22	11.14	11.06	10.98
8	11.26	11.18	11.10	11.02	10.95	10.87	10.79	10.71
9	10.99	10.92	10.84	10.76	10.69	10.61	10.53	10.46
10	10.74	10.66	10.59	10.51	10.44	10.36	10.29	10.21
11	10.48	10.40	10.33	10.28	10.18	10.11	10.04	9.96
12	10.24	10.17	10.10	10.02	9.95	9.88	9.81	9.46
13	10.01	9.94	9.87	9.80	9.73	9.66	9.59	9.52
14	9.79	9.72	9.65	9.68	9.51	9.45	9.38	9.31
15	9.58	9.51	9.44	9.58	9.31	9.24	9.18	9.11
16	9.37	9.30	9.24	9.17	9.11	9.04	8.97	8.91
17	9.18	9.11	9.05	8.98	8.92	8.85	8.79	8.73
18	8.99	8.92	8.86	8.80	8.73	8.67	8.61	8.54
19	8.81	8.74	8.68	8.62	8.56	8.49	8.43	8.37

20	8.63	8.57	8.51	8.45	8.39	8.33	8.27	8.21
21	8.46	8.40	8.34	8.28	8.22	8.16	8.10	8.04
22	8.30	8.24	8.18	8.12	8.06	8.00	7.95	7.89
23	8.15	8.09	8.03	7.97	7.91	7.86	7.80	7.74
24	7.99	7.94	7.88	7.82	7.76	7.71	7.65	7.59
25	7.85	7.79	7.74	7.68	7.60	7.57	7.51	7.46
26	7.70	7.65	7.59	7.54	7.48	7.43	7.37	7.32
27	7.57	7.52	7.46	7.41	7.35	7.30	7.25	7.19
28	7.44	7.38	7.33	7.28	7.22	7.17	7.12	7.06
29	7.31	7.26	7.21	7.15	7.10	7.05	7.00	6.94
30	7.19	7.14	7.08	7.03	6.98	6.93	6.88	6.82
31	7.06	7.01	6.96	6.91	6.86	6.81	6.76	6.70
32	6.95	6.90	6.85	6.80	6.70	6.70	6.64	6.59
33	6.83	6.78	6.73	6.68	6.83	6.58	6.53	6.48
34	6.73	6.68	6.63	6.58	6.53	6.48	6.43	6.38
35	6.61	6.56	6.51	6.47	6.42	6.37	6.36	6.27
36	6.51	6.46	6.41	6.36	6.31	6.27	6.22	6.17
37	6.40	6.35	6.31	6.26	6.21	6.16	6.12	6.07
38	6.30	6.26	6.21	6.16	6.12	6.07	6.02	5.98
39	6.26	6.15	6.11	6.06	6.01	5.97	5.92	5.87
40	6.10	6.06	6.01	5.96	5.92	5.86	5.83	5.78
41	6.00	5.96	5.91	5.87	5.82	5.78	5.73	5.69
42	5.91	5.86	5.82	5.77	5.73	5.69	5.64	5.60
43	5.82	5.78	5.73	5.69	5.65	5.60	5.56	5.51
44	5.72	5.68	5.64	5.59	5.55	5.51	5.46	5.42
45	5.64	5.59	5.55	5.51	5.47	5.42	5.38	5.34

Table 3. Temperature Dependency of Zobell's ORP Standard

Temp. °C	mV
10	243.5
15	236.0
20	228.5
25	221.1

20

11.0

Environmental Services
Pam Faggert

Electric Environmental Services
Cathy Taylor
Karen Canody
Don Hintz
Meredith Simas
Scott Lawton
Nicole Wilkinson
Ken Roller
Bill Scarpinato
Oula Shehab-Dandan
Liz Willoughby
Glenn Johnson
Rick Woolard
Manna Chan

Environmental Biology
Karen Canody
Don Landers
Sheila Hoffman
Paul Vidonic
Robert Andrews
Taylor Allen
Chris Taylor
Casey Seelig
Peter Sturke
Robert Graham
Glenn Bishop
Matt Overton
Greg Decker
James Foertch
John Swenarton
Joseph Vozarik
Raymond Heller
Stephen Dwyer
Susan Gonzalez

Environmental Laboratory
Herb Chriscoe

Gas Environmental Services
Mark Reaser
Sam Mathew
Sheri Franz
Tim Carter
Richard Gangle
Scott Kingston
Brad Will
Olive Dimon
Keith German
Troy Hawkins
Randy Rogers
Christopher Todd
Jim Levin
Roland Pratt
Jason Harshbarger
Judy Box
Mike Leger

Appendix C -

Lists of Data to be Collected and Recorded for Field - Collection and Laboratory Analysis -

Minimum Entrainment Sample Collection Data

Category	Parameter	Value			
General Information	Crew Names				
	Date				
	Time (military)				
	Tidal Phase				
Weather Condition	Air Temp. (°C)				
	Wind Direction				
	Wind Speed (MPH)				
	Sky				
	Precipitation (in)				
	Wave Height (ft)				
Facility Operation	Circulating Pump Status				
	Screen Status				
	Screen Wash Status				
Sampling Location	Unit/Bar Rack	Unit #	Bar Rack ID		
	Time (military)	Start	End		
	Duration (min.)	Calculated			
Flow meter Readings	Time (military)	Meter	Start	End	
	Flow (m^3)	Meter	Start	End	
	Total Volume (m^3)	Calculated			
Water Quality	Time (military)				
	Depth (ft)	Reading	Surface	Mid	Bottom
	Temp. (°C)	Meter	Surface	Mid	Bottom
	DO (mg/L)	Meter	Surface	Mid	Bottom
	Specific Cond. (µs)	Meter	Surface	Mid	Bottom
	Specific Cond. @ 25 °C (µs)	Calculated			
	Salinity (ppt)	Calculated	Surface	Mid	Bottom
	pH	Meter	Surface	Mid	Bottom
Water Quality QC	Temp. (°C)	Bottle			
	DO (mg/L)	Bottle			
	Specific Cond. (µs)	Bottle			
	pH	Bottle			
Gear Used	Mesh size (µm)				
	Dimension				
	Configuration				
Sample Collection	IP Sample Bottle #	Label	Surface	Mid	Bottom
Observations	Vegetation	Note	Light	Moderate	Heavy
	Invertebrates	Note	Light	Moderate	Heavy
	Vertebrates	Note	Light	Moderate	Heavy
Comments					
Crew Signature					

Minimum Entrainment Sample Laboratory Data Sheet

Category	Parameter	Value
Enumera-tion	Date/Time	
	Sample ID	
	Species Taxon Name	
	Egg	Split Fraction Count Egg
	Larvae	Split Fraction Count UID YS PYS JUV
	Total Larvae	Count
	Total Shellfish	Count
	Comments	
Morpho-metrics	Date/Time	
	Sample Number	
	Species Taxon Name	
	Lifestage	
	Total Length / Notochord Length (mm)	
	Body Depth / Width (mm)	
	Head Capsule Depth / Width (mm)	
	Greatest Body Depth / Width (mm)	
	Diameter, Max and Min (eggs only; mm)	
	Greatest Body Length, Width & Depth (Blue Crab only for each life stage; mm)	
	Maximum Widths and Depths based on carapace (Megalopa and later life stage only; mm)	
	Comments	

Note: UID = Unidentified; YS = Yolk Sac; PYS = Post Yolk Sac; JUV = Juvenile

Appendix B: Impingement Characterization Study Plan -

DRAFT Impingement - Characterization Study Plan -

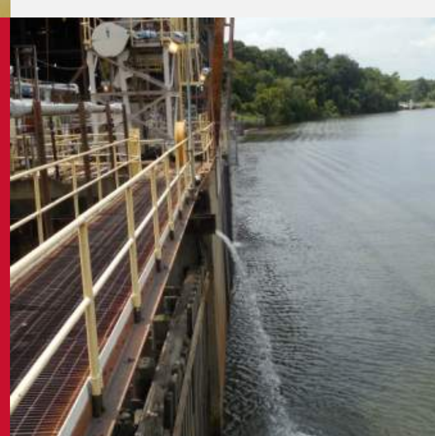
Prepared for: -
Dominion Resources Services, Inc. -

Prepared by: -
HDR Engineering, Inc. -

February 9, 2016

Chesterfield Power Station

Chester, VA 23836



Contents -

1 Introduction ..... 1 -

1.1 Regulatory Background ..... 1 -

1.2 Study Plan Objectives and Document Organization ..... 3 -

2 Generating Station Description ..... 3 -

2.1 Site and Environmental Description ..... 3 -

2.2 Station Description ..... 10 -

2.2.1 Station Operational History ..... 10 -

2.2.2 Intake Structure ..... 10 -

3 Historical Studies ..... 14 -

3.1 Impingement Studies ..... 14 -

3.1.1 Impingement Study, 2005 – 2006 ..... 14 -

3.1.2 Impingement Study, 1977 ..... 18 -

3.2 James River Studies ..... 18 -

3.2.1 Electrofishing and Gill Net Sampling, 2005 – 2006 ..... 18 -

3.2.2 Electrofishing and Gillnet Sampling, 1997 – 1999 ..... 21 -

4 Threatened and Endangered Species ..... 24 -

5 Basis for Sampling Design ..... 33 -

6 Impingement Characterization Study Plan ..... 35 -

6.1 Introduction ..... 35 -

6.2 Safety Policy ..... 35 -

6.3 Field Collection Procedures ..... 35 -

6.3.1 Location ..... 37 -

6.3.2 Equipment ..... 37 -

6.3.3 Sampling Schedule ..... 40 -

6.3.4 Water Quality Measurements ..... 40 -

6.4 Collection Processing ..... 40 -

6.4.1 Initial Impingement Survival ..... 41 -

6.4.2 Morphometrics ..... 41 -

6.4.3 Debris Load Characterization ..... 42 -

6.4.4 Handling Procedures for Atlantic Sturgeon ..... 43 -

7 References ..... 46 -

Appendices

Appendix A. Atlantic Sturgeon Life History Information

Appendix B. Field Instrumentation: Calibrations and Standardizations

Appendix C. Lists of Data to be Collected and Recorded for Field Collection and Processing

Tables -

Table 1-1. §316(b) Rule for Existing Facilities Submittal Requirements Summary .... 2 -

Table 3-1. Impingement Sampling Details, 2005 – 2006 .... 14 -

Table 3-2. Ranked Abundance and Percent Composition of Fish and Shellfish Impinged at CPS, 2005 – - 2006 .... 15 -

Table 3-3. Monthly Impingement Catch at CPS, 2005 – 2006 .... 16 -

Table 3-4. Number of Impinged Fish and Shellfish Collected During Daylight and Nighttime Hours at CPS, - 2005 – 2006 .... 17 -

Table 3-5. Summary Results of Quarterly Ambient Juvenile and Adult Fish Sampling in the Vicinity of - Chesterfield Power Station, 2005 – 2006 .... 20 -

Table 3-6. Electrofishing and Gill Net Stations in the James River in the Vicinity of CPS Shown on Figure - 3-2 below .... 21 -

Table 3-7. Frequency of Occurrence and Total Number of Fish and Shellfish Collected by Electrofishing - During the Chesterfield 316(a) Demonstration .... 23 -

Table 3-8. Frequency of Occurrence and Total Number of Fish and Shellfish Collected by Gillnetting - During the Chesterfield 316(a) Demonstration .... 24 -

Table 4-1. Federal and State Threatened, Endangered, and Proposed Species with the Potential to Occur - within 2 miles of the Cooling Water Intake of CPS .... 30 -

Table 5-1. Summary of Approach for Development of §122.21(r) Required Impingement - Characterizations .... 34 -

Figures -

Figure 2-1. Chesterfield Power Station Regional Location Map ..... 4 -

Figure 2-2. Chesterfield Power Station Area Map ..... 5 -

Figure 2-3. The James River Watershed ..... 6 -

Figure 2-4. Aerial View of Chesterfield Power Station with Cooling Water Intake Location ..... 7 -

Figure 2-5. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at - Mean Lower Low Water) ..... 8 -

Figure 2-6. Survey of James River Depths in Vicinity of Chesterfield Power Station CWISs ..... 9 -

Figure 2-7. Chesterfield Power Station CWIS Configuration ..... 11 -

Figure 2-8. Typical Plan View of Chesterfield Power Station CWIS ..... 12 -

Figure 2-9. Typical Section View of Chesterfield Power Station CWIS ..... 13 -

Figure 3-1. Map Depicting the Study Area and Sampling Stations for 316(b) Studies Conducted June - 2005 – May 2006 ..... 19 -

Figure 3-2. Map Depicting the Study Area and Sampling Stations for 316(a) Studies Conducted April - 1997 – February 1999 ..... 22 -

Figure 6-1. Impingement Sampling Locations ..... 38 -

1 Introduction

1.1 Regulatory Background

Clean Water Act §316(b) was enacted under the 1972 Clean Water Act, which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program. Facilities with NPDES permits are subject to §316(b), which requires that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. Cooling water intakes can cause adverse environmental impacts by drawing early life-stage fish and shellfish into and through cooling water systems (entrainment), or trapping juvenile or adult fish against the screens at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) rule for existing facilities was published in the Federal Register. The rule applies to existing facilities that withdraw more than 2 million gallons per day (MGD) from Waters of the United States, use at least 25 percent of that water exclusively for cooling purposes, and have or require an NPDES permit. The rule supersedes the Phase II rule, which regulated large electrical generating facilities until it was remanded in 2007, and the remanded existing-facility portion of the previously promulgated Phase III rule.

Facilities subject to the new rule are required to develop and submit technical material, identified at §122.21(r)(2)-(13), that will be used by the NPDES Director (Director) to make a BTA determination for the facility (Table 1-1). The specific material required to be submitted and compliance schedule are dependent on actual intake flow rates at the facility and NPDES permit renewal date, respectively. Facilities are to submit their §316(b) application material to their Director along with their next permit renewal, unless that permit renewal takes place prior to July 14, 2018, in which case an alternate schedule may be negotiated.

Dominion's Chesterfield Power Station (CPS) is subject to the existing facility rule and based on its current configuration and operation is anticipated to be required to develop and submit each of the §122.21(r)(2)-(13) submittal requirements with its next permit renewal in accordance with the rule's technical and schedule requirements. Within the §122.21(r)(2)-(13) requirements, (r)(4) and (6) have specific requirements related to impingement evaluations (refer to Table 1-1 for details). While these requirements do not specify that an Impingement Characterization Study must be conducted, Dominion has determined that one is warranted based on the following anticipated benefits:

- Ability to document current impingement at CPS where recent impingement data is not available to support development of 122.21(r)(4) and potentially (r)(6) submittal requirements; and
- Understanding the nature of current impingement at CPS to evaluate potential effectiveness of alternative technologies and determination of fragile species composition.

Table 1-1. §316(b) Rule for Existing Facilities Submittal Requirements Summary -

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source Water Physical Data	Characterization of the source water body including intake area of influence
(3)	Cooling Water Intake Structure Data	Characterization of cooling water system; includes drawings and narrative; description of operation; water balance
(4)	Source Water Baseline Biological Characterization data	Characterization of biological community in the vicinity of the intake; life history summaries; susceptibility to impingement and entrainment; must include existing data; identification of missing data; threatened and endangered species and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival)
(5)	Cooling Water System Data	Narrative description of cooling water system and intake structure; proportion of design flow used; water reuse summary; proportion of source water body withdrawn (monthly); seasonal operation summary; existing impingement mortality and entrainment reduction measures; flow/MW efficiency
(6)	Chosen Method of Compliance with Impingement Mortality Standard	Provides facility's proposed approach to meet the impingement mortality requirement (chosen from seven available options); provides detailed study plan for monitoring compliance, if required by selected compliance option; addresses entrapment where required
(7)	Entrainment Performance studies	Provides summary of relevant entrainment studies (latent mortality, technology efficacy); can be from the facility or elsewhere with justification; studies should not be more than 10 years old without justification; new studies are not required.
(8)	Operational Status	Provides operational status for each unit; age and capacity utilizations for the past five years; upgrades within last 15 years; uprates and Nuclear Regulatory Committee relicensing status for nuclear facilities; decommissioning and replacement plans; current and future operation as it relates to actual and design intake flow
(9)	Entrainment Characterization Study	Requires at least two years of data to sufficiently characterize annual, seasonal, and diel variations in entrainment, including variations related to climate, weather, spawning, feeding, and water column migration; facilities may use historical data that are representative of current operation of the facility and conditions at the site with documentation regarding the continued relevance of the data to document total entrainment and entrainment mortality; includes identifications to the lowest taxon possible; data must be representative of each intake; must document how the location of the intake in the water body and water column are accounted for; must document intake flows associated with the data collection; documentation in the study must include the method in which latent mortality would be identified (including QAQC); sampling and data must be appropriate for a quantitative survey
(10)	Comprehensive Technical Feasibility & Cost Evaluation Study	Provides an evaluation of technical feasibility and incremental costs of entrainment technologies; Net Present Value of facility compliance costs and social costs to be provided; requires peer review
(11)	Benefits Valuation Study	Provides a discussion of monetized and non-monetized water quality benefits of candidate entrainment technologies from (r)(10) using data in (r)(9); benefits to be quantified physical or biological units and monetized using appropriate economic valuation methods; includes changes in fish stock and harvest levels and description of monetization; must evaluate thermal discharges, facility capacity, operations, and reliability; discussion of previous mitigation efforts and affects; benefits to environment and community; social benefits analysis based on principle of willingness-to-pay; requires peer review
(12)	Non-Water Quality Environmental and Other Impacts Assessment	Provides a discussion of non-water quality factors (air emissions and their health and environmental impacts, energy penalty, thermal discharge, noise, safety, grid reliability, consumptive water use, etc.) attributable to the entrainment technologies; requires peer review
(13)	Peer Review	Documentation of external peer review, by qualified experts, of submittals (r) (10), (11), and (12). Peer Reviews must be approved by the NPDES Director and present their credentials. The applicant must explain why it disregarded any significant peer reviewer recommendations.

1.2 Study Plan Objectives and Document Organization

The Impingement Characterization Study Plan provided in this report was developed to support the CPS §316(b) compliance project through development of a site-specific impingement study plan with the following key objectives in mind:

1. - Collect data to support development of §122.21(r)(4) which requires a listing of species and life stages most susceptible to impingement at the facility including documentation of fragile fish and shellfish species (those with < 30% impingement survival);

2. - Collect data to support Dominion's objective of having data sufficient to evaluate biological efficacy of potential alternative intake technologies.

To meet these objectives, this document provides summaries of the station's configuration and operations (Section 2), historical biological sampling efforts conducted at the facility that are relevant to cooling water intake evaluations (Section 3), a summary of Threatened and Endangered Species identified in the vicinity of the facility (Section 4), a sampling program design justification based on this information (Section 5), and the recommended study methods including key parameters of gear, schedule, frequency, and quality control procedures (Section 6).

2 Generating Station Description

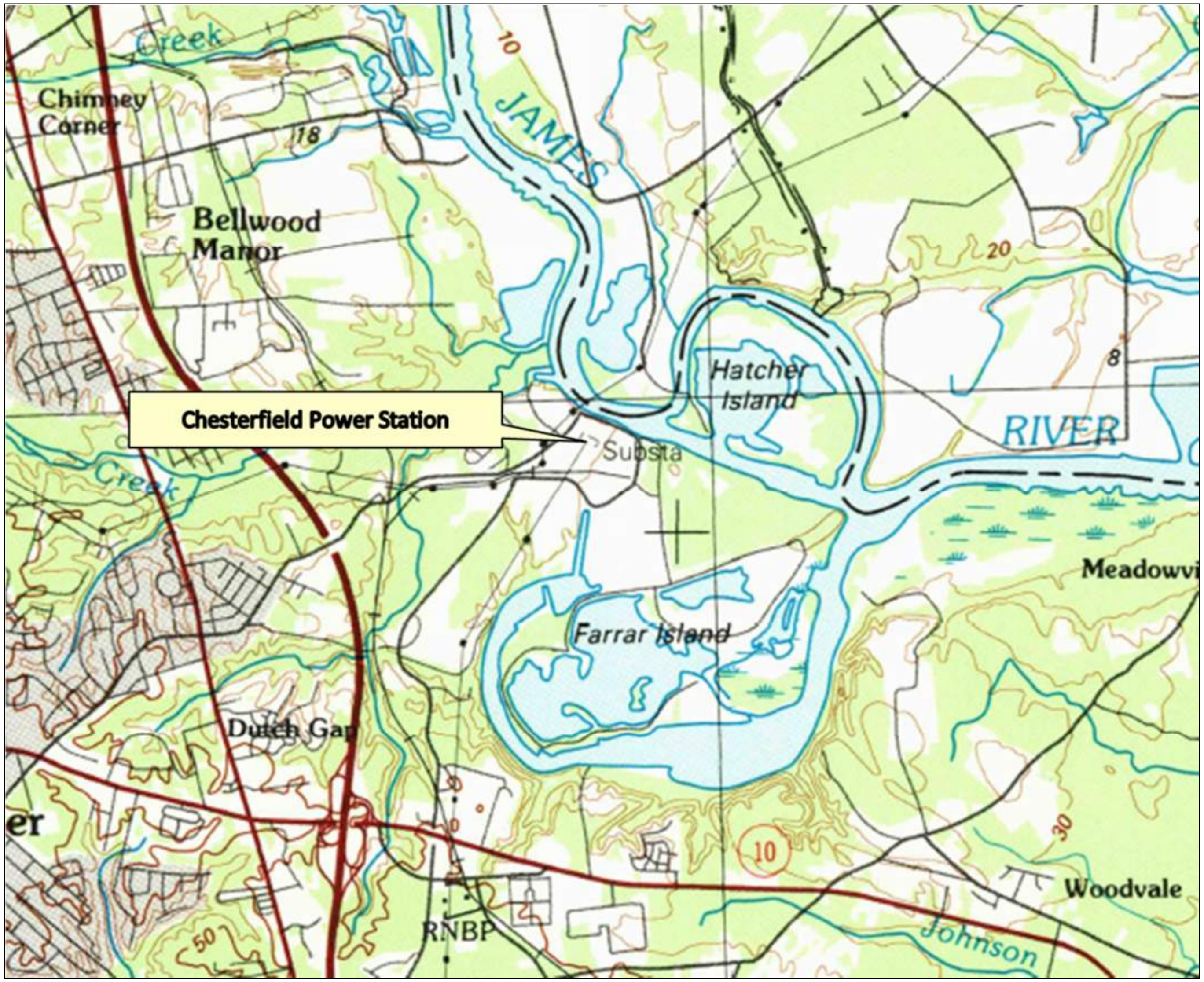
2.1 Site and Environmental Description

Chesterfield Power Station (CPS) is located in the upper tidal portion of the James River, approximately 13 miles downstream of the fall line in the City of Richmond (Figure 2-1). The CPS is located in the Lower James River section in the Coastal Uplands Physiographic Province. In the area of the Station, the James River begins the transition from a higher gradient straight channel with generally steep banks to a meandering channel with oxbow features. The CPS is located near Hatcher Island and Farrar Gut which are two of the first oxbows in the river (Figure 2-2). The river is channelized and is dredged to maintain passage for barge and vessel travel to the Port of Richmond.

The James River watershed encompasses approximately 10,000 square miles, which makes up almost 25 percent of the state. The James River watershed covers about one-third of the Chesapeake Bay drainage area in Virginia. The river flows approximately 340 miles from the Alleghany Mountains of western Virginia to the Chesapeake Bay. The watershed is comprised of three sections: the Upper James watershed begins in Allegheny County and travels through the Allegheny and Blue Ridge Mountains until Lynchburg, the Middle James watershed runs from Lynchburg to Richmond, while the Lower James watershed stretches from Richmond to the Chesapeake Bay (Figure 2-3).

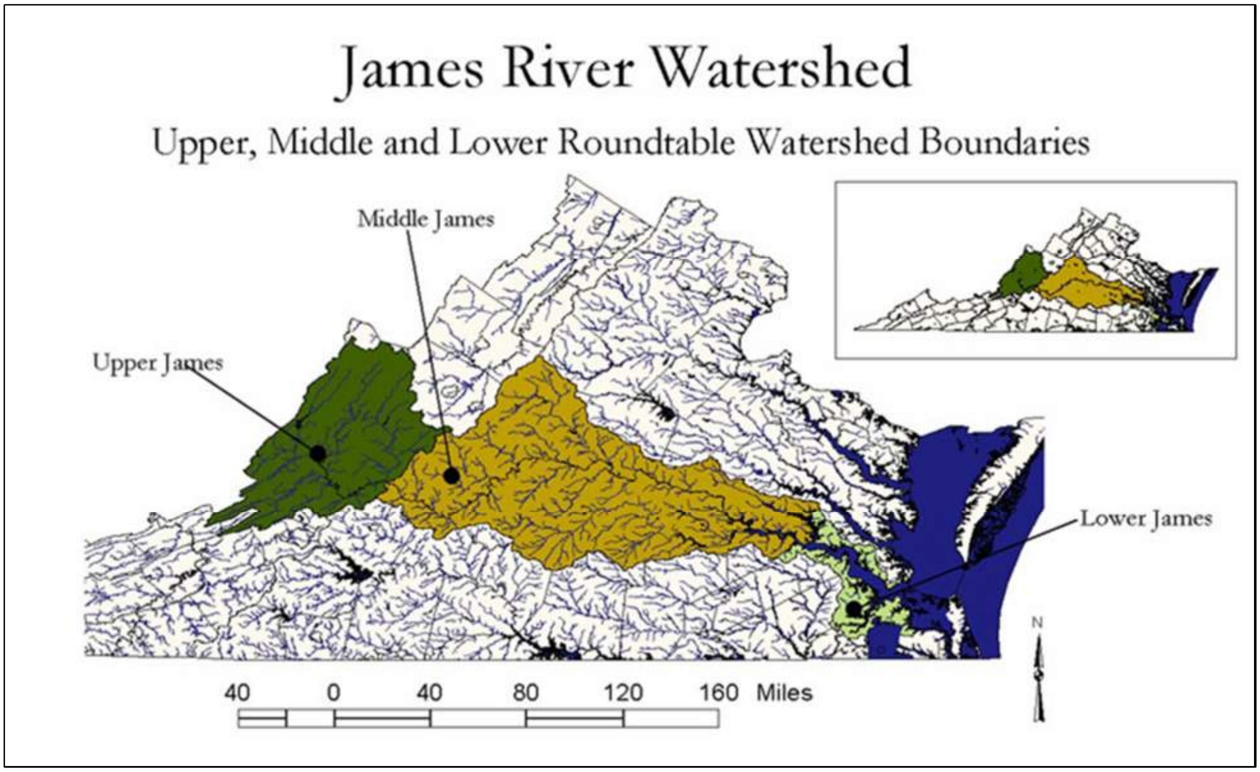
Map Source: USGS Topographic Map of Petersburg, VA; Map ID #37077-A1-TM-100 (1984)

Figure 2-1. Chesterfield Power Station Regional Location Map



Map Source: USGS Topographic Map of Petersburg, VA; Map ID #37077-A1-TM-100 (1984)

Figure 2-2. Chesterfield Power Station Area Map



Source: Middle James Roundtable

Figure 2-3. The James River Watershed

The six power-generating units at CPS use a once-through cooling water system. Cooling water is withdrawn from the James River through five submerged CWISs oriented parallel to, and flush with, the south shoreline of the river (Figure 2-4).

The CWISs for the six units are located on the south side of the river on a bluff. The intakes are located immediately downstream from the Chesterfield County's Proctors Creek Wastewater Treatment Plant. In the vicinity of the CWIS, the river has an abbreviated littoral or shoreline zone as a result of steep bank elevations and the channelized river bottom. At the station, the river is approximately 500 feet (ft) wide and flows in a generally southeasterly direction. Water depths in front of the intakes range from 29 ft to 33 ft with a normal depth of approximately 31 ft. General river depths in the region of the Station are provided in the navigational chart provided in Figure 2-5. Surveyed river bottom depths are provided in the topographical survey provided in Figure 2-6.

The James River at the station experiences a mean tidal amplitude of approximately 2.0 ft. The water level in this portion of the James River fluctuates greatly with an extreme high of elevation 19.0 ft and an extreme low of elevation -3.5 ft. The mean high and low water differ by 5.2 ft; the mean high water is at grade elevation (El.) 3.5 ft and the mean low water is at El. -1.7 ft. Maximum tidal current is approximately 2.8 ft/s with average maximum ebb and flood tidal currents of 1.34 ft/s and 1.5 ft/s, respectively. The James River in the vicinity of the station is a temperate zone river with average temperatures generally ranging from 0.0 °C in February to 34 °C in August.

Image Source: Google Earth, Retrieved 9/25/2014

Figure 2-4. Aerial View of Chesterfield Power Station with Cooling Water Intake Location

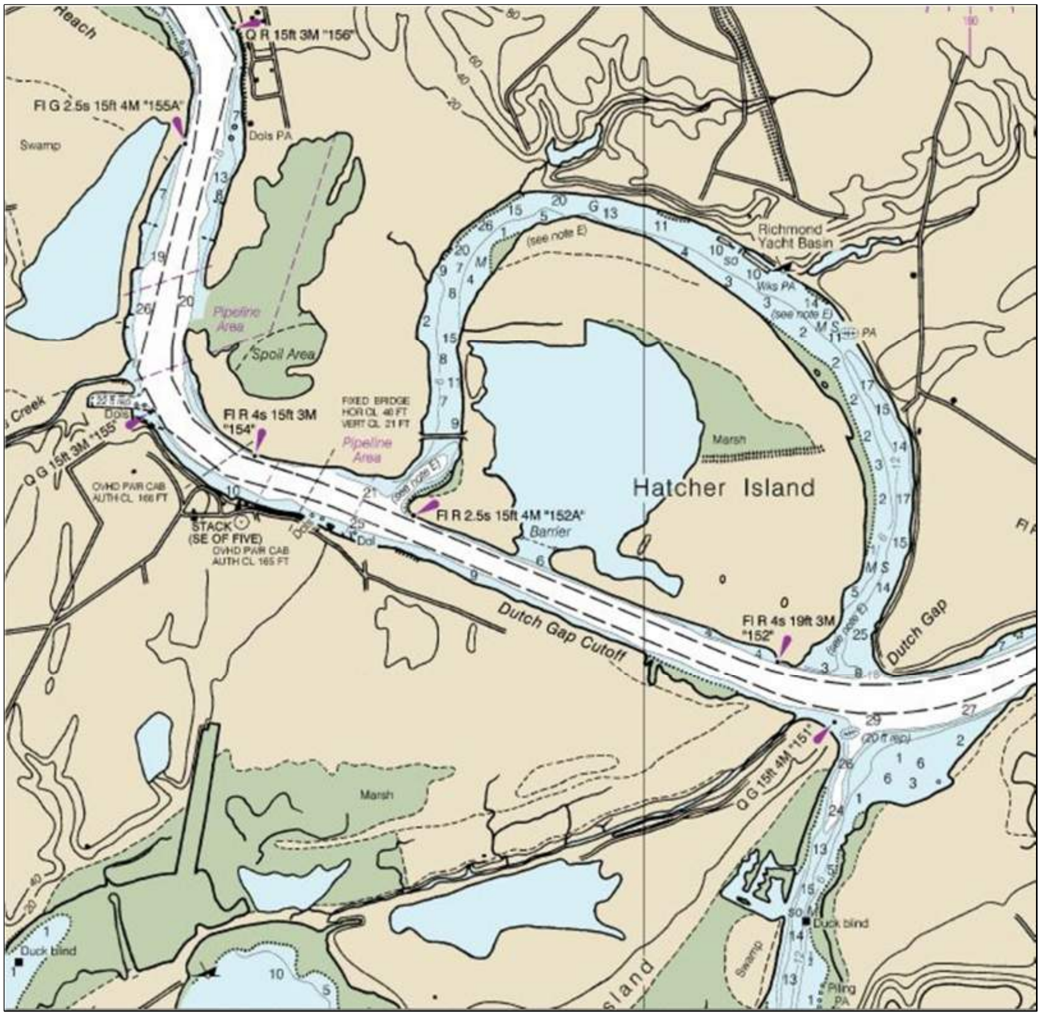


Image Source: NOAA Office of Coast Survey Chart 12252, January 2013, Retrieved 9/25/2014

Figure 2-5. General Water Depths in James River near Chesterfield Power Station (Soundings in Feet at Mean Lower Low Water)

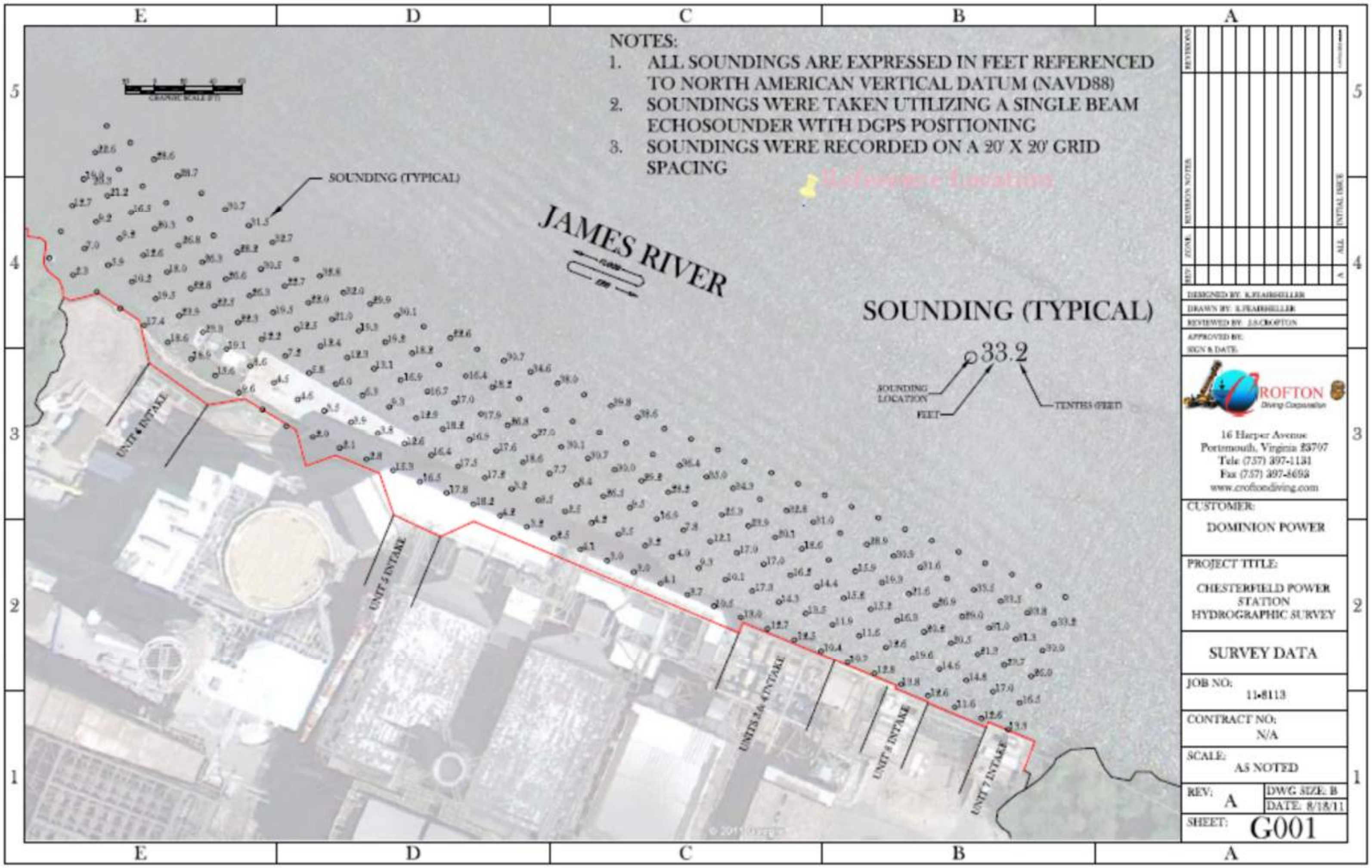


Figure 2-6. Survey of James River Depths in Vicinity of Chesterfield Power Station CWISs -

2.2 Station Description

2.2.1 Station Operational History

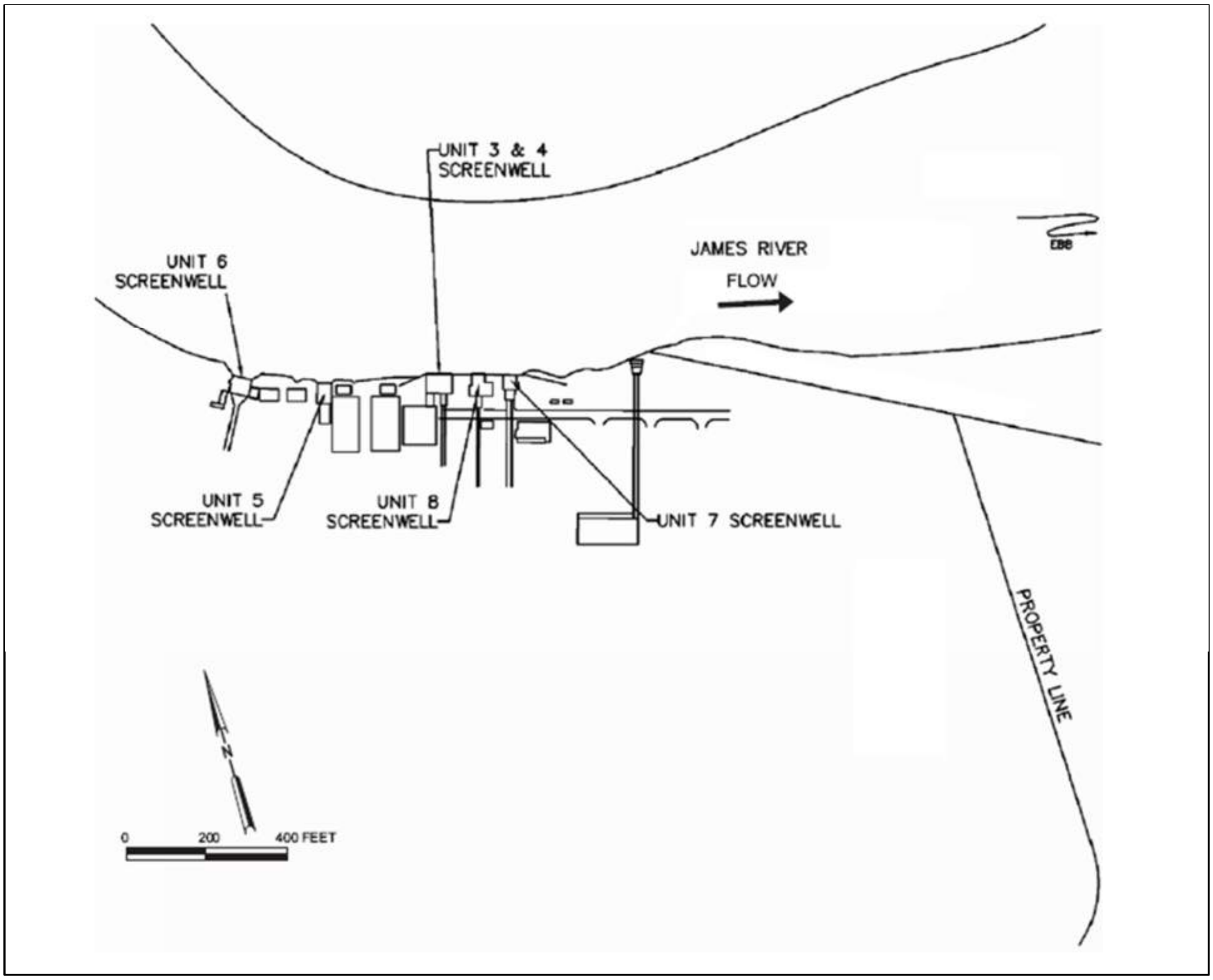
CPS contains six power-generating units: Units 3, 4, 5, and 6 are coal-fired units while Units 7 and 8 are combined-cycle units. The station is a base-load facility which means the facility serves as one of Dominion's primary means of generating the minimum amount of power necessary to meet customer demands. Accordingly, the facility generally operates on a twenty-four hour per day, seven days per week basis, although there is seasonal variation in its operations and maintenance (O&M). In the summer months, all pumps are in operation to meet thermal transfer requirements. There are times in the winter months when all of the pumps are in operation, usually in January and February, which is the winter peaking season. Major outages on the generating units are scheduled for the spring and fall months after the end of the winter peaking season. The duration of the maintenance outages depends on the scheduled work that needs to be done on the units.

2.2.2 Intake Structure

The six power-generating units at CPS utilize a once-through cooling water system that withdraws cooling water from the tidal portion of the James River through five CWISs. When the facility is generating power, the circulating cooling water system is in operation. All the CWISs are submerged and flush with and parallel to the south shoreline. See Figure 2-7 for the unit configuration layout. The total design flow at CPS with all pumps working to capacity is approximately 1,017.7 million gallons per day (MGD) [i.e., 1,574.5 cubic feet per second (cfs)]. Over 98 percent of the water withdrawn from the James River is used for cooling water purposes.

The James River in the vicinity of CPS CWISs is approximately 500 ft wide and 31 ft deep and flows in a generally southeasterly direction. The intake structures are designed to operate at river levels ranging from 3.5 ft below mean sea level (MSL) to 19.0 ft above MSL. The mean high and low water differ by approximately 5.2 ft with the mean high water at 3.5 ft above MSL while the mean low water is 1.7 ft below MSL. All elevations in this report refer to MSL.

Upon approach, the river water encounters a curtain wall that extends beyond the low water level. The curtain walls for Units 3, 4, 7, and 8 extend to 4.5 ft below MSL while the curtain wall for Units 5 and 6 drops down to approximately 4.0 ft below MSL. Downstream of the curtain wall are the trash racks which are installed across the intake structures upstream of the screen bays. Trash racks extend across the entire length of each intake structure (i.e. from the intake structure invert to the intake deck) and prevent debris from entering the screen houses. The trash racks for Units 3 and 4 are approximately 14.5 ft tall by 9.9 ft wide with 0.375-inch (in.) bars on 4.0-in. centers. The Unit 5 trash rack is approximately 16.5 ft tall by 12.5 ft wide with 0.375-in. bars on 4.5-in. centers. The Unit 6 trash rack is approximately 19.0 ft high by 15.0 ft wide with 0.375-in. bars on 4.0-in. centers. Units 7 and 8 have trash racks that are approximately 14.5 ft high by 11.0 ft wide with 0.375-in. bars on 3.0-in. centers.



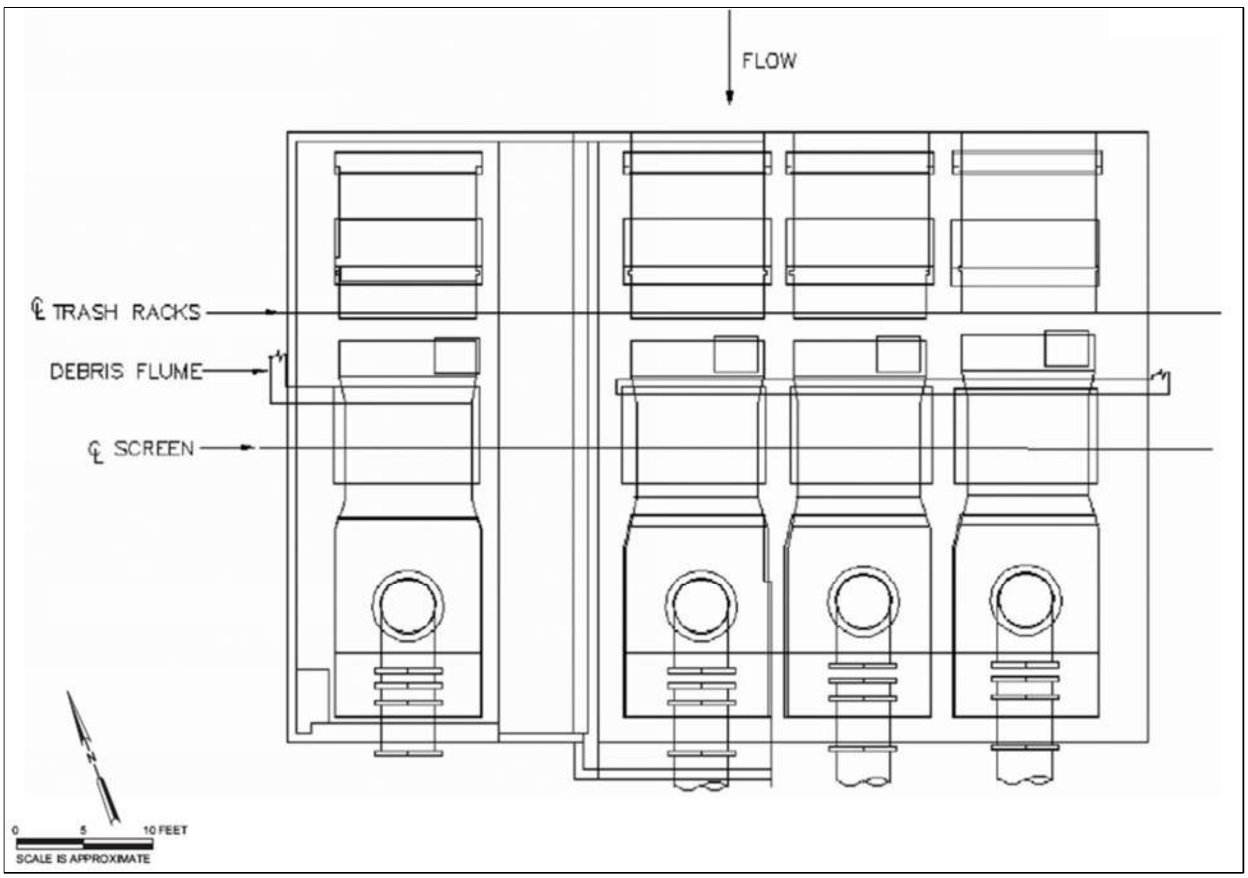
Source: CH2M HILL (2007)

Figure 2-7. Chesterfield Power Station CWIS Configuration

The traveling water screens are located between 10 and 20 ft downstream of the trash racks. Each of the power-generating units contains two traveling water screens except Unit 6, which has three traveling water screens, for a total of 13 traveling water screens. Units 3, 4, 7, and 8 have 8-foot-wide screens, and Units 5 and 6 have 10-foot-wide screens, all with standard 3/8-in. mesh. Each of the vertical traveling screens is designed for continuous operation. Units 4, 5, and 6 rotate at a single speed of approximately 10 ft per minute (ft/min), while Unit 3 can rotate at 3 ft/min or 10 ft/min in automatic mode. Units 7 and 8 can rotate at either approximately 5 ft/min or 10 ft/min depending on loading. During normal operation, the screens are typically manually controlled for all units.

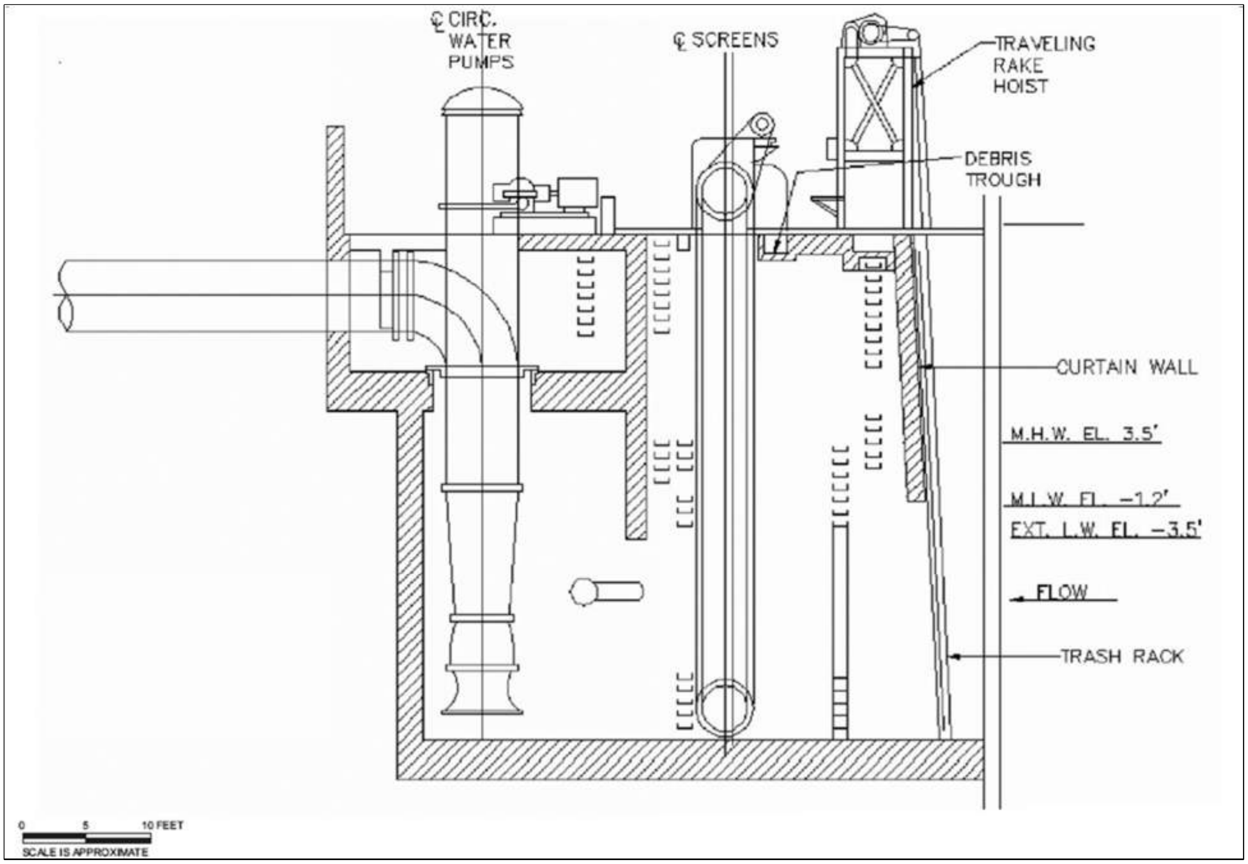
The screens have front spray wash systems and the debris collection trough located on the upstream side of the screens. Screen wash pumps for Units 7 and 8 draw water from the pump house. Units 3 through 6 do not have operating screen wash pumps, and the wash water for these screens is fed from the ash sluice water system from each unit. As the intake screens rotate, debris impinged on the screens is drawn upward and washed off by a wash water spray into a water-filled wash water trough. This water-filled trough conveys organisms and debris back into the James River. These discharges are permitted in the Virginia Discharge Elimination System (VPDES) Permit (VA0004146).

Screened cooling water is conveyed to the circulating water pumps, located at 12 to 18 ft downstream of the traveling water screens, through individual bays. Each unit has a separate circulating water system comprised of thirteen vertical shaft, wet-pit, circulating cooling water pumps, two each for Units 3, 4, 5, 7, and 8 and three for Unit 6. The circulating pumps are located in the respective Unit's pump house. Upon exiting the circulating cooling water system, the water is returned to the James River via one of three cooling water discharge points: one for Unit 3, one for Units 7 and 8, and one for Units 4, 5, and 6. The discharge for Units 3, 7, and 8 discharge directly into the James River, approximately 100 ft downstream from the CWIS (via outfalls 001 and 002). Units 4, 5, and 6 discharge into a discharge canal and then into Farrar Gut, an oxbow that flows into the James River approximately 1.2 miles downstream from the intake structures (via outfall 003). A satellite image of the outfall configuration is provided previously in Figure 2-4. Plan and section drawings of typical portions of the CPS CWIS are provided in Figures 2-8 and 2-9, respectively.



Source: CH2M HILL (2007)

Figure 2-8. Typical Plan View of Chesterfield Power Station CWIS



Source: CH2M HILL (2007)

Figure 2-9. Typical Section View of Chesterfield Power Station CWIS

3 Historical Studies

Past fisheries studies conducted at CPS which are pertinent to §316(b) include the following:

- June 2005 – May 2006 Impingement and Entrainment Study (EA 2006)
- June 2005 – May 2006 Ambient Adult and Juvenile Finfish Sampled by Electrofishing and Gillnets; Ambient Ichthyoplankton Sampling by Towed Plankton Net (EA 2006)
- April 1997 – February 1999 Adult and Juvenile Finfish Sampled by Electrofishing and Gillnets (VEPCO 2000)
- January – December 1977 Impingement and Entrainment Studies (VEPCO 1977)

For the purposes of development of this study plan, the June 2005 – May 2006 and 1977 impingement studies (EA 2006 and VEPCO 1977, respectively), and June 2005 – May 2006 and April 1997 – February 1999 adult and juvenile fish sampling (EA 2006 and VEPCO 2000, respectively) are summarized below.

3.1 Impingement Studies

3.1.1 Impingement Study, 2005 – 2006

Results of this study, conducted in June 2005 to May 2006, were used to identify the species and life stages that would be most susceptible to impingement. This generally includes adult and older juvenile life stages of fish and shellfish. This study addressed species comprising the forage base, as well as those most important in terms of significance to commercial and recreational fisheries. Details of the 2005 – 2006 impingement sampling program (EA 2006) are presented in Table 3-1.

Table 3-1. Impingement Sampling Details, 2005 – 2006

Impingement	Details
Units Sampled	Units 3, 4, 5, 6, 7 and 8
Sampling Location	Downstream of each unit (Unit 3, 4, 5, 6, 7 and 8)
Surveys from June 2005 to May 2006	Twice a month
Sampling Frequency	16, 10-minute screen-wash samples collected at 0800,0900, 1200, 1300, 1400, 1500, 1800, 1900, 2000, 2100, 2400, 0100, 0200, 0300, 0600 and 0700 hours
Sampling Method and Gear	Samples collected in five baskets consisting of 3/8-in. mesh and one dip net
Sample Duration	A single unit of effort was obtained by diverting the screen wash water from the trough into the basket for a 10-minute period.
Water Quality Measurements	Water temperature was measured with YSI Model 556 water quality analyzer in the screen-wash troughs for each of 16 hourly impingement samples

A total of 22 species of finfish and two species of shellfish were collected in impingement samples collected at CPS (Table 3-2). Blue Crab was the most abundant organism (62 individuals) and Blue Catfish (29 individuals) was the most abundant finfish collected. Most of the fish impinged were juvenile fish. Seven taxa individually accounted for 5 percent or more of the annual catch, and collectively nearly 70 percent of the total catch. The estimated annual impingement at maximum flow was calculated to be 11,383 fish and shellfish. Blue Crab were most abundant overall (6,312 individuals); most abundant finfish were Blue Catfish (2,977 individuals).

Table 3-2. Ranked Abundance and Percent Composition of Fish and Shellfish Impinged at CPS, 2005 – 2006

Species	Number	Percent	Weight (gm)	Percent
Blue Crab	62	28.6	4158.4	65.3
Blue Catfish	29	13.4	1176.0	18.5
Blueback Herring	22	10.1	54.1	0.8
Channel Catfish	18	8.3	229.0	3.6
Black Crappie	17	7.8	76.5	1.2
White Perch	16	7.4	170.3	2.7
Bluegill	11	5.1	275.6	4.3
Largemouth Bass	8	3.7	38.1	0.6
Gizzard Shad	5	2.3	45.5	0.7
Spottail Shiner	5	2.3	17.6	0.3
American Shad	4	1.8	24.3	0.4
Alewife	3	1.4	13.3	0.2
Banded Killifish	2	0.9	6.7	0.1
Flathead Catfish	2	0.9	11.0	0.2
Inland Silverside	2	0.9	6.1	0.1
Tessellated Darter	2	0.9	2.5	<0.1
Bay Anchovy	1	0.5	1.4	<0.1
Common Carp	1	0.5	21.2	0.3
Green Sunfish	1	0.5	2.0	<0.1
Hogchoker	1	0.5	29.5	0.5
Ictaluridae sp.	1	0.5	2.8	<0.1
Spot	1	0.5	0.9	<0.1
Striped Bass	1	0.5	1.9	<0.1
Unidentified Fish	1	0.5	2.2	<0.1
Common Grass Shrimp	1	0.5	1.9	<0.1
Total	217	100	6368.8	100
Source: Table 3 of EA 2006				

Information on the seasonal and daily activities of biological organisms in the vicinity of the CWISs was obtained from results of impingement studies conducted June 2005 to May 2006. Impingement was higher during June through December 2005 than during January through May 2006 (Table 3-3).

Table 3-3. Monthly Impingement Catch at CPS, 2005 – 2006

Species/Taxon	2005							2006					Annual Total
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Bay Anchovy	0	0	0	1	0	0	0	0	0	0	0	0	1
Blueback Herring	0	4	7	9	1	0	0	0	0	1	0	0	22
Alewife	1	1	1	0	0	0	0	0	0	0	0	0	3
American Shad	0	1	0	1	2	0	0	0	0	0	0	0	4
Gizzard Shad	1	0	0	0	0	1	1	0	0	1	0	1	5
Common Carp	0	0	0	0	0	0	0	1	0	0	0	0	1
Spottail Shiner	1	1	1	0	0	0	0	1	0	0	1	0	5
Ictaluridae sp.	0	0	0	1	0	0	0	0	0	0	0	0	1
Blue Catfish	3	6	4	4	2	3	1	2	1	1	1	1	29
Channel Catfish	0	1	0	3	3	2	6	0	0	0	1	2	18
Flathead Catfish	0	0	0	0	2	0	0	0	0	0	0	0	2
Inland Silverside	1	0	0	0	0	0	1	0	0	0	0	0	2
Banded Killifish	0	0	0	0	0	0	2	0	0	0	0	0	2
White Perch	0	10	1	0	3	1	1	0	0	0	0	0	16
Striped Bass	0	0	0	1	0	0	0	0	0	0	0	0	1
Green Sunfish	0	0	0	0	1	0	0	0	0	0	0	0	1
Bluegill	0	1	0	0	0	1	5	2	0	0	2	0	11
Largemouth Bass	1	5	0	2	0	0	0	0	0	0	0	0	8
Black Crappie	1	14	0	0	0	0	2	0	0	0	0	0	17
Tessellated Darter	1	0	0	0	0	0	0	1	0	0	0	0	2
Spot	1	0	0	0	0	0	0	0	0	0	0	0	1
Hogchoker	0	0	0	0	1	0	0	0	0	0	0	0	1
Damaged Fish	1	0	0	0	0	0	0	0	0	0	0	0	1
Asiatic Clam	1	0	0	0	0	0	0	0	0	3	0	0	4
Common Grass	0	0	0	0	1	0	0	0	0	0	0	0	1
Blue Crab	0	3	1	10	29	18	1	0	0	0	0	0	62
Total	13	47	15	32	45	26	20	7	1	6	5	4	221

Source: Table 4 of EA 2006

The highest numbers of fish were impinged in July and October. Comparison of the numbers of individuals impinged at day versus night revealed modest differences (Table 3-4), with 62 percent of the organisms impinged during nighttime. Blueback Herring, Channel Catfish and Blue Crab were more abundant at night.

Table 3-4. Number of Impinged Fish and Shellfish Collected During Daylight and Nighttime Hours at CPS, 2005 – 2006

Species/Taxon	Day	Night
Bay Anchovy		1
Blueback Herring	6	16
Alewife	3	
American Shad	2	2
Gizzard Shad	2	3
Common Carp		1
Spottail Shiner	1	4
Ictaluridae sp.	1	
Blue Catfish	12	17
Channel Catfish	5	13
Flathead Catfish		2
Inland Silverside	1	1
Banded Killifish		2
White Perch	6	10
Striped Bass	1	
Green Sunfish		1
Bluegill	5	6
Largemouth Bass	3	5
Black Crappie	5	12
Tessellated Darter	2	
Spot		1
Hogchoker	1	
Damaged Fish	1	
Asiatic Clam	4	
Common Grass Shrimp		1
Blue Crab	22	40
Total	83	138

Source: Table 5 of EA 2006

3.1.2 Impingement Study, 1977

Dominion conducted an impingement study at CPS from January 1977 through December 1977 (VEPCO 1977). This study consisted of twenty-seven, 24-hour periods of sampling. Each 24-hour sample period included twenty-four 10-minute sample collection periods.

A total of 441 fish representing 11 families and 23 species was collected during the study. Shellfish were not enumerated. The five most abundant species caught that comprised 65.5 percent of all impinged fish were Hogchoker (*Trinectes maculates*) (83 fish impinged), Spottail Shiner (63 fish impinged), Atlantic Menhaden (*Brevoortia tyrannus*) (55 fish impinged), Alewife (*Alosa pseudoharangus*) (54 fish impinged), and White Perch (34 fish impinged). The estimated annual impingement for each of the five abundant species was Hogchoker (11,294 impinged fish), Spottail Shiner (7,903 impinged fish), Alewife (7,028 impinged fish), Atlantic Menhaden (6,955 impinged fish), and White Perch (4,219 impinged fish). The greatest number of impingement, and the peak occurrence of the most abundant species, Hogchoker, was in October 1977. The fewest number of fish impinged occurred in January 1977. Spottail Shiner, not present in January 1977, was the most frequently impinged species throughout the year, peaking in August 1977. The estimated annual impingement at maximum flow was calculated to be 55,557 fish and shellfish.

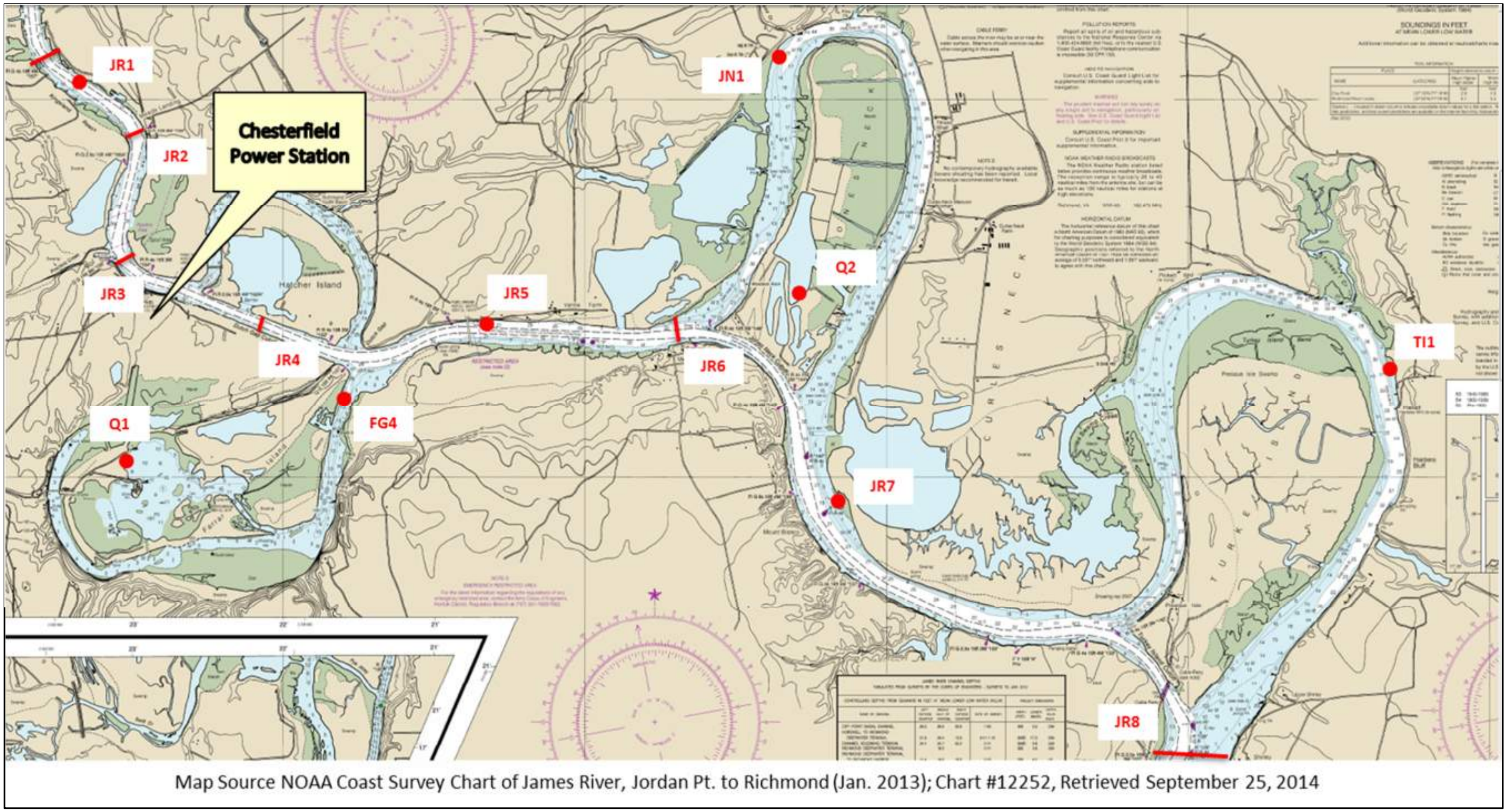
Although this study was comprehensive, it is unlikely to be representative of current conditions in terms of species composition and abundance as it was conducted more than 30 years ago. Improvement in water quality, reductions in barge traffic, and the introduction of non-native species such as Blue Catfish have all had dramatic but difficult to quantify effects on the James River's ecosystem (Lung 1991; Chesapeake Bay Journal 2011).

3.2 James River Studies

3.2.1 Electrofishing and Gill Net Sampling, 2005 – 2006

Ambient juvenile and adult fish surveys were conducted as part of impingement studies in June 2005 to May 2006, and sampled three stations by boat electrofishing and gill nets - one upstream, one downstream, and one near the station (Figure 3-1). At each station, 100 meters of shoreline were electrofished. Gill nets were 100 ft long by 6 ft deep with panels ranging from 1.5-in to 3-in stretched mesh, and were fished for 4 to 6 hours. Larger fish were identified, measured, and weighed in the field, and smaller fish were preserved and subsequently processed in the laboratory.

The fish and shellfish collected in 2005-2006 were considered representative for that year. Twenty-seven species of finfish and one shellfish (Blue Crab) were collected. White Perch, Spottail Shiners, Gizzard Shad, Blue Catfish and Bluegill were the most abundant species collected, and accounted for 80 percent of the total catch (Table 3-5). Most (88 percent) of the fish were collected during the summer (June) or fall (October) sampling periods.



Source: Modified from Dominion 2004

Figure 3-1. Map Depicting the Study Area and Sampling Stations for 316(b) Studies Conducted June 2005 – May 2006

Table 3-5. Summary Results of Quarterly Ambient Juvenile and Adult Fish Sampling in the Vicinity of Chesterfield Power Station, 2005 – 2006

Species	June	October	February	April	Total
Atlantic Sturgeon	1				**1**
Longnose Gar				1	**1**
American Eel		2			**2**
Bay Anchovy		10			**10**
American Shad	1				**1**
Blueback Herring		10		4	**14**
Gizzard Shad	40	59	1	8	**108**
Common Carp	3	17		11	**31**
Satingin Shiner	10	2	1	8	**21**
Spotfin Shiner	8				**8**
Telescope Shiner				1	**1**
Spottail Shiner	188	73	2		**263**
Flathead Catfish	1	4	1		**6**
Channel Catfish	7	30			**37**
Blue Catfish	32	52		9	**93**
Inland Silverside	19				**19**
Banded Killifish	1		8	1	**10**
Striped Bass	8	19			**27**
White Perch	26	300		19	**345**
Bluegill	8	32	18	22	**80**
Redbreast Sunfish				1	**1**
Redear Sunfish	1			1	**2**
Black Crappie		1			**1**
Largemouth Bass	5	11	5	9	**30**
Smallmouth Bass		2			**2**
Johnny Darter	2				**2**
Tessellated Darter	1				**1**
Blue Crab			1		**1**
Total	**362**	**624**	**37**	**95**	**1,118**

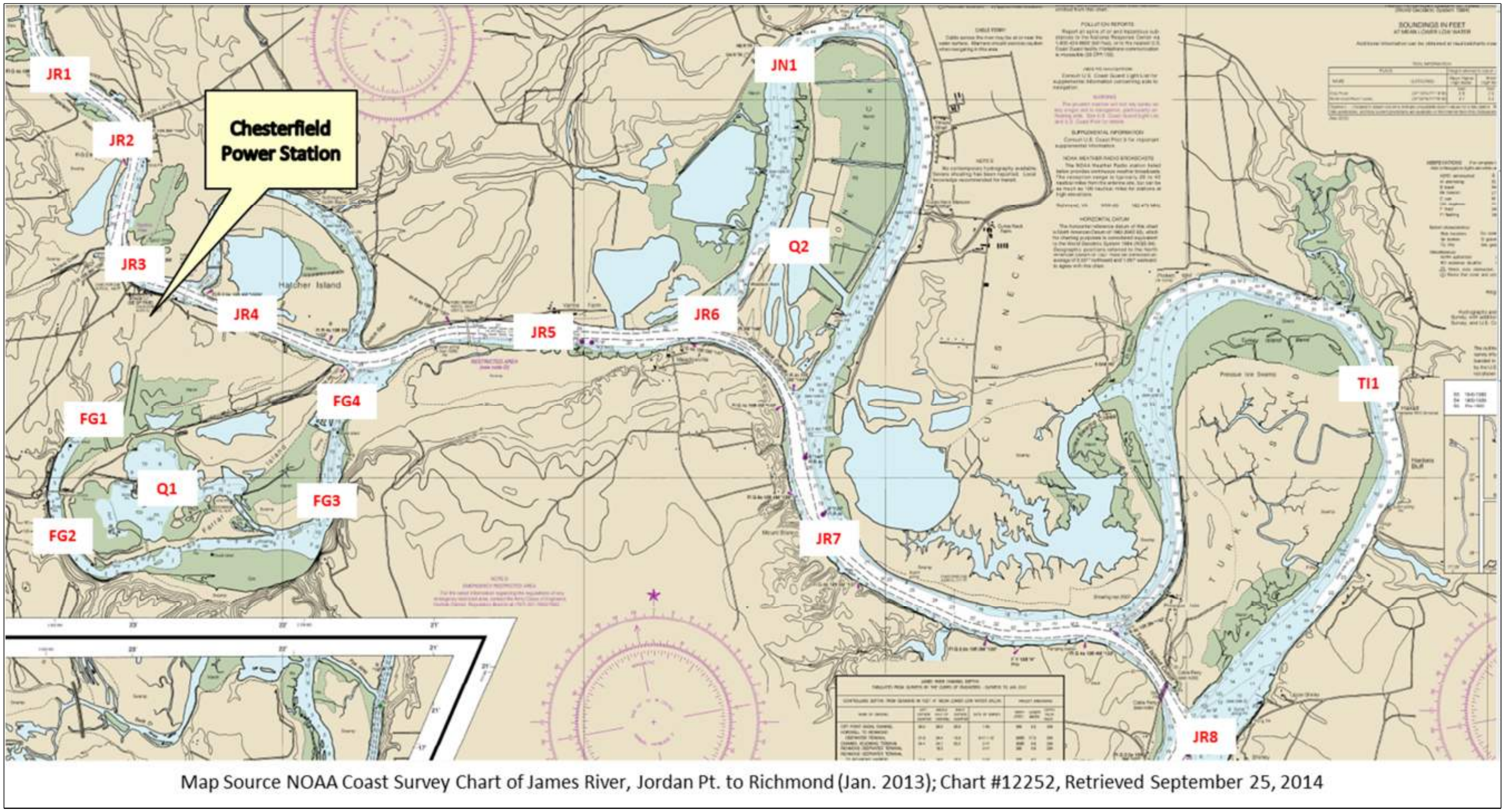
Source: Table 18 of EA 2006

3.2.2 Electrofishing and Gillnet Sampling, 1997 – 1999

In addition to the ambient sampling conducted in 2005 – 2006 in association with impingement and entrainment studies, VEPCO (2000) conducted extensive electrofishing and gillnet surveys of fish relative abundance in the vicinity of CPS as part of a 316(a) demonstration study from April 1997 to February 1999 (Table 3-6; Figure 3-2). A total of 35 native and introduced species was collected, none of which had protected status. Within the electrofishing samples, Gizzard Shad, Threadfin Shad, Bluegill Sunfish, Largemouth Bass, Carp, Spottail Shiners, and White Perch were the most frequently collected taxa (Table 3-7). The gillnet samples reflected a different fish capture selectivity, with Gizzard Shad, Threadfin Shad, White Perch, Blue Catfish, and Channel Catfish the most commonly collected taxa (Table 3-8). It was noted as part of this study that results, while not directly comparable, were similar to a previous study conducted 1968-1971 (Jensen 1974), with the principal difference displayed in the relative abundances within the Catfish family *Ictaluridae*. In Jensen's (1974) study, White Catfish were "moderately" common, Channel Catfish common and Brown Bullheads "very" abundant. In the VEPCO (2000) study, the introduced Flathead Catfish was common, and the introduced Blue Catfish abundant. Channel Catfish remained common, but no White Catfish and only one Brown Bullhead were collected. VEPCO (2000) provides discussion related to the documented effects of introduced Flathead and Blue Catfish on other native catfishes.

Table 3-6. Electrofishing and Gill Net Stations in the James River in the Vicinity of CPS - Shown on Figure 3-2 below -

Electrofishing Stations	Gill Net Stations
JR1	JR1
JR5	JR5
JR7	JR7
FG1	FG1
FG2	
FG3	FG3
FG4	FG4
JN1	JN1
TI1	TI1
Q1	
Q2	



Source: Modified from Dominion 2013

Figure 3-2. Map Depicting the Study Area and Sampling Stations for 316(a) Studies Conducted April 1997 – February 1999

Table 3-7. Frequency of Occurrence and Total Number of Fish and Shellfish Collected by Electrofishing During the Chesterfield 316(a) Demonstration

Fish	% of Samples	# of Stations	# of Surveys	Total Number
Longnose Gar	1.8	1/11	2/10	3
Bowfin	0.9	1/11	1/10	1
American Eel	9.1	4/11	7/10	15
Blueback Herring	2.7	3/11	2/10	69
Alewife	5.5	5/11	4/10	33
Gizzard Shad	86.4	11/11	10/10	1,291
Threadfin Shad	40.9	11/11	8/10	2,179
Bay Anchovy	8.2	6/11	3/10	62
Satinfin Shiner	36.4	9/11	10/10	147
Common Carp	68.2	11/11	10/10	324
Eastern Silvery Minnow	0.9	1/11	1/10	2
Golden Shiner	2.7	2/11	3/10	4
Spottail Shiner	45.5	11/11	10/10	878
Quillback	1.8	1/11	2/10	3
Shorthead Redhorse	9.1	6/11	6/10	11
Blue Catfish	20.0	8/11	8/10	41
Channel Catfish	35.5	11/11	10/10	70
Flathead Catfish	2.7	2/11	3/10	3
Chain Pickerel	0.9	1/11	1/10	1
Banded Killifish	8.2	8/11	5/10	15
Mummichog	1.8	1/11	2/10	4
Inland Silverside	28.2	9/11	8/10	84
White Perch	51.8	11/11	10/10	545
Striped Bass	11.8	7/11	7/10	25
Redbreast Sunfish	3.6	4/11	3/10	4
Green Sunfish	0.9	1/11	1/10	1
Pumpkinseed	7.3	4/11	6/10	11
Bluegill	90.0	11/11	10/10	1,942
Redear Sunfish	8.2	6/11	6/10	9
Smallmouth Bass	4.5	4/11	5/10	8
Largemouth Bass	71.8	11/11	10/10	233
Black Crappie	25.5	10/11	10/10	61
Tessellated Darter	5.5	5/11	5/10	12
Yellow Perch	5.5	4/11	5/10	10
Hogchoker	0.9	1/11	1/10	1
Blue Crab	0.9	1/11	1/10	1

Source: VEPCO 2000

Table 3-8. Frequency of Occurrence and Total Number of Fish and Shellfish Collected by Gillnetting During the Chesterfield 316(a) Demonstration -

Fish	% of Samples	# of Stations	# of Surveys	Total Number
Longnose Gar	5	1/8	4/10	9
Blueback Herring	12.5	6/8	3/10	35
American Shad	1.3	1/8	1/10	1
Atlantic Menhaden	7.5	5/8	3/10	12
Gizzard Shad	85	8/8	10/10	907
Threadfin Shad	21.3	7/8	6/10	264
Common Carp	20	7/8	7/10	26
Quillback	1.3	1/8	1/10	1
White Sucker	1.3	1/8	1/10	1
Shorthead Redhorse	7.5	5/8	3/10	6
Brown Bullhead	1.3	1/8	1/10	1
Blue Catfish	85	8/8	10/10	339
Channel Catfish	58.8	8/8	10/10	170
Flathead Catfish	16.3	6/8	8/10	14
White Perch	71.3	8/8	9/10	447
Striped Bass	33.8	8/8	10/10	67
Bluegill	6.3	4/8	4/10	10
Redear Sunfish	1.3	1/8	1/10	1
Largemouth Bass	10	4/8	5/10	11
Black Crappie	7.5	4/8	4/10	7
Spot	1.3	1/8	1/10	1
Hogchoker	1.3	1/8	1/10	1
Blue Crab	16.3	6/8	8/10	35

Source: VEPCO 2000

4 Threatened and Endangered Species

The EPA consulted with the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) (or collectively, Services) under the Endangered Species Act during development of the existing facilities §316(b) rule. While the Services concluded that the rule is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat, the rule requires that facilities identify all Federally-listed threatened and endangered species and/or designated critical habitat that are or may be present "in the vicinity of impingement and entrainment at the cooling water intake structure" in §122.21(r)(4). The text below provides a review of listed species associated with CPS to support development of this Impingement Characterization Study Plan.

The Virginia Fish and Wildlife Information Service (VAFWIS) database, managed by the Virginia Department of Game and Inland Fisheries (VDGIF), and the USFWS Information, Planning, and Conservation System were consulted on June 20, 2015 to develop a list of Federal and state of Virginia endangered and threatened species known or likely to occur within a 2-mile radius of CPS (See Table 4-1). Additionally, the complete list of threatened and endangered species that occur in the state of Virginia (VDGIF 2015a) was reviewed and compared against the list of threatened and endangered species under NMFS (NMFS 2015) jurisdiction to confirm that NMFS species were not omitted from the list. A review of scientific literature and other documents was also conducted, including a NMFS Biological Opinion and Letter of Concurrence for projects proposed to occur near the vicinity of the CWIS; those documents were used to confirm that marine species under the jurisdiction of NMFS were appropriately considered. Additionally, for each species with the potential to occur in the vicinity of the CWIS, the USFWS or NMFS species profile was reviewed to confirm that no critical habitat was designated. A review of the following resources was used to develop the species list in Table 4-1.

- VAFWIS (http://vafwis.org/fwis/)
- IPAC (http://ecos.fws.gov/ipac/)
- USFWS Listings and Occurrence for Virginia (http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=VA&s8fid=112761032792&s8fid=112762573902)
- Endangered and Threatened Species Under NMFS' Jurisdiction (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm)
- Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).
- Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.
- USFWS or NMFS Species Profile (http://www.fws.gov/endangered/, http://www.nmfs.noaa.gov/pr/species/esa/listed.htm)

Note that only Federal and State threatened and endangered species were included in Table 4-1. Federal species of concern and candidate species were omitted from the list (unless they were also State Threatened or Endangered) because there are no requirements to address those species under Section 7 of the Endangered Species Act.

The majority of the species in Table 4-1 are terrestrial species or occur in habitats that are not in the vicinity of the CPS CWISs and thus would not be subject to entrainment or impingement at the facility. Additional literature was reviewed to identify aquatic species that do not occur near the CWIS and thus should be eliminated from further consideration; these documents are cited in Table 4-1.

Atlantic Sturgeon (listed as both endangered and threatened)[1] spawn in the James River. Benthic substrates that provide suitable sturgeon spawning habitat (i.e., rock and cobble gravel) occur in the vicinity of CPS; however, these areas might not have viable spawning conditions (e.g., hydrodynamic characteristics) (Bilkovic et al. 1999). Bushnoe et al. (2005) indicate that the Turkey Island and Jones Neck oxbows, which are approximately 3 – 7 miles downstream from CPS, are considered potential spawning habitat due to their hydrodynamic characteristics and benthic substrate (i.e., rock and gravel/cobble/pebble) (Bilkovic et al. 2009, NMFS 2012a). A second area of seemingly suitable habitat is located approximately 30 miles downstream of CPS (NMFS 2012b).

In a telemetry study, Hager (2011) observed two seasonal migrations by adult Atlantic Sturgeon in the James River; in the spring from April through May and in the late summer and early fall from August through October. No fish passed above river mile 67 in the spring (downstream of CPS). During the late summer to early fall residency (August-October), fish ascended the river rapidly and congregated in upriver sites between river mile 48 and the fall line near Richmond, VA. During late summer, Atlantic Sturgeon exhibited a preference for the river section where the upper James and Appomattox rivers meet, approximately 9 miles downriver from CPS (Hager 2011). Appendix A provides additional detail on Atlantic Sturgeon spawning migrations in the James River.

Eggs are adhesive and demersal and are expected to attach to the substrate within 20 minutes following fertilization; therefore, sturgeon eggs occur only on the spawning grounds (Hildebrand and Schroeder 1928, Jones et al. 1978). Spawning is expected to occur during April through June (temperatures for spawning can range from 13 – 26°C); evidence suggests that spawning might occur in the fall as well, with high adult usage in the river from August through November (Balazik et al. 2012, Secor et al. 2012). Eggs typically hatch in 4 – 7 days depending on temperature (Gilbert 1989; Hildebrand and Schroeder 1928). At hatching, Atlantic Sturgeon larvae are large bodied and are assumed to undertake a demersal existence in the same areas where they were spawned (ASMFC 2012, Bath et al. 1981). Bath et al. (1981) only collected sturgeon larvae in bottom samples. Larvae are also active swimmers and leave the bottom when 8 to 10 days old to swim in the water column (Kynard and Horgan 2002). The yolk-sac larval stage is completed in about 8 to12 days (Jones et al. [1978] reports 6 days), at which time the larvae move downstream to the rearing grounds (Kynard and Horgan 2002). During the first half of this migration, larvae move only at night and use benthic structure (e.g., gravel matrix) as refuge during the day (Kynard and Horgan 2002). During the latter half of migration to the rearing grounds, when larvae are more fully developed, movement occurs during both day and night. Larvae transition into the juvenile phase at approximately 30 mm total length (TL) and move further downstream into brackish waters, developing a tolerance to salinity. Eventually they become residents in estuarine waters for months to years before emigrating to open ocean

[1] Atlantic Sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina Distinct Population Segments (DPSs) are listed as endangered. Those originating from the Gulf of Maine DPS are listed as threatened. Atlantic Sturgeon from these five DPSs have the potential to occur in the James River and the vicinity of the Chesterfield cooling water intake; however, the majority of the spawning adults are likely to originate from the James River and thus, the Chesapeake Bay DPS (NMFS 2012a).

(ASSRT 2007, ASMFC 2012). ASMFC (2012) notes that some Atlantic Sturgeon occupy freshwater habitats for two or more years, while others move downstream to brackish waters when the water temperature drops. Bain et al. (2000) report that early juveniles were collected from salinities ranging from 0 – 5 ppt from April through October in the Hudson River and from 3 – 18 ppt from October through March. However, temperature and dissolved oxygen are likely key habitat parameters (ASMFC 2012). Bain et al. (1997) report that from July through September juvenile sturgeon use deep channels in the Hudson River. Juvenile Atlantic Sturgeon in North Carolina use deep and cool areas as thermal refuges, particularly in the summertime (Moser and Ross 1995 as cited in ASMFC 2012). A more detailed account of Atlantic Sturgeon life history, including distribution and size at age and other characteristics is presented in Appendix A.

Impingement occurs when a fish cannot swim fast enough to escape the intake flow vortices (e.g., the fish's swimming ability is overtaken by the velocity of water being drawn into the intake). The approach velocity at the CPS's trash racks is 0.51 to 0.72 feet per second, with a through-rack velocity of 0.55 to 0.79 feet per second. In order for impingement to happen, a fish must be overcome by the intake or approach velocity. Atlantic Sturgeon are known to occur in the vicinity of CPS. Shortnose Sturgeon, while not expected to occur in the vicinity of the CPS CWIS, are well studied and have swimming capabilities expected to be representative of Atlantic Sturgeon. Juvenile and adult Shortnose Sturgeon (body lengths greater than 58.1 cm) can avoid impingement at intakes with velocities as high as 3.0 feet per second (Kynard et al. 2005 as cited in NMFS 2012b). Shortnose Sturgeon with body lengths greater than 28 cm have been demonstrated to avoid impingement at intakes with velocities of 1.0 fps (Kynard et al. 2005 as cited in NMFS 2012b). Verhille et al. (2014) tested the swimming capacity of larval Green Sturgeon (*Acipenser mediocris*) and White Sturgeon (*Acipenser transmontanus*) until completion of metamorphosis to juveniles. Green Sturgeon swimming capacity, based on critical swimming velocity (the speed at which a fish can no longer propel itself forward), was not significantly different, but slightly greater than White Sturgeon swimming capacity, throughout larval development. Results indicated that 4.3-cm and 6.5-cm Green Sturgeon could sustain 1.17 fps and 1.49 fps for 5 minutes, while 4.7-cm and 8.0-cm White Sturgeon could sustain 0.83 fps and 1.16 fps for 5 and 10 minutes, respectively. Critical swimming velocity for 15.4-cm, 22.1 cm, and 22.2-cm Green Sturgeon reported in other studies was 1.42 fps (20 minutes), 1.58 (20 minutes), and 1.73 fps (5 minutes). Critical swimming velocity ranged from 0.2 fps to 2.6 fps for 20 to 30 minutes for larger Green Sturgeon (34.7 cm to 68.3 cm). All Green Sturgeon were tested at 18-19ºC. Critical swimming velocity for larger White Sturgeon (24.8 cm to 38.3 cm) ranged from 1.9 fps to 2.27 fps (for 20-30 minutes. White Sturgeon were tested at 11-12.5 ºC and 18-19ºC. Absolute swimming capacity increased with size. Poletto et al. (2013) reported that Green Sturgeon (29.6 cm fork length [FL] and 150-198 days after hatching) contacted fish exclusion screens more frequently than White Sturgeon (27.4 cm FL and 170-192 days after hatching) as simulated intake flow velocity increased. However, the majority of the fish never became impinged with impingement events per fish ranging from 0 to 15 for Green Sturgeon and 0 to 1 for White Sturgeon. Fish were tested at flows of 0.67 and 1.2 fps. There were 0.68 impingements per fish for Green Sturgeon and 0.02 impingements for fish for White Sturgeon. Atlantic Sturgeon share similar life history strategies with Green and White Sturgeon; that is, besides morphological similarities and taxonomic relationships, all three species are estuarine dependent during substantial portions of their juvenile and sub-adult stages, make forays or long distance migrations through marine waters, and require similar habitat attributes for reproduction. Similar life history features and requirements support an assumption of similar swimming capabilities and behavioral responses to altered flows.

For the purposes of this study plan, it is assumed that the only listed species with potential to be impinged at CPS is Atlantic Sturgeon, but because of swimming capabilities, the probability of impingement is deemed unlikely and unexpected. Although no Atlantic Sturgeon are expected to be encountered as part of this study, this study plan includes handling methods focused on reducing stress and quickly releasing Atlantic Sturgeon, in the unlikely event that they are collected in impingement samples.

The freshwater bivalve Atlantic Pigtoe (*Fusconaia masoni*) is a state threatened species and a Federal species of concern, currently under review for listing under the ESA, that may inhabit the James River near CPS. However, this species typically inhabits the upper parts of rivers, above the fall line, in clean, swift-moving waters and is often found in gravel or gravel-sand substrate (VAFWIS 2014, Terwilliger 1991). The species has been documented in the James River, near Richmond in Henrico County; however, Terwilliger (1990) indicates that the species might no longer be present in the James. In 2011 and 2012, Virginia Department of Game and Inland Fisheries (VGDIF) conducted extensive mussel surveys on the James River upstream of the Richmond (and the project site). No Atlantic Pigtoe were encountered in this survey. In the vicinity of CPS, sediments are described as gravel/cobble/pebble, rock, and sand with complex bottom (Bilkovic et al. 2009). The navigation channel near the CPS is maintained via dredging (NMFS 2012a, Bushnoe et al. 2005). Furthermore, all stations in the main stem of the James River were characterized as degraded, based on a benthic index of biotic integrity. The one non-degraded station was located in the oxbow around Hatcher Island (Roberts et al. 2002).

This species is thought to be tachytictic (i.e., short-term brooder), with gravid females collected from the James River from May to June, and glochidia most likely released before September (VAFWIS 2014, Terwilliger 1991, Johnson 1970). Once attached to a suitable host fish, the time it takes for glochidia to metamorphose into juveniles and drop off the fish has been documented at 19 – 24 days (Rash 2005), depending on water temperature, host fish species and other factors. Once juveniles excyst from the host fish they must settle into suitable substrate to survive.

Knowledge is incomplete as to which fish species provides the most suitable host for the Atlantic Pigtoe (Wolf 2010). Results of laboratory research indicate that host fish for Atlantic Pigtoe include Bluegill Sunfish (*Lepomis macrochirus*), Shield Darter (*Percina peltata*), White Shiner (*Luxilus albeolus*) and Satinfin Shiner (*Cyprinella analostana*), Longnose Dace (*Rhinichthys cataractae*) and Creek Chub (*Semotilus atromaculatus*) (Dee and Watters 1998; Rash 2005, Wolf and Emrick 2011). Of these, the White Shiner is not expected to occur in the James River. Longnose Dace and Creek Chub were the primary hosts of the fish tested by Wolf and Emrick (2012), but habitat in the main stem of the tidal James River in the vicinity of CPS is not suitable for these species.

There is a small risk of impingement for infected host fish; however because the preferred habitat for the Atlantic Pigtoe, and any fish they might infest, is above the fall line, which is upstream of the CPS CWIS such an event is unlikely and unexpected. Additionally, Bluegill Sunfish are the only potential host fish that have been documented to have been impinged at the CPS CWS (Dominion 2007).

The Green Floater (*Lasmigona subviridis*) is state-listed as a threatened species, currently under review for listing under the ESA, which has been collected from the James River Drainage (VDGIF 2015b). In Virginia, the Green Floater is known to occur in the several tributaries of the James River (NatureServe 2014). The VAFWIS database does not indicate that there is a confirmed occurrence of this species within the search area and it has not been observed in Henrico or Chesterfield counties (VDGIF 2015b).

In 2011 and 2012, VDGIF conducted extensive mussel surveys on the James River upstream of Richmond and the fall line (and CPS) (Watson 2012). Five specimens of Green Floater were collected during this survey; however, the location is not provided. Green Floaters were also documented during a survey at Bremo Power Station, upriver from CPS. These specimens were relocated upriver of Bremo Power Station (CH2MHILL 2011).

This species occupies very small to medium-sized streams, quiet pools with eddies with gravel and sand bottoms, and cannot tolerate very strong currents. Host fish for the Green Floater have not been identified. The Green Floater is known to be a rare hermaphroditic mussel with fully transformed juvenile mussels held within the female marsupia collected from tributaries to the Neuse River in North Carolina and Susquehanna River in Pennsylvania (Barfield and Watters 1998, Lellis and King 1998).

While this species has been documented upriver of CPS, it has not been documented near CPS or in Chesterfield or Henrico counties. Considering the benthic nature of this species, it is unlikely to be impinged or entrained at CPS even if present in the vicinity of the facility. Further, a host fish species has not been identified for the Green Floater and information to date suggests this species may not require a host fish to complete its lifecycle. Therefore, collection of this species in impingement collections is unlikely and unexpected.

Table 4-1. Federal and State Threatened, Endangered, and Proposed Species with the Potential to Occur within 2 miles of the Cooling Water Intake of CPS

Common Name	Scientific Name	Status*	Tier**	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
FISH						
Atlantic Sturgeon[a]	*Acipenser oxyrinchus*	FE, SE	II	Early life stages – Likely Adults and Juveniles - Likely	Likely Rare Event[2]	Unlikely and Unexpected
MOLLUSKS						
Atlantic Pigtoe[a]	*Fusconaia masoni*	FS, ST	II	Adults, juveniles, and glochidia – Unlikely, preferred habitat is upstream of the fall line Host fish – likely to occur in the vicinity of the CWIS	Unlikely and Unexpected	No
Green Floater[a]	*Lasmigona subviridis*	ST	II	Unlikely – This species has not been documented in Henrico or Chesterfield counties[e]. Host fish have not been documented for this species and may not be needed due to hermaphroditic nature.	Unlikely and Unexpected	No
AMPHIBIANS						
Barking Treefrog[a]	*Hyla gratiosa*	ST	II	No - breeds in cypress ponds and bays, and in pine barren ponds; open canopied ponds; all Virginia breeding sites were found in graminoid dominated temporary ponds.[c]	No	No

[2] Based on the demersal nature of sturgeon eggs and larvae, entrainment of the early life stages of Atlantic Sturgeon was considered unlikely and unexpected during development of this study plan. However, two Atlantic Sturgeon yolk sac larvae were collected during biweekly sampling July - December 2015. Therefore, entrainment of Atlantic Sturgeon is considered likely to be a rare event.

Common Name	Scientific Name	Status*	Tier**	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
BIRDS						
Upland Sandpiper[a]	*Bartramia longicauda*	ST	I	No – terrestrial	No	No
Loggerhead Shrike[a]	*Lanius ludovicianus*	ST	I	No – terrestrial	No	No
Migrant Loggerhead Shrike[a]	*Lanius ludovicianus migrans*	ST	--	No – terrestrial	No	No
Peregrine Falcon[a]	*Falco peregrinus*	ST	I	No – terrestrial	No	No
MAMMALS						
Northern Long-Eared bat[a,b]	*Myotis septentrionalis -*	FP	--	No – terrestrial	No	No
Rafineque's Bat[a]	*Corynorhinus - rafineesqui macrotis*	SE	I	No – terrestrial	No	No
PLANTS						
Sensitive Joint-Vetch[b]	*Aeschynomene virginica*	FT		No - typically grows in the intertidal zone of coastal marshes[d]	No	No
Status*		**Tier****				
FE= Federally Endangered		I=VA Wildlife Action Plan - Tier I – Critical Conservation Need;				
FT= Federally Threatened		II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;				
SE= State Endangered		III=VA Wildlife Action Plan - Tier III - High Conservation Need;				
ST= State Threatened		IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need				

Common Name	Scientific Name	Status*	Tier**	Potential to Occur in the Vicinity of the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
FS= Federal Species of Concern						
Source						
[a]Virginia Department of Game and Inland Fisheries; Fish and Wildlife Information Service						
[b]US Fish and Wildlife Service; Information, Planning, and Conservation System						
[c]VGDIF 2014						
[d]USFWS 2012						

5 Basis for Sampling Design

HDR preformed a site visit at CPS on August 19, 2014 to evaluate potential impingement sampling options for the CWISs, the point of §316(b) compliance at the facility. As shown in Figure 2-9 (See Section 2.2.2), there are five separate intake structures at this power station. Units 7 and 8 are adjacent to each other at the east end of the intake area. Units 3 and 4 have a common intake structure in the center section of the intake area for CPS. Units 5 and 6 are adjacent to each other at the west end of the intake area. There is no common access between the intake structures. All of the Units have conventional traveling screens. Units 7 and 8 have separate fish/debris return troughs. The troughs exit the intake structures on the east side of the structures. At the Unit 3 and 4 intake structure, the eastern three screens empty into a common fish/debris return trough that exits from the east side of intake structure and the western-most screen empties into a trough that exits from the west side of the structure. These two fish/debris troughs wrap around the intake structure and both discharge at a common point off the northeast corner of the intake structure. Units 5 and 6 have separate fish/debris return troughs. The troughs for these two units also exit the intake structures on the east side of the structures. All of the fish/debris return troughs empty back into the James River adjacent to the intake structures.

Sampling of screenwash from individual screens was determined to be impracticable due to the limited space available to install an impingement sampling net or basket in the trough sections prior to their joining the common fish discharge trough and because the force of the water entering such a sampling device would result in increased mortality to the organisms collected in the device and thus compromise the planned initial impingement survival assessments that are an important component of the sampling objectives. In addition, there are a total of 13 individual screens at CPS that would not be able to be concurrently monitored effectively. During the site visit, the CPS representatives indicated a drop-in type basket was used at the end of the last screen house for each intake structure during the previous impingement study in 2005-2006. They indicated these baskets were available if needed for the current impingement study.

Based on these findings, it was determined that the preferred impingement sampling location would be collection of impingement samples from the fish/debris troughs at the end of the last screen house at each intake structure. Specifically, impingement sample collections will be conducted by using drop-in baskets/nets installed in the fish/debris troughs at the end of the last screen at each intake structure. Impingement sample collection events will be conducted twice per month over a 12-month study period from July 1, 2015 – June 30, 2016. Each sample collection event will be conducted over a 24-hour period with 10-minute samples collected every hour at each of the six locations. This hourly sample frequency will require the CPS to operate the screens in a continuous wash mode for the duration of a 24-hour sampling event at all five intake structures. This schedule and frequency are selected to allow for initial impingement survival assessments and to mesh with the Entrainment Characterization Study to capture efficiencies available from having field staff already on site for that study. The sample duration and frequency selected for the current impingement study will provide finfish and invertebrate (shellfish) taxonomic identifications, seasonal impingement density distributions, diel variation, and initial impingement survival. One year of study is anticipated to be sufficient to achieve the project objectives.

The approach for development of the specific impingement characterizations required in §122.21(r) is summarized in Table 5-1.

Table 5-1. Summary of Approach for Development of §122.21(r) Required Impingement Characterizations

Data Needs	Basis for Developing the Data
122.21(r)(4) requirement to determine species most susceptible to impingement	Evaluation of species and life stage composition and densities based on 2015-2016 Impingement Study
122.21(r)(4) requirement for identification of fragile fish and shellfish species (<30% impingement survival)	Evaluation of literature values and initial impingement survival values from 2015-2016 Impingement Study
Diel variation	Evaluation of densities in 1-hour sample collections in the 2015-2016 Impingement Study
Variation related to climate and weather	Evaluation of the 2015-2016 Impingement Study data relative to water temperature and weather events (e.g., rain events)
Period of occurrence	Evaluation of the 2015-2016 Impingement Study monthly densities
Impingement data to support alternative technology evaluations	Evaluation of the 2015-2016 Impingement Study densities, length and weight data, and initial impingement survival

6 Impingement Characterization Study Plan

6.1 Introduction

This section of the Study Plan provides methods, materials, and procedures for impingement sample collection and processing. Any failures at the sampling or laboratory analysis stage are often uncorrectable because design-specified sampling times cannot be repeated once they have passed. Therefore, Standard Operating Procedures (SOPs) and a Quality Assurance (QA) Plan will be developed by the contractor performing the field studies for the impingement sample collection and processing based on this Study Plan and the contractors preferred methods, datasheets and equipment to eliminate, reduce, and/or quantify those errors.

Adherence to sample collection SOPs will be observed and documented through regular technical assessments. These technical assessments will be conducted by a QA officer, who is independent of those individuals collecting and generating the data during the study and has experience in performing QA/QC programs for aquatic monitoring surveys, and will be scheduled to occur at least quarterly throughout the course of the study. The specific requirements are to be developed by the contractor performing the work, will incorporate a checklist of items to be inspected based on the SOPs, and will include observations relevant to performance of sampling that may not be covered by the SOP. Careful attention will be paid to the initiation of the study when staff may be less familiar with the SOPs.

6.2 Safety Policy

All work performed under the direction of Dominion Environmental Services (DES) and/or Dominion Business Units (BU) on Dominion properties and/or on properties owned or operated by third parties (i.e., not owned or operated by the contractor or Dominion) is to be performed using safe work practices that are at least equivalent to those required for Dominion personnel and of any third party owner or operator. At a minimum, all contractors are expected to be aware of, and adhere to, Dominion’s Corporate Safety Policy, DES Safety Work Practices and any BU or other location-specific safety policies and procedures.

6.3 Field Collection Procedures

An overview of the Impingement Characterization Study Plan methods is provided in Table 6-1. Upon arrival at the plant, the crew will check in with facility security and operations personnel prior to commencing any on-site activities. Prior to the start of each 24-hour impingement sampling event, the crew with the assistance of an operations engineer or designee will document the screens will be operating in a continuous wash mode for the duration of a 24-hour sampling event. The number of operating cooling water pumps will be documented.

Table 6-1. Impingement Sampling Details -

Impingement	Details
Units to be Sampled	Units 3 & 4, 5, 6, 7, and 8
July 1, 2015 – June 30, 2016 Sampling Events	Twice per month sampling events (within the first and third week of each month) for 12 months [2/month x 12 months = 24 sampling events]
Daily Collection Schedule	Samples collected every hour in a 24-hr period (24 collections / 24-hr period)
Targeted Organisms	Adult and juvenile fish and shellfish
Sampling Location	Sample common fish return trough screenwash at the end of the last screen at each intake structure
Sampling Gear	3⁄8-inch square mesh drop-in basket/net after the last screen at each intake structure
Sample Duration	10 minutes as the target interval (every hour)
Number of Samples per Survey	24 sample collections/survey
Total Number of Samples	24 samples/survey x 2 surveys/month x 12 months x 6 sampling locations = 3,456 samples

Consideration must be made to ensure the sampling event does not interfere with plant operation nor result in risk to health and safety of field personnel. Specific sampling details associated with each 1-hour sample period are as follows:

- Circulating water pump status, traveling screen and rake status will be documented for each Unit, pump and intake bay.
- If a Unit is not in operation impingement samples will not be collected at this location.
- If no circulating water pumps are operating at all Units, sampling will be rescheduled; periods of downtime for operation of one or more units are anticipated and should not affect the schedule, and screens should not be rotated for the unit that is not operating during impingement sampling.
- At the start of impingement sampling all screens at the operating units will be washed prior to sample collection and all screens for the operating units will be placed in a continuous mode for the duration of a 24-hour sampling event.
- After the screens have been washed and completed a minimum of one full rotation, the drop-in basket/net will be inserted in the trough to start the initial 10-minute sample collection in the first hour.
- The installation of the drop-in basket/net at each location will be staggered within each hour to allow the sampling crew to monitor all the baskets/nets and remove them after the 10-minute sample interval.
- At the end of the 10-minute sample collection period, the basket/net will be removed from the trough at each location.
- Following completion of each sampling time, the crew will promptly retrieve the catch from the basket/net at each location and analyze the catch. The catches from each sample location will be analyzed separately to document the catches from the individual units (the catches from Units 3 and 4 will be analyzed together).

- If the analysis cannot be done immediately the contents of the collection event will be put in a plastic bag, placed on ice and analyzed as soon as possible; this will preclude handling procedures of Sturgeon (see Section 6.4.4) and evaluations of initial impingement survival.
- After collection of the impingement sample, the fish will be separated from the debris and prepared for analysis.
- Collected finfish and shellfish will be processed and analyzed for identification, enumeration and length/weight measurements.
- Initial impingement survival data will be collected for the first 10 minutes of sample processing only during each hourly sampling (See Section 6.4.1).
- Water quality parameters (water temperature, dissolved oxygen, pH, salinity and conductivity) will be recorded with a water quality analyzer (see instrument specifications above). Water quality sampling will be conducted at the near-surface, mid-depth, and near-bottom at the Unit 6 intake.
- Other climatic data such as rain, cloud cover, wind speed and direction, etc. shall also be recorded on the datasheet.
- At the end of each 24-hour sampling event the crew will notify the facility engineer or designee that impingement sampling has concluded.

6.3.1 Location

Impingement samples will be collected from the fish/debris return troughs at the east end of the intake structures after the last screen. Individual samples will be collected from Unit 7, Unit 8, Unit 3, Unit 4, Unit 5, and Unit 6 (a total of 6 sample locations; however the samples from the two sample locations at the Unit 3 and 4 intakes will be analyzed together). Drop-in baskets/nets will be used to collect the samples. At the Unit 3 and 4 intake structure, three screens drain to the east side of the structure and one screen drains to the west side of the structure. See Figure 6-1 for the impingement sampling locations where the nets will be inserted into the troughs.

6.3.2 Equipment

Sampling equipment will be acquired and/or constructed according to specifications in this Study Plan. Adequate backup equipment will be provided to ensure the study design can be followed in the event of equipment failure or loss. Prior to initiation of sampling, equipment will be tested or confirmed to meet specifications.

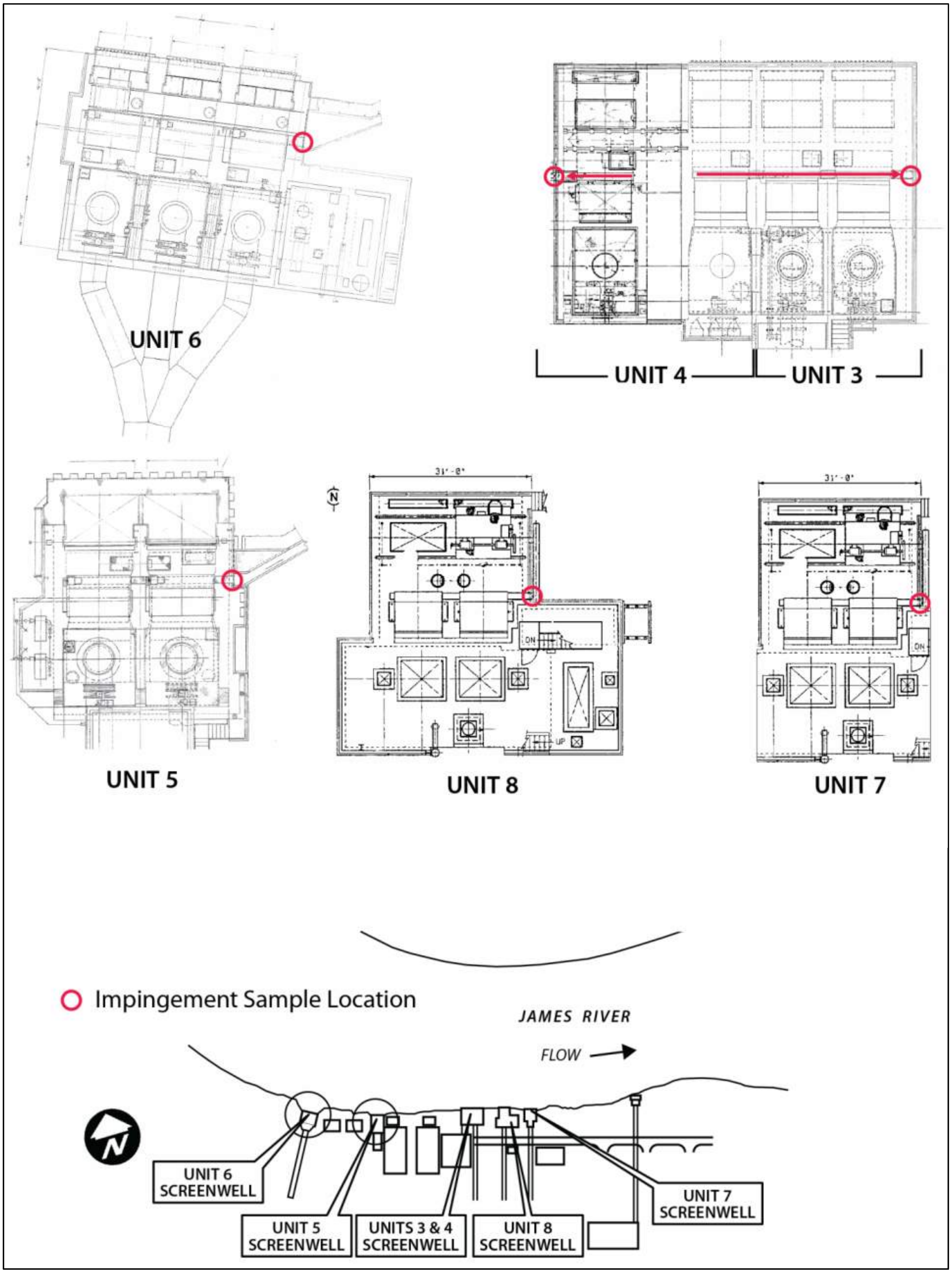


Figure 6-1. Impingement Sampling Locations -

A calibration program will be instituted for equipment requiring calibration that must be consistent with Dominion's instrumentation calibration and maintenance practice document (See Appendix B). The following list includes the minimum items expected to be required for impingement sample collection:

- Balance/Electronic Scale/Spring scale (accurate to the nearest gram)
- Calibrated weights
- Sorting bin
- Table to weigh and measure on
- Measuring boards (accurate to the nearest millimeter)
- Scissors, forceps
- Disposable Nitrile gloves
- Paper towels
- Field Binder w/ pens, pencils, SOP, data sheets, QC sheets, etc.
- Calculator
- Plastic buckets (both 2 quart & 5 gallon)
- Plastic bags (large, small, & Ziploc), labels, & twist ties
- Taxonomic keys
- Cooler(s) with ice
- Calibrated 5-gallon bucket for debris volume estimates
- Certified thermometers (2)
- pH pens (3) & standards
- Watch
- 500-ml plastic bottles for water quality QC
- Portable water quality meters (2) as described below[3]
    - Handheld Salinity, Conductivity & Temperature meters (2) with autoranging scales (e.g., YSI Model 30 or equivalent) with the following minimum specifications:
        - Conductivity ranges of 0 to 500 µS/cm and 0-200 mS/cm with an accuracy of +/- 0.5 % full scale
        - Salinity range of 0 to 80 ppt with an accuracy of +/- 2 % or +/- 0.1 ppt
        - Temperature range of -5 to 45 °C with an accuracy of +/- 0.2 °C
    - Handheld Dissolved Oxygen & Temperature meters (2) with autoranging scales (e.g., YSI Model 55 or equivalent) with the following minimum specifications:
        - Dissolved Oxygen % Saturation ranging from 0 to 200 % with an accuracy of +/- 2 %
        - Dissolved Oxygen mg/L ranging from 0 to 2 mg/L with an accuracy of +/- 0.3 mg/L
        - Temperature range of -5 to 45 °C with an accuracy of +/- 0.2 °C
    - Portable pH meters (2) with the following minimum specifications:
        - pH range of 0 to 14 units with an accuracy of +/- 0.2 units
- Calibration solutions as required for the water quality instrumentation
- Buckets/Containers with calibrated 0.5 gallon graduations; 1-, 3-, and 5-gallon sizes, or as dictated by debris load.
- Shovels/scoops as necessary

[3] A multiple parameter water quality meter may be used provided it meets the minimum specifications outlined for the individual meters.

- Digital camera
- Nitrile or latex gloves
- Hand sanitizer
- Identification keys for aquatic vegetation

6.3.3 Sampling Schedule

The program will be continued for 12 consecutive months with the 24 sample events conducted over the July 1, 2015 – June 30, 2016 period. Each sampling event will encompass a 24-hour period with 24, one-hour subsampling periods. Sampling events will be distributed within the first and third week of each month for the 12 month period. If a sampling event is missed due to weather or other events, the scheduled sampling event will be conducted within 96-hours of resolution of the complicating event.

6.3.4 Water Quality Measurements

Water quality parameters (water temperature, dissolved oxygen, pH, salinity and conductivity) will be recorded with a water quality analyzer (see instrument specifications above). Water quality sampling will be conducted at the near-surface, mid-depth, and near-bottom at the Unit 6 intake.

Quality control for water quality data collection will be performed twice per sampling event (once per 12-hour shift) using either a second calibrated water quality meter or by collecting water samples for wet chemistry analysis. Calibration of water quality equipment will be consistent with the *Field Instrumentation: Calibration and Standardizations* requirements in Appendix B.

6.4 Collection Processing

The following collection processing will be accomplished on-site:

- All fish and macroinvertebrates will be identified to the lowest practical taxonomic level and enumerated.
- In addition, the following fish and shellfish will be enumerated on site and preserved in 5% Formalin solution for laboratory identification and morphometrics:
    - Up to 20 age-0 or age-1 river herring (alewife and blueback herring) per impingement sample will be preserved for laboratory identification by dissection (age-2 and older river herring are expected to be able to be identified to species in the field). If more than 20 age-0 and age-1 river herring are collected in a sample, these additional fish will be identified and enumerated as “river herring” or “*Alosa* spp.” on field datasheets.
    - Up to 50 crayfish per 24-hr impingement sampling event will be preserved for laboratory identification and morphometrics.
- Up to 10 randomly selected live and fresh dead fish from each species collected will be measured for total length, maximum body width, and maximum body depth to the

nearest millimeter and weighed to the nearest gram. Additionally, up to 10 randomly selected live and/or fresh dead blue crabs (*Callinectes sapidus*) will be measure for greatest body (carapace) length, width, and depth. No more than 100 measurements of each species are required within a 24-hour impingement sampling event.

- A voucher collection will be maintained for the project representing each species collected during impingement. Vouchered fish will be collected from the site and fixed in unstained 10 percent formalin. After a period of at least 48 hours the fish will be transferred to 70 percent ethanol after being soaked in water for at least 48 hours and up to one week.
- All balances will be checked against standard weights on each day that they are used and the results will be recorded.
- Threatened or endangered species will be processed immediately. Refer to Section 6.4.4 *Handling Procedures for Atlantic Sturgeon* for more details.
- Debris collected during a sampling event will be categorized and an estimate of volume for each category will be recorded in the datasheet.
- Following analysis of the catch and categorization of the debris, all organisms and debris will be placed in an appropriate trash receptacle to eliminate the potential for re-impingement.

Refer to Appendix C for a summary of key data to be collected during the study.

6.4.1 Initial Impingement Survival

Initial impingement survival data will be collected for the first 10 minutes of sample processing only during each hourly sampling. Field crews will select fish for processing at random across species and size classes present in the screen wash sample. Each fish and macroinvertebrate will be classified according to the following condition criteria and enumerated by category:

- \- Live, Undamaged – live with no apparent damage
- \- Live, Damaged – live with evidence or indication of abrasion or laceration
- \- Fresh Dead - no vital signs, no body or opercular movement, clear eyes, red gills and no obvious signs of decay
- \- Dead Decaying - no vital signs, cloudy eyes, soft flesh, pale gills, other obvious signs of decay.

6.4.2 Morphometrics

For each 1-hour sample period, up to 10 randomly selected live and fresh dead fish from each taxon collected will be measured for total length, maximum body width, and maximum body depth to the nearest millimeter and weighed to the nearest gram. Additionally, up to 10 randomly selected live and/or fresh dead blue crabs (*Callinectes sapidus*) will be measure for greatest body (carapace) length, width, and depth. No more than 100 measurements of each species are required within a 24-hour impingement sampling event.

All balances will be checked against standard weights on each day that they are used and the results will be recorded on the appropriate form.

6.4.3 Debris Load Characterization

Upon completion of fish and shellfish catch processing, a debris load characterization will be completed for the impingement collection. Debris volume will be measured to the nearest 0.1 gallon (for reference, 0.1 gallon = 12.8 ounces, 0.4 quart, 0.38 liter, 1.6 cups) by means of marked and calibrated buckets or other containers of varying sizes. At a minimum, one-, three- and five-gallon containers will be available; exact size and number of containers may be modified as is appropriate for the debris load at the facility. If feasible, debris types (outlined below) will be separated, and the volume of each measured. If this is not feasible, total debris volume will be measured, and the best possible estimation of volume of each debris type will be made. A photograph of the debris load will be required only if debris characterization or quantification is not possible. Data will be recorded on the impingement sampling data forms.

Debris types/categories will include at a minimum:

- Aquatic vegetation and algae, with taxonomic description as practicable
- Terrestrial vegetation – leafy/herbaceous
- Terrestrial vegetation – woody[4]
- Aquatic or terrestrial fauna (e.g. Ctenophora; Cnidaria; Insecta) not quantified in impingement sample, with taxonomic description as practical
- Sediments or other natural inorganic debris, with general description of size composition (e.g. gravel, sand, silt etc.)
- Man-made debris/refuse with general description of types (plastic, metal etc.)

If debris collected at a facility does not fall into one of the above categories, a new one may be created. Whenever pertinent, additional descriptions and photos of debris should be recorded. Following measurement and description, debris will be disposed of according to facility procedures.

[4] Branches and other woody debris that cannot conveniently be put into a bucket should be photographed.

6.4.4 Handling Procedures for Atlantic Sturgeon

Atlantic Sturgeon are not expected to be susceptible to impingement at CPS. However, in the event of observation or collection of Atlantic Sturgeon, the VDGIF will be contacted by Dominion (i.e., DES) within 24-hours of collection per the requirements of the Scientific Collection Permit that will be obtained prior to any sampling. In addition, the following handling methods are provided in order to reduce stress, avoid injury and mortality, and quickly release Atlantic Sturgeon, in the unlikely event that they are collected. Atlantic Sturgeon is the only sturgeon species expected in the area of the CPS intake and as such, there is no need to distinguish Atlantic Sturgeon from other species of sturgeon (NMFS 2012b).

1) - Sturgeon will be removed from the collection gear as quickly and carefully as possible and total processing time, exclusive of resuscitation efforts, should not exceed 10 minutes.

2) - Live sturgeon will be placed into tubs filled and overflowing with ambient river water, which will be continuously supplied to the tubs while they contain fish.

3) - In the absence of a continuous water source (pump and hose) or for sturgeon that don’t fit in tubs, buckets will be used to add ambient water or every few minutes or to keep sturgeon wet while they are being processed.

4) - Each sturgeon will be placed on the measuring board where live sturgeon will be kept wet throughout the data collection procedure. Large specimens will be measured using a tape measure. The following measurements will be quickly recorded in mm:

   - Total Length: straight line along the body axis from the tip of the snout to the tip of the tail (not following the curvature of the body)
   - Fork Length: straight line along the body axis from the tip of the snout to the posterior edge of the fork of the tail (not following the curvature of the body)
   - Interorbital Width: distance between the lateral margins of the bony skull at the midpoint of the orbit
   - Mouth Width: distance between the left and right inside corners of the mouth (i.e., excluding the lips); this should be measured with the mouth closed

5) - Each individual will be examined for a Passive Integrated Transponder (PIT) tag and external injuries.

6) - After making sure that the fish is wet enough, three photographs will be quickly taken to aid in species identification and document the condition of the fish. One will be taken of the top of the fish, one will be taken of the bottom of the fish (a good view of the mouth is important), and one will be taken of the side of the fish. A ruler will be included in the photograph for scale of the dorsal and ventral surface of the head. Injuries and physical abnormalities will also be photographed. After the requisite data has been collected, live fish will be returned to the river at the boat ramp located approximately 1,000 ft

downstream of the CPS CWISs, as quickly and as gently as possible to prevent mortality.

7) - If Atlantic Sturgeon appear nonresponsive, an attempt will be made to resuscitate them by flushing water over the gills until recovery is obvious by the fish's desire to escape. The best method is to use a pump and hose directed into or placed in the mouth (with a piece of sponge to protect the mouth). In the absence of a pump and hose, the sturgeon can be gently dragged back and pushed forward underwater. The drag back should be gentle and slower to protect the gills (Damon-Randall et al. 2010).

8) - Sturgeon handling and reporting would comply with all conditions of the VDGIF Scientific Collection Permit.

9) - If incidental death or injury of Sturgeon occurs, Dominion is to notify VDGIF at collectionpermits@dgif.virginia.gov within twenty-four (24) hours of occurrence. The following information must be reported: collector, date, species, location (county, quad, waterbody, and latitude and longitude to nearest second), and number collected. Dead Sturgeon will be retained by Dominion on ice or frozen until VDGIF specific handling guidance is obtained. Non-lethal injured Sturgeon will be returned to the source waterbody alive.

10) If incidental observation or collection and live release of Sturgeon occur, Dominion is required to notify VDGIF at collectionpermits@dgif.virginia.gov within seven (7) days, providing the same information as the above condition.

Refer to the following references for additional information on sturgeon handling practices:

- Moser, M.L., M. Bain, M.R. Collins, N. Haley, B. Kynard, J.C. O'Herron II, G. Rogers, and T.S. Squiers. 2000. A Protocol for Use of Shortnose and Atlantic Sturgeons. National Marine Fisheries Service, NOAAT Technical Memorandum NMFS-OPR-18.

- Damon-Randall, K., R. Bohl, S. Bolden, D. Fox, C. Hager, B. Hickson, E. Hilton, J. Mohler, E. Robbins, T. Savoy, and A. Spells. 2010. Atlantic Sturgeon research techniques. NOAA Technical Memorandum NMFS-NE-215.

The following includes the minimum items expected to be needed to handle sturgeon, should they be collected in impingement samples:

- Large tank or tub (~5 ft x 2.5 ft x 2 ft)
- 12-volt water pump for flow-through on holding tank with hoses & fittings as required
- Battery to operate pump
- 12 volt pig-tail adapter
- Fish sling (to hold & lift large fish safely for handling, transport & aid in release)
- PIT Tag Reader
- 5-Gallon Buckets
- Scale to weigh larger fish
- Measuring board (for smaller fish)
- Tape (for large fish)
- Calipers for interorbital and mouth measurements
- Camera

- Contact numbers -

7 References

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Habitat Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

Balazik, G. C. Garman, J.P. Van Eenennaam. 2012. Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia. Transactions of the American Fisheries Society 141: 1465-1471.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. *Environmental Biology of Fishes* 48: 347-358.

Bain, M.B., N. Haley, D. Peterson, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic Sturgeon Acipenser oxyrinchus Mitchill, 1815, in the Hudson River estuary: Lessons for sturgeon conservation. Boletin-Instituto Español de Oceanografía 16: 43-53.

Barfield, M.L. and E.T. Watters. 1998. Non-parasitic life cycle in the green floater, *Lasmigona subviridis* (Conrad, 1835). Triannual Unionid Report, 16: 22.

Bilkovic, DM, K Angstadt, and D Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia. Final report to NOAA Chesapeake Bay Office, Award Number NA06NMF4570303. Virginia Institute of Marine Science, Center for Coastal Resources Management, Gloucester Point, Virginia.

Bushnoe, T.M., J.A. Musick, and D.S. Ha. 2005. Essential Spawning and Nursery Habitat of Atlantic Sturgeon (Acipenser oxyrinchus) in Virginia. Appendix 1 of Essential Fish Habitat of Atlantic Sturgeon Acipenser oxyrinchus in the Southern Chesapeake Bay. Principal Investigator: Jasck Musick. VIMS Scientific Report #145.

Chesapeake Bay Journal. May 2011. Blue catfish boom threatens region's river ecosystems. The Bay Journal 22(3).

CH2MHILL. 2011. Best Technology Available Determination for Reducing Impingement Mortality, Bremo Power Station.

Dee, S.O. and T. Watters. New or confirmed host identifications for ten freshwater mussels. Proceedings of the Conservation, Captive Care, and Propagation of Freshwater Mussels Symposium. Pages 77-82. Ohio Biological Society.

Dominion Electric Environmental Services (Dominion). 2013. Draft 316(b) Six Month Requirements Submittal for the Chesterfield Power Station.

Dominion. 2004. Proposed Biological Studies – Chesterfield Power Station

EA, Engineering Science and Technology (EA). 2006. Draft Impingement and Entrainment Mortality Characterization Report, June 2005 – May 2006, Chesterfield Power Station.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and Shortnose Sturgeons. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28 pp.

Hager, C. 2011. Atlantic Sturgeon review: Gather data on reproducing subpopulation of Atlantic Sturgeon in the James River. Contract EA133FIOCN0317.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Department of Commerce, Bulletin of the United States Bureau of Fisheries, Volume XLIII.

Johnson, R.I. 1970. The systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the southern Atlantic slope region. Bulletin of the Museum of Comparative Zoology 140(6):263-449.

Johnson, R.S. The Systematics and Zoogeography of the Unionidae (Mollusca: Bivalvia) of the Southern Atlantic Slope Region. Bulletin of Museum of Comparative Zoology 140(6):263-449.

Jones, P. W., Martin, F. D. and Hardy, J. D. Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

Kynard, B., D. Pugh and T. Parker. 2005. Experimental studies to develop a bypass for Shortnose Sturgeon at Holyoke Dam. Final report to Holyoke Gas and Electric, Holyoke, MA.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, and Shortnose Sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

Lellis, W.A. and T.L. King. 1998. Release of metamorphosed juveniles by the green floater, *Lasmigona subviridis*. Triannual Unionid Report, 16: 23.

Lung, W.S. 1991. Trends in BOD/DO modeling for wasteload allocations of the James River estuary. Technical memorandum prepared under subcontract for Tetra Tech, Inc., Fairfax, VA, by Envirotech, Inc., Charlottesville, VA.

Moser, M. L., and S. W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the lower Cape Fear River, North Carolina. Transactions of the American Fisheries Society 124: 225-234.

National Marine Fisheries Service (NMFS). 2015. Endangered and Threatened Species Under NMFS' Jurisdiction (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm).

NMFS. 2012a. Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).

NMFS. 2012b. Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission, that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.

NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://explorer.natureserve.org. (Accessed: October 21, 2014).

Poletto, J.B., Cocherell, D.E., Ho, N., Cech, J.J. Jr., Klimley, A.P., and Fangue, N.A. Juvenile green sturgeon (*Acipenser medirostris*) and white sturgeon (*Acipenser transmontanus*) behavior near water-diversion fish screens: experiments in a laboratory swimming flume. (2014). *Canadian Journal of Fisheries and Aquatic Sciences* 71:1030-1038.

Rash, J.M. 2005. Life history characteristics of the Atlantic pigtoe (Fusconaia masoni). Abstract of Papers 83rd Annual Meeting of the Virginia Academy of Science, May 17-20, 2005. James Madison University, Harrisonburg, VA.

Secor, D. H., E. J. Niklitschek, J. T. Stevenson, T. E. Gunderson, S. P. Minkkinen, B. Richardson, B. Florence, M. Mangold, J. Skjeveland, and A. Henderson-Arzapalo. 2000. Dispersal and growth of yearling Atlantic Sturgeon, Acipenser oxyrinchus, released into Chesapeake Bay. Fishery Bulletin 98: 800-810.

Terwiliger, K. 1991. Virginia's Endangered Species: Proceedings of a Symposium. Virginia Department of Game and Inland Fisheries, McDonald and Woodward Publishing Company, Blacksburg, VA.

U.S. - Fish and Wildlife Service (USFWS). 2015. IPAC. Information for Planning and Conservation. Web. http://ecos.fws.gov/ipac/. Retrieved June 20, 2015.

USFWS - Raleigh Ecological Serices Field Office. 2012. Sensitive Joint-vetch (Aeschynomene virginica). Retrieved September 7, 2014. http://www.fws.gov/raleigh/species/es_sensitive_joint-vetch.html

VEPCO. 2000. Section 316(a) Demonstration. VPDES Permit Number VA0004146 - Chesterfield Power Station. Virginia Electric and Power Company, Environmental Policy and Compliance, Glen Allen, Virginia.

VEPCO. 1977. Chesterfield Power Station Impingement and Entrainment Study. Final report. Prepared by Virginia Electric and Power, Environmental Services Department, Richmond, VA.

Verhille, C.E., Poletto,J.B., Cocherell, D.E., DeCourten, B., Baird, S., Cech, J.J. Jr., and Fangue, N.A. Larval green and white sturgeon swimming performance in relation to water diversion flows. Conservation Physiology 2: doi:10.1093/conphys/cou031.

Virginia Department of Game and Inland Fisheries (VDGIF). 2014. Barking treefrog (Hyla gratiosa). Available online. Retrieved September 7, 2014. http://www.dgif.virginia.gov/wildlife/information/?s=020002

VDGIF. 2015a. Fish and Wildlife Information Service (VAFWIS). Web. http://vafwis.org/fwis/. Retrieved June 20, 2015.

VDGIF. 2015b. VAFWIS Chapters for Green Floater. Available online: https://vafwis.dgif.virginia.gov/fwis/booklet.html?Menu=_.Occurrence&bova=060081&version=16606. Retrieved July 27, 2015.

Watson, J. 2012. James River Mainstem Freshwater Mussel Surveys. Virginia Department of Game & Inland Fisheries, Bureau of Wildlife Resources. Accessed on November 13, 2013 Available online: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CC8QFjAD&url=http%3A%2F%2Fncmollusks.wikispaces.com%2Ffile%2Fview%2FJamesRiverSurveys.pdf&ei=1QVmVIfDH_TesASBvICgBg&usg=AFQjCNHoLbYHINRMh89V_2H6BPNyEZT8cA&sig2=NR_T2jFldgg2ucIZqnJn_w&bvm=bv.79142246,d.cWc.

Wolf, E.D. 2010. Propagation and Culture of Species at Risk Atlantic Pigtoe. Department of Defense Legacy Program. Project #09-450.

Wolf, E.D. and V. Emrick. 2011. Propagation and Culture of Species at Risk Atlantic Pigtoe. Department of Defense Legacy Program. Project #10-450.

Appendix A -

Atlantic Sturgeon Life History Information -

Atlantic Sturgeon Life History Information

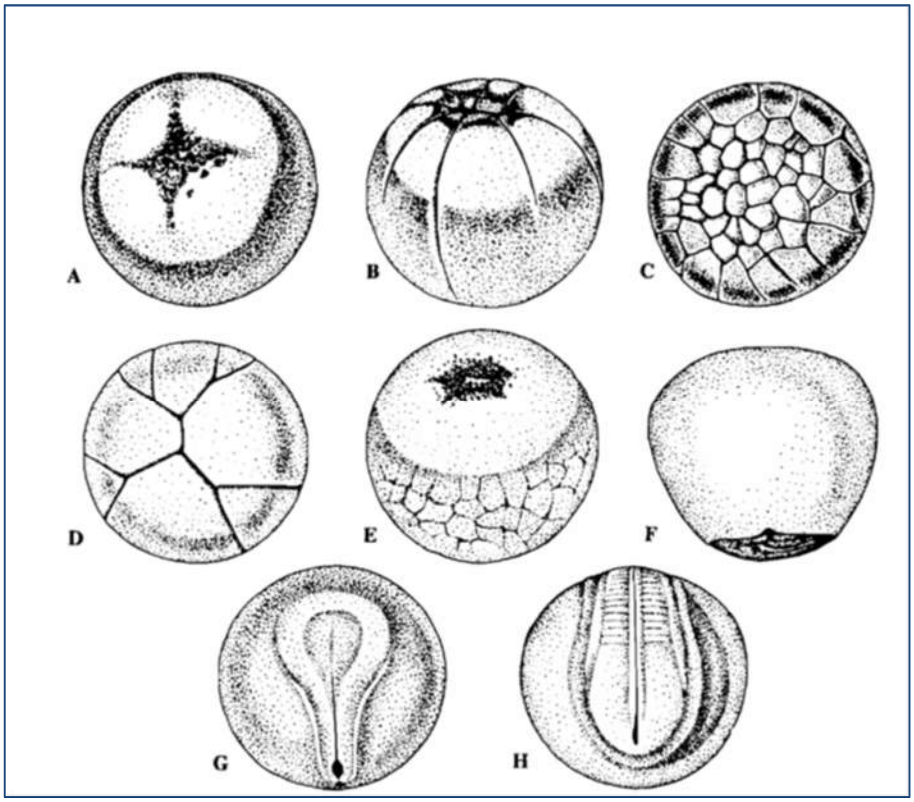
Atlantic Sturgeon (*Acipenser oxyrinchus*) originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina Distinct Population Segments (DPSs) are listed as endangered. Those originating from the Gulf of Maine DPS are listed as threatened. Atlantic Sturgeon from these five DPSs have the potential to occur in the James River and the vicinity of the cooling water CWIS of the CPS. The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida (NMFS 2012a).

The James River historically provided the largest stock of Atlantic Sturgeon in the Chesapeake and the majority of the adults in the river are likely to originate from the James River and thus, the Chesapeake Bay DPS (Hildebrand and Shroeder 1928; ASSRT 2007; Hager 2011; NMFS 2012a). Because early life stages (eggs and larvae), yearlings, and juveniles do not leave their natal river or estuary, any Atlantic Sturgeon from these life stages in the James River would have originated from the Chesapeake Bay DPS. Subadult Atlantic Sturgeon (greater than 50 cm but not yet sexually mature), move outside their natal rivers. Therefore, subadult Atlantic Sturgeon present in the James River and in the vicinity of the CWIS could be from any of the five DPSs.

Atlantic Sturgeon spawn in the James River. Benthic substrates that provide suitable sturgeon spawning habitat (i.e., rock and cobble gravel) occur in the vicinity of CPS; however, some of these areas might not have viable spawning conditions (e.g., hydrodynamic characteristics) (Bilkovic et al. 1999). Bushnoe et al. (2005) indicate that the Turkey Island and Jones Neck oxbows, which are approximately 3 -7 miles downstream CPS are considered potential spawning habitat due to their hydrodynamic characteristics and also benthic substrate, including rock and gravel/cobble/pebble (Bilkovic et al. 2009, NMFS 2012a). Spawning is expected to occur from the April through June; evidence exists that spawning might occur in the fall as well, with high adult usage in the river from August through November (Balazik et al. 2012, Secor et al. 2000). Virginia Marine Resources Commission restricts dredging in the James River from March 15 through June 30 to accommodate spring-spawning anadromous fish (Balazik et al. 2012) and NMFS (2012b) recently restricted dredging in the lower James River from February 15 to June 15th and in the rest of the river from February 15 to June 30 to protect anadromous fish during migration and spawning periods.

Eggs can hatch in 4 - 7 days depending on temperature (Gilbert 1989; Hildebrand and Schroeder 1928). Eggs are strongly adhesive and demersal, and occur only on the spawning grounds attaching to the substrate in 20 minutes (Jones et al. 1978). Atlantic Sturgeon eggs are approximately 2.6 mm in diameter (Hildebrand and Schroeder 1928) and hatch approximately 94, 140, and 168 hours after egg deposition at temperatures of 20°C, 18°C, and 17.8 °C, respectively (Gilbert 1989; Hildebrand and Schroeder 1928).

Ripe (unfertilized) Atlantic Sturgeon eggs are reported to be 2.5 - 2.6 mm in diameter, globular in shape, and of a light to dark brown color. Fertilized eggs are up to 2.9 mm in diameter, slate gray or light to dark brown, and become oval as development proceeds (Jones et al. 1978) (see Figure A-1). The germinal disc is evident in the unfertilized egg. A cross- or star-shaped pigment patch is apparent in the animal pole of the fertilized egg. The eggs are distinctly two-layered with the outer layer being a viscous substance.



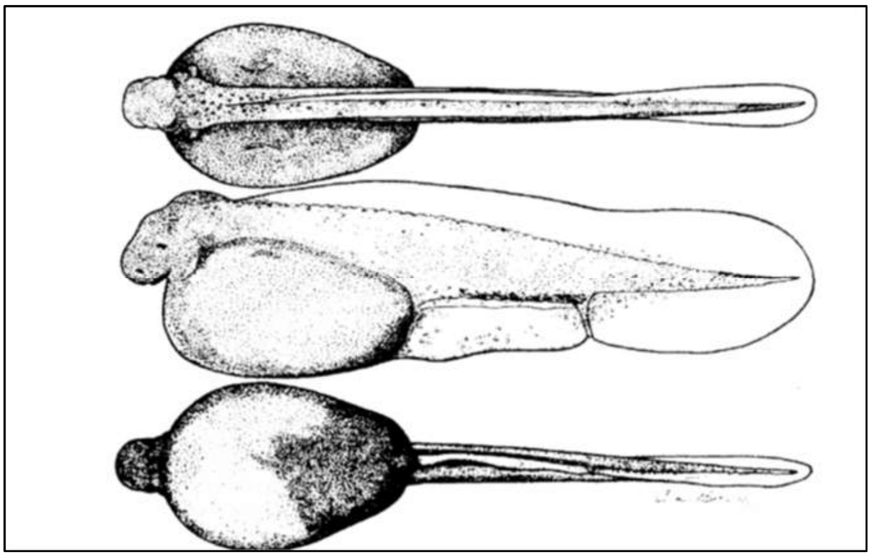
Source: Jones et al. 1978 as presented in Gilbert 1989

Figure A-1. Atlantic Sturgeon Egg Development from Unfertilized Egg to 48-hour Stage

Yolk-sac larvae are expected to inhabit the same areas where they were spawned (Bain et al. 2000; ASMFC 2012). Smith et al. (1980 in Gilbert 1989) also reported that the yolk-sac larvae were darkly pigmented and active swimmers. Hard substrate is important to larval Atlantic Sturgeon as it provides refuge from predators (Kieffer and Kynard 1996 and Fox et al. 2000 as cited in ASMFC 2012). Bath et al. (1981) only collected sturgeon larvae in bottom samples. Larvae are also active swimmers and leave the bottom when 8 to 10 days old to swim in the water column (Kynard and Horgan 2002).

The yolk-sac larval stage is completed in about 8 to12 days (Jones et al. [1978] reports 6 days), at which time the larvae move downstream to the rearing grounds (Kynard and Horgan 2002). During the first half of this migration, larvae move only at night and use benthic structure (e.g., gravel matrix) as refuge during the day (Kynard and Horgan 2002). During the latter half of migration to the rearing grounds, when larvae are more fully developed, movement occurs during both day and night. Larvae transition into the juvenile phase at approximately 30 mm total length (TL) and move further downstream into brackish waters, developing a tolerance to salinity. Eventually they become residents in estuarine waters for months to years before emigrating to open ocean (ASSRT 2007, ASMFC 2012).

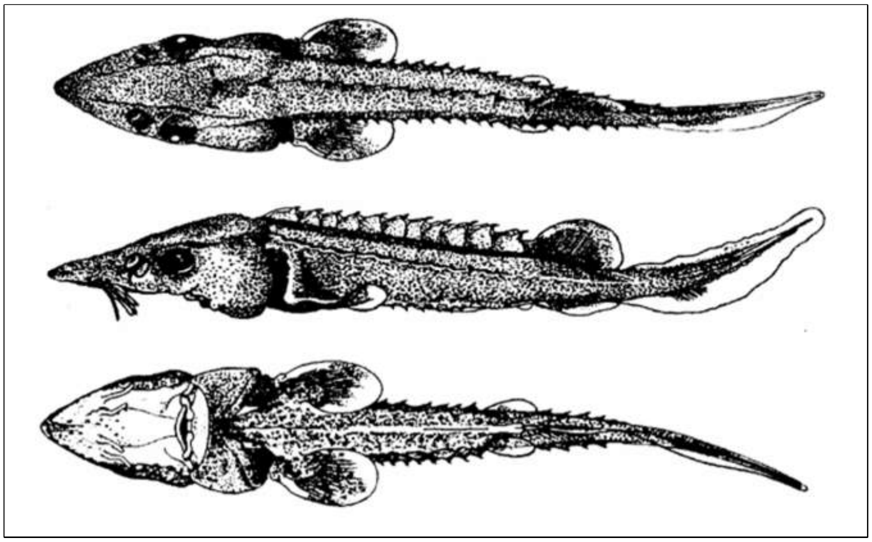
Atlantic Sturgeon larvae are expected to be approximately 7 - 9 mm TL at hatching (Bath et al. 1981, Smith 1980 as cited in Bain et al. 2000, Gilbert 1989, Snyder 1988), although Jones et al. (1978) describe a newly hatched Atlantic Sturgeon larvae at 11.5 mm TL. The head width is 8% of standard length (SL) with a depth of 11 % of SL (behind the posterior margin of the eye). The yolk-sac maxima is 23 % of SL and the yolk-sac depth is 20% of SL (Snyder 1988). Jones et al. (1978) describes the newly hatched Atlantic Sturgeon larvae with a head and the tail that is darkly pigmented and a yolk that is a large "dirty yellow," vascular oval. The head is not deflected over the yolk (bent around the yolk). The mouth is formed. The eye is relatively small and is about the same size as the round auditory vesicles. The branchial arches are concealed by the opercular folds, the barbels are lacking, pectoral buds are present, and the origin of the dorsal finfold is in the occipital region. Bath et al. (1981) reports that a continuous finfold extends from behind the head dorsally around the notochord and ventrally to the posterior end of the yolk sac, a dorsal wedge-shaped cavity at the fourth ventricle in the posterior of the blunt head, and a vent extended through the finfold at 0.6 to 0.7 of the TL from the snout. The spiral valve was distinguishable, even in small specimens.



Source: Snyder 1988

Figure A-2. Atlantic Sturgeon Yolk Sac Larvae Just Hatched

Snyder (1988) reports that Atlantic Sturgeon complete yolk absorption by 13 - 14 mm SL in 6 - 7 days, acquire their first scutes between 17 and 20 mm SL at 13 - 29 days, acquire their first fin rays at 21 mm SL (13 - 29 days), and acquire a full complement of fin rays, except the caudal fin, between 47 and 58 mm SL at 29 - 100 days. A 29-day hatchery-reared larva is presented in Figure A-3.



Source: Snyder 1988

Figure A-3. Atlantic Sturgeon, 28.9 mm SL, 29.3 MM TL, 29 Days After Hatching

Mean myomere counts for Shortnose and Atlantic Sturgeon are 38 preanal and 22 or 23 postanal. Snyder (1988) presents a detailed comparison of shortnose and Atlantic Sturgeon and provides details on the age and length of the onset of certain developmental events.

Juvenile Atlantic Sturgeon demonstrate a lot of variation with regard to salinity tolerance (ASMFC 2012). Atlantic Sturgeon spawn in their natal river and remain in the river until approximately age two and at lengths of approximately 76 - 92 cm (30 - 36 inches; ASSRT 2007). Yearlings are known to occupy freshwater portions of their natal river (Secor et al. 2000) and their distribution in the James River is expected to follow this pattern. Juveniles in the river are also restricted to low salinity areas, with overwintering known to occur in deep water areas near river mile 25 (NMFS 2012a).

Hager (2011) used telemetry to establish movement patterns of adult and subadult Atlantic Sturgeon in the James River. Thirty-two adults and thirty-three subadults were outfitted with telemetry tags and telemetry receivers were placed throughout the river to record the presence of tagged fish when they are within approximately one kilometer of the receivers.

Results of Hager (2011) indicate that adult Atlantic Sturgeon enter the James River in spring when water temperatures are around 17°C, and occur from river mile 29 to river mile 67 before departing from the river in June when water temperatures are around 24° C. Data collected in 2010 demonstrated a congregation of sturgeon in freshwater areas near river mile 48, suggesting the possibility of spawning in this area (Hager 2011). Adult Sturgeon appear to be absent from the James River for most of the summer until late August when tagged fish are once again detected in the river (Hager 2011). During the late summer-early fall residency (August-October), fish ascend the river rapidly and congregate in upriver sites between river mile 48 and the fall line near Richmond, VA; possibly in response to physiologically stressful conditions (e.g., low dissolved oxygen and elevated water temperature) in the lower James River and Chesapeake Bay (Hager 2011). During late summer, Atlantic Sturgeon exhibited a preference for the river section where the upper James and Appomattox rivers meet, approximately 9 miles downstream from CPS (Hager 2011). As temperature declines in late September or early October, adults disperse through downriver sites and begin to move out of the river (Hager 2011). By November, adults occupy only lower river sites (Hager 2011). By December, adults are undetected on the tracking array and, thus, are presumed to be out of the river (Hager 2011).

The highest number of subadults are present in the river in the spring and fall with the lowest numbers present in August when ambient water temperatures in the river are the highest. At this time of year, most subadults leave the river and any Atlantic Sturgeon remaining in the river are holding in cool water refugia (Hager 2011). The number of subadults in the river peaks in October. Many subadults leave the river for overwintering with some known to overwinter off the coast of North Carolina. Subadults overwintering within the river are located downstream of Hog Island.

Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Habitat Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon.

Atlantic Sturgeon Status Review Team (ASSRT). 2007. Status Review of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Balazik, G. C. Garman, J.P. Van Eenennaam. 2012. Empirical Evidence of Fall Spawning by Atlantic Sturgeon in the James River, Virginia. Transactions of the American Fisheries Society 141: 1465-1471.

Bain, M.B., N. Haley, D. Peterson, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic Sturgeon, *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River estuary: Lessons for sturgeon conservation. Boletin-Instituto Español de Oceanografía 16: 43-53.

Bath, D.W., J.M. O'Conner, J.B. Alber & L.G. Arvidson. 1981. Development and identification of larval Atlantic Sturgeon (*Acipenser oxyrhynchus*) and Shortnose Sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. Copeia 1981: 711–717.

Bilkovic, DM, K Angstadt, and D Stanhope. 2009. Atlantic Sturgeon Spawning Habitat on the James River, Virginia. Final report to NOAA Chesapeake Bay Office, Award Number NA06NMF4570303. Virginia Institute of Marine Science, Center for Coastal Resources Management, Gloucester Point, Virginia.

Bushnoe, T.M., J.A. Musick, and D.S. Ha. 2005. Essential Spawning and Nursery Habitat of Atlantic Sturgeon (*Acipenser oxyrinchus*) in Virginia. Appendix 1 of Essential Fish Habitat of Atlantic Sturgeon *Acipenser Oxyrinchus* in the Southern Chesapeake Bay. Principal Investigator: Jasck Musick. VIMS Scientific Report #145.

Fox, D. 2006. History of Atlantic Sturgeon Fishery. Power Point presentation presented to Delaware Department of Natural Resources, courtesy of Greg Murphy (DEDNR) April 13, 2006.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and Shortnose Sturgeons. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28 pp.

Hager, C. 2011. Atlantic Sturgeon review: Gather data on reproducing subpopulation of Atlantic Sturgeon in the James River. Contract EA133FIOCN0317.

Hildebrand, S.F. and W.C. Schroeder. 1928. Fishes of Chesapeake Bay. Department of Commerce, Bulletin of the United States Bureau of Fisheries, Volume XLIII.

Jones, P. W., Martin, F. D. and Hardy, J. D. Jr. 1978: Development of fishes of the Mid-Atlantic Bight. An atlas of egg, larval and juvenile stages. Volume I Acipenseridae through

Ictaluridae. U. S. Dep. Interior, Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS-78/12. 366 pp.

Kieffer, M. C. and B. Kynard. 1993. Annual movements of Shortnose and Atlantic Sturgeons in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 122: 1088-1103.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, and Shortnose Sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

National Marine Fisheries Service (NMFS). 2012a. Letter of concurrence, from Mr. D.M. Morris, NMFS, to Ms. Amy Hull, Nuclear Regulatory Commission, that continued operation Surry Nuclear Power Station, Units 1 and 2 is not likely to adversely affect species listed by NMFS.

NMFS. 2012b. Biological Opinion of James River Federal Navigation Project: Tribell Shoal Channel to Richmond Harbor in Surry, James City, Prince George, Charles City, Henrico, and Chesterfield Counties and the Cities of Richmond and Hopewell, Virginia (FINER/2012/01183).

Smith, T. I. J., E. K. Dingley and D. E. Marchette. 1980. Induced spawning and culture of the Atlantic Sturgeon, *Acipenser oxyrinchus* (Mitchill). Progressive Fish-Culturist 42: 147-151.

Secor, D. H., E. J. Niklitschek, J. T. Stevenson, T. E. Gunderson, S. P. Minkkinen, B. Richardson, B. Florence, M. Mangold, J. Skjeveland, and A. Henderson-Arzapalo. 2000. Dispersal and growth of yearling Atlantic Sturgeon, *Acipenser oxyrinchus*, released into Chesapeake Bay. Fishery Bulletin 98: 800-810.

Snyder, D.E. 1988. Description and Identification of Shortnose and Atlantic Sturgeon Larvae. American Fisheries Society Symposium 5: 7-30.

Appendix B -

Field Instrumentation: -
Calibrations and Standardizations -

WORK PRACTICE DOCUMENT

Field Instrumentation:

Calibrations and Standardizations

Dominion Environmental Services

Table of Contents

1.0 Introduction 2
2.0 Scope 2
3.0 Dominion Employees Covered 2
4.0 Work Practice Description 3
5.0 Safety 3
6.0 Work Practice Requirements 3
7.0 Electric Environmental Biology Calibration and Standardization Protocols 5
7.1 Chlorine 5
7.2 Conductivity/Salinity 5
7.3 Dissolved Oxygen (D.O) 7
7.4 pH Meters 8
7.5 Flowmeters 10
7.6 Temperature 10
7.7 Turbidity 10
7.8 Weight 11
7.9 Oxidation/Reduction Potential ORP 12
8.0 Contacts 13
9.0 Tables 14
11.0 Distribution List 21

WORK PRACTICE DOCUMENT

Calibrations and Standardizations

Electric Environmental Biology

Written Date: 8/16/2011

Revision Date:

Document Owner: Casey Seelig

1.0 Introduction

Dominion is required to monitor a variety of physicochemical parameters in the environment. These parameters are monitored with various types and models of scientific instrumentation. Instruments must be either calibrated or standardized and properly maintained to ensure the accuracy and precision of the data being collected. **Calibration** is a process of physically adjusting an instrument to accurately read a known standard or series of standards. **Standardization** is a process of checking an instrument against a known standard or series of standards to document its accuracy. Standardization, without a physical adjustment to the instrument, checks that the instrument is functioning to its design specifications and, if not the instrument can either be calibrated, serviced by the operator, or sent back to the manufacturer for repair. The manufacturer's recommended calibration and maintenance procedures for a particular instrument are designed to keep the equipment performing to the manufacturer's specifications. Every instrument's accuracy should be verified and documented to ensure it meets the acceptability criteria established for the work.

2.0 Scope

The purpose of this work practice document is to provide the protocols necessary to ensure all field instrumentation and test methods, which are used to measure environmental parameters, are providing data of acceptable accuracy. This work practice document defines the proper methods, frequencies, and acceptance criteria for documenting field instrument and test kit accuracy using calibrations and standardizations. The procedures in this document are general in nature. Due to the number and variety of field instrumentation used, specific calibration procedures for each instrument are beyond the scope of this document. The user's manual should be consulted for specific calibration and standardization procedures.

3.0 Dominion Employees Covered

This work practice applies to all Dominion Environmental Services (DES) employees using field instrumentation to monitor environmental parameters as well as any contractors employed by DES that conduct environmental analyses for monitoring studies. The guidelines and procedures listed in this work practice document apply to instruments used in the field. This does not cover the calibration or standardization of laboratory equipment.

4.0 Work Practice Description

The field instrumentation calibrations and standardizations work practice provides guidance on how to prepare for and safely conduct calibrations and equipment accuracy checks on field instrumentation. This work practice is intended for experienced field technicians or for those under the direct supervision of employees trained in proper calibration and standardization methods used for equipment and reagents required in the collection of environmental data.

5.0 Safety

Safety is a core Dominion principle and all calibration and standardization work must incorporate safe work practices. It is the responsibility of every employee and contractor to work safely. Safety of each employee, contractor, their co-workers and the general public are the first priority of every job. The conduct of all work should conform to the expectations described in the Dominion Safety Policy, the Safety Work Practice for Dominion Environmental Services, the Safety Work Practice for Biology, and the policies of the business unit where the work is being done. The types of Personal Protective Equipment (PPE) necessary for calibrating and standardizing field instruments must be reviewed prior to starting calibrations or standardizations to identify and mitigate any hazards.

1. Specific hazards associated with the type of instruments to be calibrated or standardized must be known prior to the start of the calibration or standardization. Examples of such hazards might include: health and safety concerns associated with the use of pH standards as identified by the Material Safety Data Sheet (MSDS).
2. Where the mitigation of hazards is not possible, Personal Protective Equipment (PPE) must be worn to safely complete the calibration/standardization. A hazard assessment must be performed to evaluate each calibration or standardization task and the proper PPE needs to be worn as outlined in the MSDS and any governing Laboratory Chemical Hygiene Plan. The need for safety glasses, gloves, and appropriate clothing should be considered in every hazard assessment.
3. All employees are required, at a minimum, to be familiar with the Hazard Communication Program for their business unit. The Hazard Communication Program outlines safety expectations when handling and using chemical products, including employee training, chemical labeling, and access to MSDS.

6.0 Work Practice Requirements

1. Personnel that will be calibrating or standardizing instruments or test kits for readings will, at a minimum:

a) Be cognizant of the safe handling and waste disposal of calibration or standardization chemicals.
b) Have training in the use of instrumentation;
c) Have training for the proper use of required PPE;
d) Have a thorough understanding of the proper methods outlined by the manufacturer to maintain, calibrate or standardize the instrument or test kit.

2. Verify state and federal protocols for accuracy and precision of measurements:
   a) Review acceptance criteria required by the state and agencies (current acceptance criteria are listed in calibration procedures below and in Table1);
   b) Document all calibrations and standardizations of monitoring instruments and test kits.
3. Pre-Calibration/Standardization Preparation
   a) Review the manufacturer's recommendations and procedures;
   b) Locate and fill out the appropriate calibration/standardization log sheet;
   c) Verify the expiration/certification date of all standards to be used in the calibration/standardization process;
   d) Verify the instrument's or test kit's make, model, and serial number or unique identifier and record it on the log sheet;
4. Instrument or Test kit Calibration/Standardization
   a) Document the date, time, and the person(s) conducting the calibration/standardization;
   b) Select a range of standards to be used for calibration or to be checked for the instrument/test kit's accuracy, which will bracket expected field/laboratory survey results;
   c) Document the results (standard verses reading) and verify that they meet the acceptance criteria;
   e) If the equipment fails calibration/standardization, service and clean the equipment and re-calibrate/standardize;
   f) If the equipment continues to fail, label "Inactive Status" and remove the equipment from service (send the equipment back to the manufacturer for servicing) and document this on the log sheet;

Note: If an instrument or test kit does not comply with the established acceptance criteria, it must not be used for collecting data and must be removed from service.

   g) Properly label and dispose of all waste chemicals and materials. Dispose of any hazardous wastes according to the Hazard Waste Management Guidance Document.
5. Verification
   a) DES personnel must record the instrument/test kit identifier (e.g., serial number) on field and boat log sheets to provide a traceable accuracy for every measurement collected;
   b) Annual reviews of calibration/standardization logs should be performed to verify compliance. Calibration/standardization logs should be checked to verify that records are complete, legible, and up to date.

7.0 Calibration and Standardization Protocols

Many instruments and test kits are not able to be calibrated in the field or by the user. These instruments and test kits need to be checked routinely using known standards to establish and document their accuracy. For example it is not possible to adjust a capillary thermometer; therefore accuracy needs to be compared to a reference thermometer of certified accuracy. In many cases checking standards and documenting the instrument's accuracy in the range of conditions it will be used can be more efficient than calibration procedures. In all cases, follow the manufacturer's recommended maintenance and calibration directives.

The following frequencies (Table 1) established for documenting calibrations and standardizations are for instruments and test kits routinely being used for weekly or monthly monitoring studies. If equipment is being used daily for recording large amounts of data, calibration/standardization frequencies must be increased (see Table 1) or standards must be run with samples. For infrequently used equipment (once a quarter or year), calibrations and standardizations should occur prior to use. Data loggers which are being deployed for extended periods of time (>1 month) must be calibrated/standardized immediately prior to and following deployment in the field.

Prior to calibration, all instrument probes must be cleaned according to the manufacturers instructions. Failure to perform this step (proper maintenance) can lead to erratic measurements. When calibrating instruments care must be taken to insure that the volume of the calibration solutions is sufficient to cover both the probe and temperature sensor and be free of air bubbles (see manufacturer's instructions for additional information).

A record of each calibration must be made in the calibration log. The record needs to include at a minimum:

- serial number of the instrument
- parameters which were calibrated
- standards used in calibration
- date and time of calibration
- initials of technician

7.1 Chlorine

Chlorine testing in the field is usually done using a colorimeter. There are two methods of standardization: 1) gel standards (once a week or prior to use) and 2) ampule standards (recommended every 13 weeks). Prior to reading the standards, zero the colorimeter with a blank (deionized water) and record measurements to 0.01 mg/L. Acceptance criterion for the gel standards (0.20, 0.83, and 1.53 mg/L) is ±15% and for the ampule standards (0.12, 0.60, 1.20 mg/L) is ±20%. If expected chlorine levels are higher than the range of these standards, select standards that bracket the expected field results.

7.2 Conductivity and Salinity

Conductivity is used to measure the ability of an aqueous solution to carry an electrical current. Specific conductance is the conductivity value corrected to 25°C. There are a variety of instruments available to measure conductivity, specific conductance, salinity, and temperature. Most instruments are calibrated against a single standard which is near, but below the specific conductance of the environmental samples. A second standard which is above the environmental sample specific conductance is used to check the linearity of the instrument in the range of measurements.

If cleaning electrical connections, changing batteries (recharging), or changing sensors does not correct standardization failures, then the unit should be sent back to the manufacturer for servicing. Freshwater standards (0.05-1.00 mS/cm) or Seawater standards (40-60 mS/cm) are recommended for standardizations checks every 13 weeks. These standardizations should be conducted at a temperature of 25°C±1°C. The acceptance criterion is ±5%. The temperature probes of these meters should be checked for accuracy (acceptance criterion ±0.5°C) at the same time because temperature is factored into the meters program for calculating conductivity, specific conductance and salinity. Standardizations can be done with a specifically designated and labeled "Reference Meter", which must be standardized with standard water samples every 4 weeks. Refractometers (salinity/density) must be standardized (acceptance criterion ±1.0 ppt) every 13 weeks or prior to use with a "Reference Meter." Before using a refractometer for recording salinity data, verify that it meets or exceeds the precision requirements for the data being collected.

Calibration Procedure

1. Allow the calibration standard to equilibrate to the ambient temperature.

2. Remove probe from its storage container, rinse the probe with a small amount of the conductivity/specific conductance standard (discard the rinsate), and place the probe into the conductivity/specific conductance standard.

3. Select monitoring/run mode. Wait until the probe temperature has stabilized.

4. Look up the conductivity value at this temperature from the conductivity versus temperature correction table usually found on the standard bottle or on the standard instruction sheet. You may need to interpolate the conductivity value between temperatures. Select calibration mode, then conductivity. Enter the temperature corrected conductivity value into the instrument.

5. Select monitoring/run mode. The reading should remain within manufacturer's specifications. If it does not, re-calibrate. If readings continue to change after recalibration, consult manufacturer.

6. Read the specific conductance on the instrument and compare the value to the specific conductance value on the standard. The instrument value should agree with the standard within the manufacturer's specifications. If not, re-calibrate. If the re-calibration does not correct the problem, the probe may need to be cleaned or serviced by the instrument manufacturer.

7. Remove probe from the standard, rinse the probe with a small amount of the second conductivity/specific conductance standard (discard the rinsate), and place the probe into the second conductivity/specific conductance standard. The second standard will serve to verify the linearity of the instrument. Read the specific conductance value from the instrument and compare the value to the specific conductance on the standard. The two values should agree within the specifications of the instrument. If they do not agree, recalibrate. If readings do not compare, then the second standard may be outside the linear range of the instrument. Use a standard that is closer, but above the first standard and repeat the verification. If values still do not compare, try cleaning the probe or consult the manufacturer.

8. When monitoring groundwater or surface water, use the specific conductance readings.

7.3 Dissolved Oxygen (D.O.)

Dissolved oxygen (DO) content in water is measured using a membrane electrode. The DO probe's membrane and electrolyte solution should be replaced prior to the sampling period. Failure to perform this step may lead to erratic measurements. There are a variety of instruments available to measure dissolved oxygen (% saturation & mg/L) and temperature.

If cleaning electrical connections, changing batteries (recharging), or changing the permeable membrane on the sensor does not correct standardization failures, then the unit should be sent back to the manufacturer for servicing. If the unit has an air calibration function, air calibrate (100% saturation) the meter prior to use or follow manufacture's directives. Newer instruments utilize a luminescent dissolved oxygen probe (LDO). LDO sensor caps need to be replaced based on the manufacturer's maintenance schedule. LDO sensors are calibrated using air saturated water.

Calibration Procedure

1. Gently dry the temperature sensor according to manufacturer's instructions.

2. Place a wet sponge or a wet paper towel on the bottom of the DO calibration container.

3. Place the DO probe into the container without the probe coming in contact with the wet sponge or paper towel. The probe must fit tightly into the container to prevent the escape of moisture evaporating from the sponge or towel.

4. Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn-on the instrument to allow the DO probe to warm-up. Select monitoring/run mode. Check temperature readings. Temperature readings must stabilize before continuing to the next step.

5. Select calibration mode; then select "DO %".

6. Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement must be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location. [Note: inches of mercury times 25.4 mm/inch equals mm of mercury or consult Oxygen Solubility at Indicated Pressure, Table 2].

7. The instrument should indicate that the calibration is in progress. The instrument will take approximately one minute to calibrate. After calibration, the instrument should display percent saturated DO.

8. Select monitoring/run mode. Compare the DO mg/l reading to the Oxygen Solubility at Indicated Pressure chart (Table 2). The numbers should agree. If they do not agree to the accuracy of the instrument (usually ± 0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution. Insure that there are no air bubbles trapped below the membrane.

9. Remove the probe from the container and place it into a 0.0 mg/L DO standard. The standard must be filled to the top of its container and the DO probe must fit tightly into the standard's container (no head space). Check temperature readings. They must stabilize before continuing.

10. Wait until the "mg/l DO" readings have stabilized. The instrument should read 0.0 mg/L or to the accuracy of the instrument (usually ± 0.2 mg/L). If the instrument cannot reach these values, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, prepare a new 0.0 mg/L DO standard. If these measures do not work, contact manufacturer.

Note: To prepare a zero mg/L DO standard follow the procedure stated in Standard Methods (4500-O G; 18th edition). The method states to add excess sodium sulfite (until no more dissolves) and a trace amount of cobalt chloride to water. The standard container must be completely filled (no head space). This solution is prepared prior to the sampling event. If some of the solution is lost during instrument calibration, add more water to the container so that the standard is stored with no head space.

7.4 pH Meters

The pH of a sample is determined electrometrically using a glass electrode. There are a variety of instruments available to measure pH and temperature. There are pH test strips, indicator solutions, data loggers (e.g., Hydrolab minisonde) with pH sensors and hand-held DC powered pH meters. A pH meter must be calibrated/standardized daily prior to use (Standard Methods 4500-H^+ B; 18th Edition). If standardizing, select standard buffer solutions that bracket the pH range of the samples to be measured. The acceptance criterion is ±0.1 su. If pH standards 2 and 10 are used, pH 7 should be used as a check. When calibrating (two point calibration), use fresh (unused) buffer standards. The temperature probes of pH meters (if there is a readout displayed) should be checked for accuracy (acceptance criterion (±0.5°C) at the same time as pH calibration/standardization because temperature adjustments are made by the meters program in calculating the pH value. Properly label and dispose of all waste chemicals and materials. Dispose of hazardous wastes according with the Hazard Waste Management Guidance Document.

Calibration Procedure

1. Allow the fresh buffered standards to equilibrate to the ambient temperature.

2. Fill calibration containers with the fresh buffered standards so each standard will cover the pH probe and temperature sensor.

3. Remove probe from its storage container, rinse with distilled water, and blot dry with soft tissue.

4. Select monitoring/run mode. Immerse probe into the initial standard (e.g., pH 7).

5. Stir the standard until the readings stabilize. If the reading does not change within 30 seconds, select calibration mode and then select "pH". Enter the buffered standard value into instrument. Select monitoring/run mode. The readings should remain within manufacturer's specifications; if they change, re-calibrate. If readings continue to change after re-calibration, consult manufacturer.

6. Remove probe from the initial standard, rinse with distilled water, and blot dry.

7. Immerse probe into the second standard (e.g., pH 4). Repeat step 5.

8. Remove probe from the second standard, rinse with distilled water, and blot dry. If instrument only accepts two standards, the calibration is complete. Go to step 11. Otherwise continue.

9. Immerse probe in third buffered standard (e.g., pH 10) and repeat step 5.

10. Remove probe from the third standard, rinse with distilled water, and blot dry.

11. Select monitoring/run mode, if not already selected. To ensure that the initial calibration standard (e.g., pH 7) has not changed; immerse the probe into the initial standard. Wait for the readings to stabilize. The reading should read the initial standard value within the manufacturer's specifications. If not, re-calibrate the instrument. If recalibration does not help, the calibration range may be too great. Reduce calibration range by using standards that are closer together.

12. The calibration is complete. Place pH probe in its storage container.

7.5 Flowmeters

Flowmeters (e.g., General Oceanics, Inc.) are used in the openings of plankton nets to estimate the volume of water passing through the net during sampling. These mechanical meters record the revolutions of the impellers; the revolutions per unit time are used to calculate flow through the net. Flowmeters must be standardized once every 52 weeks. The accuracy of these meters is based on how freely the impeller spins, which is verified using a General Oceanics, Inc. Calibration Frame. The frame imparts a torsionally precise spin to the rotor and a count difference is noted in the flowmeter window. A minimum count is necessary for the flowmeter to be within calibration. The acceptance criterion for a General Oceanics, Inc. flowmeter is 80 revolutions per standard spin.

7.6 Temperature

Temperature data are collected with data loggers, thermometers, and thermistors in a variety of multiparameter meters (e.g., pH, D.O., and Conductivity/Salinity). Each instrument must have the accuracy of its temperature component verified because many of the other parameters change with temperature. "Reference Thermometers" are glass, capillary thermometers that have a read out accuracy 0.1°C and they have their accuracy verified with a certified thermometer once every 52 weeks. The acceptance criterion for Reference Thermometers is ±0.2°C. All other capillary thermometers used in the collection of data are standardized to the Reference Thermometers every 52 weeks (the acceptance criterion is ±0.5°C). Data loggers are standardized every 26 weeks (the acceptance criterion is ±0.5°C). Thermistors in multimeters are standardized every 13 weeks (the acceptance criterion is ±0.5°C).

Verification Procedure

1. Allow a container filled with water to come to room temperature.

2. Place a thermometer that is traceable to the National Institute of Standards and Technology (NIST) and the instrument's temperature sensor into the water and wait for both temperature readings to stabilize.

3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer measurement within the accuracy of the sensor (usually ±0.15°C). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

7.7 Turbidity

Turbidity meters are standardized with primary standards once every 13 weeks and with secondary standards prior to use. The meters are zeroed with de-ionized water prior to standardization and use. Primary standards are made up from mixing a powder in de-ionized water (4 standards are measured: <1, 20, 100, & 800 NTU) and the acceptance criterion is ±5%. Secondary standards are gels in the range of 5, 50, 500

NTU and the acceptance criterion is ±10%. De-ionized water is measured three times prior to measuring the gel standards.

The turbidity is based upon a comparison of intensity of light scattered by a sample under defined conditions with the intensity of light scattered by a standard reference suspension. A turbidimeter is a nephelometer with a visible light source for illuminating the sample and one or more photo-electric detectors placed ninety degrees to the path of the light source. Some instruments will only accept one standard. For these instruments, the standards will serve as check points.

Calibration Procedures

1. Allow the calibration standards to equilibrate at the ambient temperature. The use of commercially available polymer primary standards (AMCO-AEPA-1) is preferred, however, the standards can be prepared using Formazin according to the EPA analytical Method 180.1.

2. If the standard cuvette is not sealed, rinse a cuvette with deionized water. Shake the cuvette to remove as much water as possible. Do not wipe dry the inside of the cuvette because lint from the wipe may remain in the cuvette. Add the standard to the cuvette.

3. Before performing the calibration procedure, make sure the cuvettes are not scratched and the outside surfaces are dry, free from fingerprints and dust. If the cuvette is scratched or dirty, discard or clean the cuvette respectively.

4. Zero the instrument by using either a zero or 0.02 NTU standard. A zero standard (approximately 0 NTU) can be prepared by passing distilled water through a 0.45 micron pore size membrane filter.

5. Using a standard in the range of 5 - 20 NTUs, calibrate according to manufacturer's instructions or verify calibration if instrument will not accept a second standard. If verifying, the instrument should read standard value to within the specifications of the instrument. If the instrument has range of scales, check each range that will be used during the sampling event with a standard that falls within that range.

7. Using a standard between 20 and 100 NTUs, calibrate according to manufacturer's instructions or verify calibration if instrument does not accept a third standard. If verifying, the instrument should read standard value to within the specifications of the instrument. If the instrument has range of scales, check each range that will be used with the proper standard for that scale.

7.8 Weight

Precision balances with an accuracy of 0.001 to 0.00001 grams are calibrated once every 52 weeks by a vendor. All scales and balances used for collecting environmental data are standardized with a minimum of three standard weights (Class 4 or better) every 4 weeks. Personnel using balances to collect weight data need to check the calibration sticker for the standardization expiration date and the range of the standardization. If weight measurements are being made outside the documented standardization range, a new weight range bracketing the expected measurements needs to be used in standardizing the balance.

7.9 Oxidation/Reduction Potential (ORP)

The oxidation/reduction potential is the electrometric difference measured in a solution between an inert indicator electrode and a suitable reference electrode. The electrometric difference is measured in millivolts (mV) and is temperature dependent. ORP is calibrated using one-point calibration with a Zobell solution. The acceptance criteria for ORP standard potential should be within ±10 mV at a defined temperature.

Calibration Procedure

1. Allow the calibration standard (a Zobell solution) to equilibrate to ambient temperature.

2. Remove the probe from its storage container, and place it into the standard.

3. Select monitoring/run mode.

4. While stirring the standard, wait for the probe temperature to stabilize, and then read the temperature.

5. Look up the millivolt (mv) value at this temperature from the millivolt versus Temperature (Table 3) correction table usually found on the standard bottle or on the standard instruction sheet. You may need to interpolate millivolt value between temperatures. Select "calibration mode", then "ORP". Enter the temperature-corrected ORP value into the instrument.

6. Select monitoring/run mode. The readings should remain unchanged within manufacturer's specifications. If they change, re-calibrate. If readings continue to change after re-calibration, consult manufacturer.

7. If the instrument instruction manual states that the instrument is factory calibrated, then verify the factory calibration against the standard. If they do not agree within the specifications of the instrument, the instrument will need to be re-calibrated by the manufacturer.

8.0 Contacts

Name	Office	Cell
Karen Canody (Manager Biology)	804-273-3893 804-271-5304	804-627-3262
Casey Seelig (EB)	804-271-5312	804-385-6655
Raymond Heller (EB Millstone)	860-447-1791 ext. 5054	860-333-3832
Keith German (GES)	304-627-3947 ext. 4836	412-736-2983
Jim Levin (Cove Point)	410-286-5136	443-532-0912

9.0 Tables

Table 1. Calibration and Standardization Protocols

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Chlorine	Test Kit (gel standard)	Weekly	0.20 mg/L, 0.83 mg/L, 1.53 mg/L	±15%	Standardization	Zero meter to blank prior to measuring gel standards.
	Test Kit (ampule standard)	13 wks	Total Chlorine 0.12 (0.02 to 0.22) mg/L 0.60 (0.40 to 0.80) mg/L 1.20 (0.90 to 1.50) mg/L	±20%	Standardization	Record concentrations to 0.01 mg/L. Zero meter to blank prior to measuring standards.
Conductivity (specific conductance)	Instrument/Meter	13 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	If standard temperature is 25°C±1, standardize to specific conductance or conductivity.
			Seawater 40-60 mS/cm	±5%	Standardization	
	Reference Meter	4 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	
			Seawater 40-60 mS/cm	±5%	Standardization	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Dissolved Oxygen	Reference/Instrument/Meter	4 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L	±0.05 mg/L	Standardization	For dissolved oxygen, air calibrate prior to comparing to standard and record the temperature of standard.
	Optical DO Meter	4 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
	Test Kit	52 wks	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
	Test Kit Instrument/Meter	Air calibrate prior to use	Azide – Winkler method using potassium iodide – iodate solution with an equivalent DO concentration of about 10 mg/L or Reference Meter	±0.05 mg/L	Standardization	
ORP	Instrument/Meter	Prior to use	Zobell's Solution	±10mV	Calibration	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
pH	AC Counter Top Units	Daily/Weekly	4.0, 7.0, and 10.0 Buffers	±0.1 su	Two Point Calibration or Standardization	Daily when meter is first turned on or weekly if meter remains on
	Battery Powered Portable Units	Day-of-Use	4.0, 7.0, and 10.0 Buffers	±0.1 su	Two Point Calibration or Standardization	Day-of-Use = 24 hour period following the last meter calibration or standardization
Flowmeter	Calibration Fame	52 wks	Standard spin	at least 80 revolutions	Standardization	General Oceanics Inc. Method
Salinity (specific conductance)	Visual Inspection	13 wks	Manufacturer's recommendations	Good condition	Equipment Check	Batteries are replaced every 13 weeks
	Reference Meter	4 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	If standard temperature is 25°C±1, standardize to specific conductance or conductivity.
	Instrument/Meter	13 wks	Seawater 40-60 mS/cm	±5%	Standardization	
	Instrument/Meter	13 wks	Freshwater 0.05-1.00 mS/cm	±5%	Standardization	
	Instrument/Meter	13 wks	Seawater 40-60 mS/cm	±5%	Standardization	

Parameter	Method	Interval	Standard	Acceptance Criterion	Calib./Stand. Method	Comments
Temperature	Reference Thermometer	52 wks	Certified Thermometer	±0.2°C	Three Temperatures to 0.1 °C accuracy	If deviation is greater than 0.1 °C, attach a tag with the correction factor to 0.1 °C or replace the thermometer
	Thermistor	13 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	
	Thermometer	52 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	For thermometers with 1 °C increments, record temperature to 0.2 °C and for thermometers with 0.1 °C increments to 0.1 °C
	Data Logger	26 wks	Reference Thermometer	±0.5°C	One temperature to 0.1 °C accuracy	
Turbidity	Primary Standard	13 wks	4 Standards (<1, 20, 100, & 800 NTU)	±5%	Standardization	Zero meter to de-ionized water.
	Secondary Standard	Prior to Use	Gel Standards (0-10, 10-100, 100-1000 NTU)	±10%	Standardization	Measure de-ionized water three times prior to measuring gel standards.
Weight	Balance	4 wks	Minimum of three reference weights	±5% Reference Weight	Standardization	Two weights should bracket the expected range for which the balance will be used and the third weight should be at an approximate mid-range.

Table 2. Oxygen Solubility (mg/L) at Indicated Pressure

	Atmospheric Pressure (mm Hg)						
Temp. °C	760	755	750	745	740	735	730
0	14.57	14.47	14.38	14.28	14.18	14.09	13.99
1	14.17	14.08	13.98	13.89	13.79	13.70	13.61
2	13.79	13.70	13.61	13.52	13.42	13.33	13.24
3	13.43	13.34	13.25	13.16	13.07	12.98	12.90
4	13.08	12.99	12.91	12.82	12.73	12.65	12.56
5	12.74	12.66	12.57	12.49	12.40	12.32	12.23
6	12.42	12.34	12.26	12.17	12.09	12.01	11.93
7	12.11	12.03	11.95	11.87	11.79	11.71	11.63
8	11.81	11.73	11.65	11.57	11.50	11.42	11.34
9	11.53	11.45	11.38	11.30	11.22	11.15	11.07
10	11.28	11.19	11.11	11.04	10.96	10.89	10.81
11	10.99	10.92	10.84	10.77	10.70	10.62	10.55
12	10.74	10.67	10.60	10.53	10.45	10.38	10.31
13	10.50	10.43	10.36	10.29	10.22	10.15	10.08
14	10.27	10.20	10.13	10.06	10.00	9.93	9.86
15	10.05	9.98	9.92	9.85	9.78	9.71	9.65
16	9.83	9.76	9.70	9.63	9.57	9.50	9.43
17	9.63	9.57	9.50	9.44	9.37	9.31	9.24
18	9.43	9.37	9.30	9.24	9.18	9.11	9.05
19	9.24	9.18	9.12	9.05	8.99	8.93	8.87
20	9.06	9.00	8.94	8.88	8.82	8.75	8.69
21	8.88	8.82	8.76	8.70	8.64	8.58	8.52
22	8.71	8.65	8.59	8.53	8.47	8.42	8.36
23	8.55	8.49	8.43	8.38	8.32	8.26	8.20
24	8.39	8.33	8.28	8.22	8.16	8.11	8.05
25	8.24	8.18	8.13	8.07	8.02	7.96	7.90
26	8.09	8.03	7.98	7.92	7.87	7.81	7.76
27	7.95	7.90	7.84	7.79	7.73	7.68	7.62
28	7.81	7.76	7.70	7.65	7.60	7.54	7.49
29	7.68	7.63	7.57	7.52	7.47	7.42	7.36
30	7.55	7.50	7.45	7.39	7.34	7.29	7.24
31	7.42	7.37	7.32	7.27	7.22	7.16	7.11
32	7.30	7.25	7.20	7.15	7.10	7.05	7.00
33	7.08	7.13	7.08	7.03	6.98	6.93	6.88

34	7.07	7.02	6.97	6.92	6.87	6.82	6.78
35	6.95	6.90	6.85	6.80	6.76	6.71	6.66
36	6.84	6.79	6.76	6.70	6.65	6.60	6.55
37	6.73	6.68	6.64	6.59	6.54	6.49	6.45
38	6.63	6.58	6.54	6.49	6.44	6.40	6.35
39	6.52	6.47	6.43	6.38	6.35	6.29	6.24
40	6.42	6.37	6.33	6.28	6.24	6.19	6.15
41	6.32	6.27	6.23	6.18	6.14	6.09	6.05
42	6.22	6.18	6.13	6.09	6.04	6.00	5.95
43	6.13	6.09	6.04	6.00	5.95	5.91	5.87
44	6.03	5.99	5.94	5.90	5.86	5.81	5.77
45	5.94	5.90	5.85	5.81	5.77	5.72	5.68

Table 2 (cont'd). Oxygen Solubility (mg/L) at Indicated Pressure

	Atmospheric Pressure (mm Hg)							
Temp. °C	725	720	715	710	705	700	695	690
0	13.89	13.80	13.70	13.61	13.51	13.41	13.32	13.22
1	13.51	13.42	13.33	13.23	13.14	13.04	12.95	12.86
2	13.15	13.06	12.07	12.88	12.79	12.69	12.60	12.51
3	12.81	12.72	12.63	12.54	12.45	12.36	12.27	12.18
4	12.47	12.39	12.30	12.21	12.13	12.04	11.95	11.87
5	12.15	12.06	11.98	11.89	11.81	11.73	11.64	11.56
6	11.84	11.73	11.68	11.60	11.51	11.43	11.35	11.27
7	11.55	11.47	11.39	11.31	11.22	11.14	11.06	10.98
8	11.26	11.18	11.10	11.02	10.95	10.87	10.79	10.71
9	10.99	10.92	10.84	10.76	10.69	10.61	10.53	10.46
10	10.74	10.66	10.59	10.51	10.44	10.36	10.29	10.21
11	10.48	10.40	10.33	10.28	10.18	10.11	10.04	9.96
12	10.24	10.17	10.10	10.02	9.95	9.88	9.81	9.46
13	10.01	9.94	9.87	9.80	9.73	9.66	9.59	9.52
14	9.79	9.72	9.65	9.68	9.51	9.45	9.38	9.31
15	9.58	9.51	9.44	9.58	9.31	9.24	9.18	9.11
16	9.37	9.30	9.24	9.17	9.11	9.04	8.97	8.91
17	9.18	9.11	9.05	8.98	8.92	8.85	8.79	8.73
18	8.99	8.92	8.86	8.80	8.73	8.67	8.61	8.54
19	8.81	8.74	8.68	8.62	8.56	8.49	8.43	8.37

20	8.63	8.57	8.51	8.45	8.39	8.33	8.27	8.21
21	8.46	8.40	8.34	8.28	8.22	8.16	8.10	8.04
22	8.30	8.24	8.18	8.12	8.06	8.00	7.95	7.89
23	8.15	8.09	8.03	7.97	7.91	7.86	7.80	7.74
24	7.99	7.94	7.88	7.82	7.76	7.71	7.65	7.59
25	7.85	7.79	7.74	7.68	7.60	7.57	7.51	7.46
26	7.70	7.65	7.59	7.54	7.48	7.43	7.37	7.32
27	7.57	7.52	7.46	7.41	7.35	7.30	7.25	7.19
28	7.44	7.38	7.33	7.28	7.22	7.17	7.12	7.06
29	7.31	7.26	7.21	7.15	7.10	7.05	7.00	6.94
30	7.19	7.14	7.08	7.03	6.98	6.93	6.88	6.82
31	7.06	7.01	6.96	6.91	6.86	6.81	6.76	6.70
32	6.95	6.90	6.85	6.80	6.70	6.70	6.64	6.59
33	6.83	6.78	6.73	6.68	6.83	6.58	6.53	6.48
34	6.73	6.68	6.63	6.58	6.53	6.48	6.43	6.38
35	6.61	6.56	6.51	6.47	6.42	6.37	6.36	6.27
36	6.51	6.46	6.41	6.36	6.31	6.27	6.22	6.17
37	6.40	6.35	6.31	6.26	6.21	6.16	6.12	6.07
38	6.30	6.26	6.21	6.16	6.12	6.07	6.02	5.98
39	6.26	6.15	6.11	6.06	6.01	5.97	5.92	5.87
40	6.10	6.06	6.01	5.96	5.92	5.86	5.83	5.78
41	6.00	5.96	5.91	5.87	5.82	5.78	5.73	5.69
42	5.91	5.86	5.82	5.77	5.73	5.69	5.64	5.60
43	5.82	5.78	5.73	5.69	5.65	5.60	5.56	5.51
44	5.72	5.68	5.64	5.59	5.55	5.51	5.46	5.42
45	5.64	5.59	5.55	5.51	5.47	5.42	5.38	5.34

Table 3. Temperature Dependency of Zobell's ORP Standard

Temp. °C	mV
10	243.5
15	236.0
20	228.5
25	221.1

20

11.0

Environmental Services
Pam Faggert

Electric Environmental Services
Cathy Taylor
Karen Canody
Don Hintz
Meredith Simas
Scott Lawton
Nicole Wilkinson
Ken Roller
Bill Scarpinato
Oula Shehab-Dandan
Liz Willoughby
Glenn Johnson
Rick Woolard
Manna Chan

Environmental Biology
Karen Canody
Don Landers
Sheila Hoffman
Paul Vidonic
Robert Andrews
Taylor Allen
Chris Taylor
Casey Seelig
Peter Sturke
Robert Graham
Glenn Bishop
Matt Overton
Greg Decker
James Foertch
John Swenarton
Joseph Vozarik
Raymond Heller
Stephen Dwyer
Susan Gonzalez

Environmental Laboratory
Herb Chriscoe

Gas Environmental Services
Mark Reaser
Sam Mathew
Sheri Franz
Tim Carter
Richard Gangle
Scott Kingston
Brad Will
Olive Dimon
Keith German
Troy Hawkins
Randy Rogers
Christopher Todd
Jim Levin
Roland Pratt
Jason Harshbarger
Judy Box
Mike Leger

Appendix C -

Lists of Data to be Collected and Recorded for Field - Collection and Processing -

Impingement Sample Collection Data Sheet

Category	Parameter	Value				
General Information	Crew Names					
	Date					
	Time (military)					
	Tidal Phase					
Weather condition	Air Temp. (^{o}C)					
	Wind Direction					
	Wind Speed (MPH)					
	Sky					
	Precipitation (in.)					
	Wave Height (ft)					
Facility Operation	Circulation Pump					
	Screen Status					
	Screen Wash Method					
Water Quality	Time (military)					
	Depth (ft)	Reading				
	Temp. (^{o}C)	Meter				
	DO (mg/L)	Meter				
	Specific Cond. (µs)	Meter				
	Specific Cond. @ 25	Calculated				
	Salinity (ppt)	Calculated				
	pH	Meter				
Water Quality QC	Temp. (^{o}C)	Bottle				
	DO (mg/L)	Bottle				
	Specific Cond. (µs)	Bottle				
	pH	Bottle				
Gear Used	Mesh size (µm)					
	Dimension					
	Configuration					
Sample Collection	Time (military)	Start	End			
	Volume	Reading				
Collection Processing	Species Name	Live, Undamaged Count	Live, Damaged Count	Fresh Dead Count	Dead/decaying Count	Batch Species Weight
	Comments					
Length/Weight	Species Name	Length (mm)	Max Depth (mm)	Max Width (mm)	Weight (g)	
Atlantic Sturgeon	See *Handling Procedures for Atlantic Sturgeon* (Section 6.4.4)	Total Length (mm)	Fork Length (mm)	Interorbital Width (mm)	Mouth Width (mm)	Weight (g)
Debris Load	Total Debris Volume	gallons				
	Debris Volume by Type	Percentage	Aquatic vegetation and algae	Terrestrial vegetation – leafy/herbaceous		Terrestrial vegetation – woody
			Aquatic or terrestrial fauna not quantified in impingement sample, with description (exact taxonomic identification if feasible but not necessary, e.g. aquatic insect larvae)			
			Sediments or other natural inorganic debris, with general description of size composition (e.g. gravel, sand, silt etc.)			
			Man-made debris/refuse with general description of types (plastic, metal etc.)			
			"Other" with description			
Crew Signature						

Example Impingement Identification and Enumeration Quality Control Results Data Sheet

Category	Value	
Date		
Project Location		
QC Analyzer		
Original Analyzer		
QC Program:		
Model 1		
Model 2		
QC#		
Sample Number		
Date		
Species		
Original Count		
QC Count		
% Efficiency	I.D.	Count
Comments		

Appendix C: Dredging Joint Permit Applications -

COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

William A. Pruitt
Commissioner

April 25, 2003

Ms. Pamela F. Faggert
Vice President and Chief Environmental Officer
Dominion Virginia Power
5000 Dominion Boulevard
Glen Allen, VA 23060

Re: VMRC Permit # 00-0431

Dear Ms. Faggert:

This is to inform you that in response to your letter dated April 1, 2003, I have approved the extension of the above-referenced permit which authorized maintenance dredging at your existing barge slip at the Chesterfield Power Station along the James River in Chesterfield County.

The work authorized by the permit shall be completed by August 31, 2008. All other conditions of the permit will remain in effect to include the submission of a post dredge bathymetric survey within 30 days of the completion of any dredging. Please attach this letter to the previously issued permit as evidence of the authorization contained herein. Should you have any questions or if we may be of further assistance, please do not hesitate to contact Mr. Ben Stagg of my staff at (757) 247-2009.

Sincerely,

Tony Watkinson

Tony Watkinson
Acting Chief, Habitat Management

TW/lmn
HM
cc: U. S. Army Corps of Engineers

Chesterfield COB14 Permit

COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
P.O. Box 756
Newport News, Virginia 23607-0756

William A. Pruitt
Commissioner

October 4, 2000

Annette Christian
Virginia Power
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060

RE: VMRC #00-0431

Dear Ms. Christian:

Enclosed is the Marine Resources Commission authorization for you to maintenance dredge approximately 8,000 cubic yards of material by either hydraulic or clamshell methods to provide maximum depths of -21 feet at mean low water for access and within an existing barge slip at the Chesterfield Power Station situated along the James River in Chesterfield County.

A yellow placard is also enclosed. This placard reflects the authorized activities for inspection purposes and must be conspicuously displayed at the work site throughout the construction phase. Failure to properly post the placard in a prominent location will be considered a violation of your permit conditions.

YOU ARE REMINDED THAT ANY DEVIATION FROM THE PERMIT OR ATTACHED DRAWINGS REQUIRES PRIOR AUTHORIZATION FROM THE MARINE RESOURCES COMMISSION. FAILURE TO OBTAIN THE NECESSARY MODIFICATION WILL BE CONSIDERED A VIOLATION AND COULD SUBJECT YOU TO CIVIL CHARGES IN AMOUNTS NOT TO EXCEED $10,000 PER VIOLATION.

The work authorized by this permit is to be complete by August 31, 2003. Please note that in conformance with Special Condition 17 of your permit you are to notify the Commission prior to commencement of your permitted project. The enclosed self-addressed, stamped, post card is to be used for this purpose. All other conditions of the permit will remain in effect.

Please be advised that you may also require issuance of a U. S. Army Corps of Engineers permit before you begin work on this project. You may wish to contact them directly to verify any permitting requirements.

Sincerely,

Robert W. Grabb
Chief, Habitat Management

RWG:amn
HM
Enclosure

cc: U. S. Army Corps of Engineers

COMMONWEALTH OF VIRGINIA
MARINE RESOURCES COMMISSION
PERMIT

The Commonwealth of Virginia, Marine Resources Commission, hereinafter referred to as the Commission, on this 28th day of August 2000, hereby grants unto:

Virginia Power
Innsbrook Technical Center
ATTN: Mr. Marty L. Bowling
Vice President Fossil & Hydro Operations
5000 Dominion Boulevard
Glen Allen, Virginia 23060

hereinafter referred to as the Permittee, permission to:

_x_ Encroach in, on, or over State-owned subaqueous bottoms pursuant to Chapter 12, Subtitle III, of Title 28.2 of the Code of Virginia.

____ Use or develop tidal wetlands pursuant to Chapter 13, Subtitle III, of Title 28.2 of the Code of Virginia.

Permittee is hereby authorized to maintenance dredge approximately 8,000 cubic yards of material by either hydraulic or clamshell methods to provide maximum depths of minus 21 feet at mean low water for access and within an existing barge slip at the Chesterfield Power Station situated along the James River in Chesterfield County. All dredged material shall be placed in the existing permitted ash pond at the power station. All activities authorized herein shall be accomplished in conformance with plans and drawings dated 1/31/2000, which are attached and made a part of this permit.

This permit is granted subject to the following conditions:

(1) The work authorized by this permit shall be completed by **August 31, 2003**. The Permittee shall notify the Commission when the project is completed. The completion date may be extended by the Commission in its discretion. Any such application for extension of time shall be in writing prior to the above completion date and shall specify the reason for such extension and the expected date of completion of construction. All other conditions remain in effect until revoked by the Commission or the General Assembly.

(2) This permit grants no authority to the Permittee to encroach upon the property rights, including riparian rights, of others.

(3) The duly authorized agents of the Commission shall have the right to enter upon the premises at reasonable times, for the purpose of inspecting the work being done pursuant to this permit.

(4) The Permittee shall comply with the water quality standards as established by the Department of Environmental Quality, Water Division, and all other applicable laws, ordinances, rules and regulations affecting the conduct of the project. The granting of this permit shall not relieve the Permittee of the responsibility of obtaining any and all other permits or authority for the projects.

(5) This permit shall not be transferred without written consent of the Commissioner.

(6) This permit shall not affect or interfere with the right vouchsafed to the people of Virginia concerning fishing, fowling and the catching of and taking of oysters and other shellfish in and from the bottom of acres and waters not included within the terms of this permit.

(7) The Permittee shall, to the greatest extent practicable, minimize the adverse effects of the project upon adjacent properties and wetlands and upon the natural resources of the Commonwealth.

(8) This permit may be revoked at any time by the Commission upon the failure of the Permittee to comply with any of the terms and conditions hereof or at the will of the General Assembly of Virginia.

(9) There is expressly excluded from the permit any portion of the waters within the boundaries of the Baylor Survey.

(10) This permit is subject to any lease of oyster planting ground in effect on the date of this permit. Nothing in this permit shall be construed as allowing the Permittee to encroach on any lease without the consent of the leaseholder. The Permittee shall be liable for any damages to such lease.

(11) The issuance of this permit does not confer upon the Permittee any interest or title to the beds of the waters.

(12) All structures authorized by this permit which are not maintained in good repair shall be completely removed from State-owned bottom within three (3) months after notification by the Commission.

(13) The Permittee agrees to comply with all of the terms and conditions as set forth in this permit and that the project will be accomplished within the boundaries as outlined in the plans attached hereto. Any encroachment beyond the limits of this permit shall constitute a Class 1 misdemeanor.

(14) This permit authorizes no claim to archaeological artifacts which may be encountered during the course of construction. If, however, archaeological remains are encountered, the Permittee agrees to notify the Commission, who will, in turn notify the Department of Historic Resources. The Permittee further agrees to cooperate with agencies of the Commonwealth in the recovery of archaeological remains if deemed necessary.

(15) The Permittee agrees to indemnify and save harmless the Commonwealth of Virginia from any liability arising from the establishment, operation or maintenance of said project.

A permit issuing fee of: $100.00

and a royalty of: N/A

for a total of $100.00 This permit consists of 6 sheets.

PERMITTEE

Permittee's signature is affixed hereto as evidence of acceptance of all of the terms and conditions herein.

In cases where the Permittee is a corporation, agency or political jurisdiction, please assure that the individual who signs for the Permittee has proper authorization to bind the organization to the financial and performance obligations which result from activity authorized by this permit.

PERMITTEE

Accepted for Virginia Power

27th day of September, 2000 By M L Bowling Vice President
(Name) (Title)

State of Virginia
City (or County) of Henrico, to-wit:
I, Sharon Humphreys a Notary Public in and for said City (or County) and State hereby certify that Martin L. Bowling Jr, Permittee, whose name is signed to the foregoing, has acknowledged the same before me in my City (or County) and State aforesaid.
Given under my hand this 27th day of September, 2000
My Commission Expires: April 30, 2003

Notary Public Sharon L Humphreys

COMMISSION

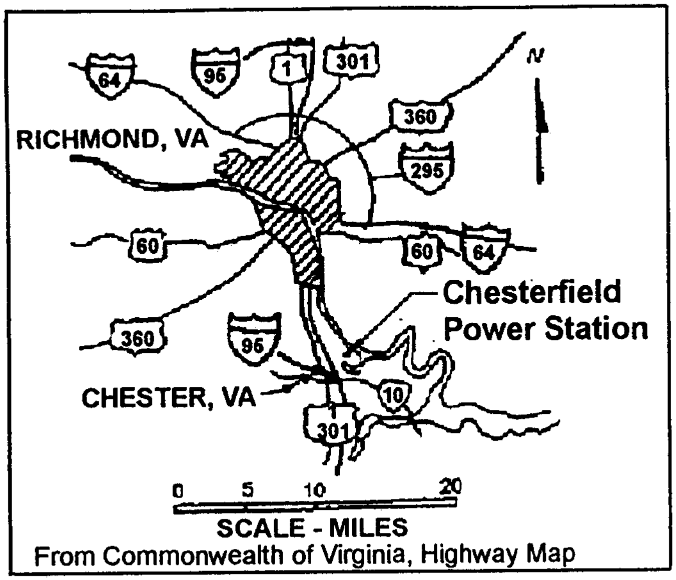
IN WITNESS WHEREOF, the Commonwealth of Virginia, Marine Resources Commission has caused these presents to be executed in its behalf by Robert W. Grabb, Chief
(Name) (Title) Marine Resources Commission

4th day of October, 20 00 by RW Grabb

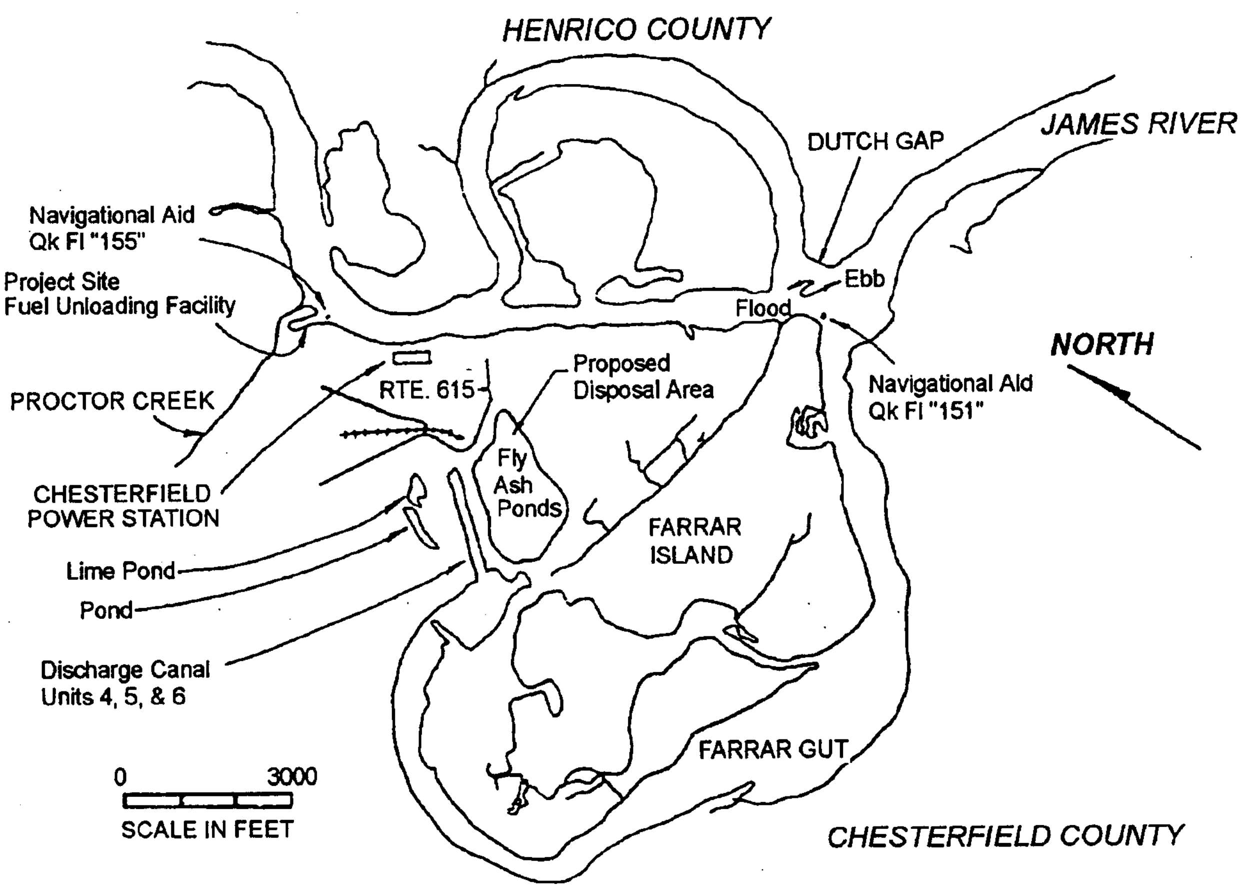
State of Virginia
City of Newport News, to wit:

I, Audrey M. Nichols, a Notary Public within and for said City, State of Virginia, hereby certify that Robert W. Grabb, whose name is signed to the foregoing, bearing the 28th day of August 2000, has acknowledged the same before me in City aforesaid.
Given under my hand this 4th day of October, 2000
My Commission Expires: 4-30-2003

Notary Public Audrey M. Nichols



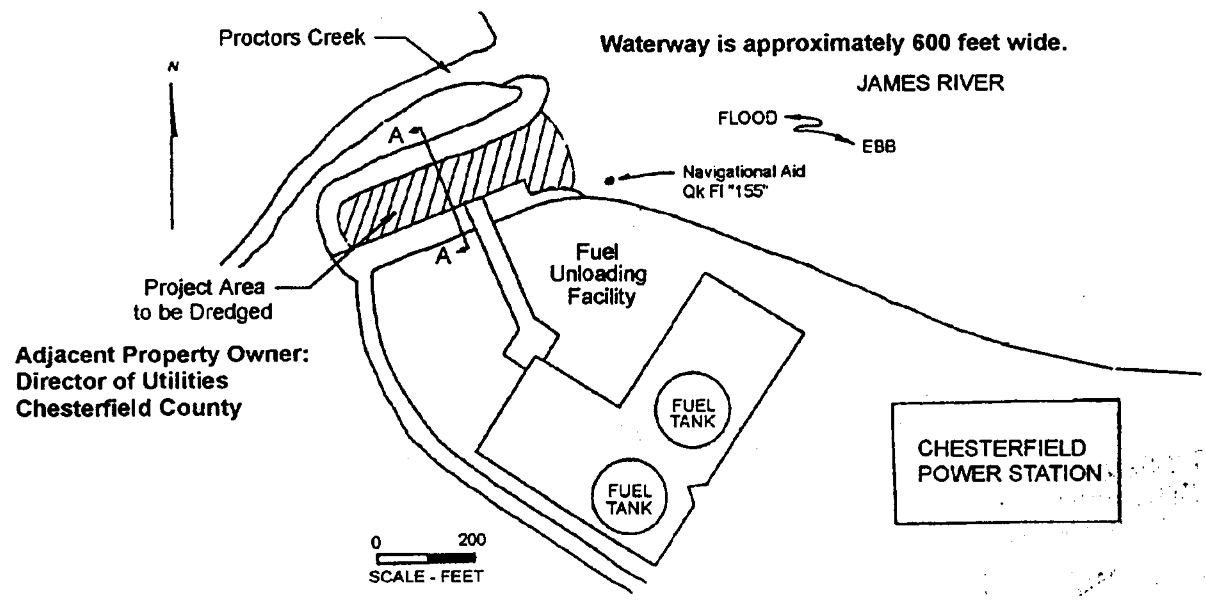
RESOURCES COMMISSION
RECEIVED
MAR 14 2000
BY



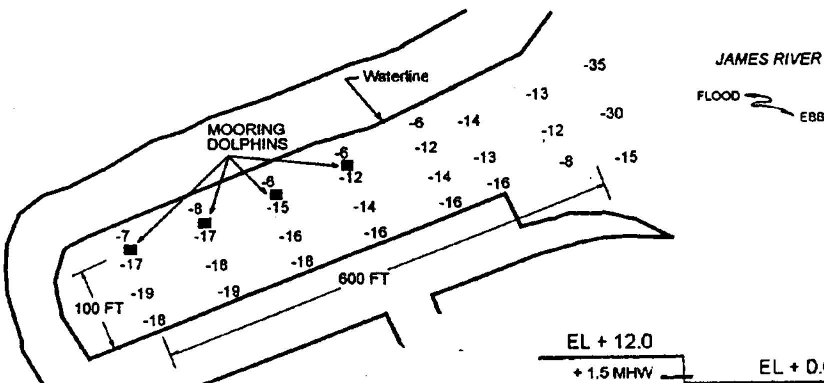
LOCATION AND VICINITY MAPS

Chesterfield Power Station Fuel Oil Unloading Facility Maintenance Dredging Project	COLLINS ENGINEERS, INC. CIVIL, STRUCTURAL, WATER RESOURCES AND UNDERWATER ENGINEERING 745 Bluecrab Road, Suite B, Newport News, VA 23606	Date: 1/31/2000 Scale: As Shown Figure No. 1

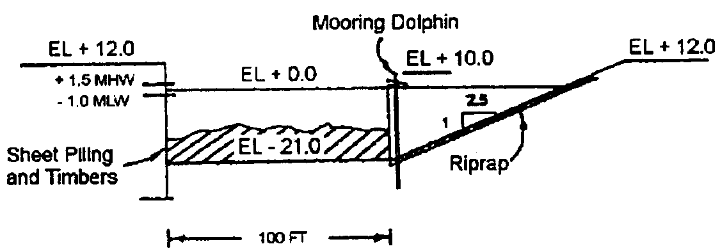
X:\2687\FIGURES.wpd



PLAN VIEW OF DREDGE AREA



SOUNDING PLAN



CROSS SECTION A-A

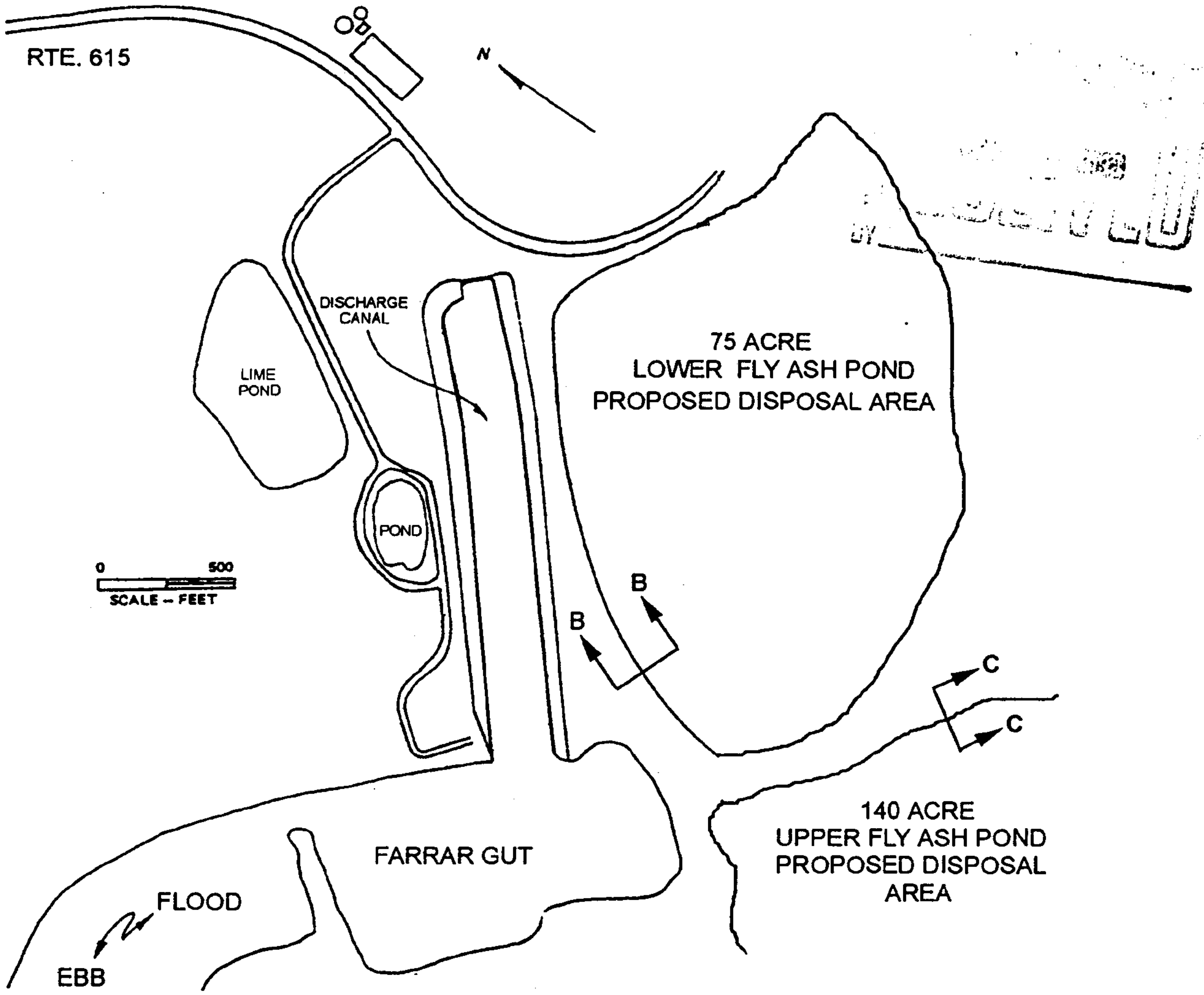
NOTES:

1. ALL SOUNDINGS GIVEN IN FEET BELOW MLW.
2. SOUNDINGS TAKEN ON 12/10/98 BY VIRGINIA POWER.
3. APPROXIMATELY 8,000 CY OF SILTY SAND WILL BE DREDGED BY HYDRAULIC OR CLAMSHELL METHOD AND PLACED IN THE DISPOSAL AREA AT THE UPPER AND/OR LOWER FLY ASH PONDS, AS SHOWN IN FIGURE 3.
4. DEPTH OF SOIL TO BE DREDGED (SECTION A-A) VARIES FROM 2 FT TO 13 FT.
5. THE DREDGE AREA MEASURES APPROXIMATELY 100 FT WIDE BY 600 FT LONG.

PLAN AND SECTION VIEWS - DREDGE AREA

Chesterfield Power Station Fuel Oil Unloading Facility Maintenance Dredging Project	COLLINS ENGINEERS, INC. CIVIL, STRUCTURAL, WATER RESOURCES AND UNDERWATER ENGINEERING 745 Bluecrab Road, Suite 8, Newport News, VA 23606	Date: 1/31/2000 Scale: As Shown Figure No. 2

X:\2687\FIGURES.wpd



CROSS SECTION B-B **CROSS SECTION C-C**

NOTES

1. **APPROXIMATELY 8,000 CY OF SILTY SAND WILL BE DREDGED BY EITHER HYDRAULIC OR CLAMSHELL METHOD.**
2. **IF HYDRAULIC METHOD USED, MATERIAL WILL BE PLACED IN THE LOWER ASH POND BY PIPELINE.**
3. **IF CLAMSHELL METHOD USED, MATERIAL WILL BE PLACED IN THE UPPER ASH POND BY TRUCK.**

PLAN AND SECTION VIEWS - DISPOSAL AREA

Chesterfield Power Station Fuel Oil Unloading Facility Maintenance Dredging Project	**COLLINS ENGINEERS, INC.** CIVIL, STRUCTURAL, WATER RESOURCES AND UNDERWATER ENGINEERING 745 Bluecrab Road, Suite B, Newport News, VA 23606	Date: 1/31/2000 Scale: As Shown Figure No. 3

X:\2687\FIGURES.wpd

The following special conditions are imposed on this permit:

(16) The yellow placard accompanying this permit document must be conspicuously displayed at the work site throughout the construction phase of the authorized activity.

(17) Permittee agrees to notify the Commission a minimum of 15 days prior to the start of the construction activities authorized by this permit.

(18) The Permittee shall provide a post-dredging bathymetric survey of the dredged area within 30 days of the completion of the dredging. The survey shall be signed and dated as being accurate and true. The survey shall be referenced to mean low water and shall include a transect at the channelward end of the dredge cut, at a distance 50 feet from the channelward end and 100 feet from the channelward end.

Permit # 00-0431

Commonwealth of Virginia
Marine Resources Commission
Authorization

A Permit has been issued to:

Virginia Power
Innsbrook Technical Center
ATTN: Mr. Marty L. Bowling
Vice President Fossil & Hydro Operations
5000 Dominion Boulevard
Glen Allen, Virginia 23060

The Permittee is hereby authorized to:

Maintenance dredge approximately 8,000 cubic yards of material by either hydraulic or clamshell methods to provide maximum depths of minus 21 feet at mean low water for access and within an existing barge slip at the Chesterfield Power Station situated along the James River in Chesterfield County. All dredged material shall be placed in the existing permitted ash pond at the power station.

Issuance Date: 8-28-2000 **Expiration Date:** 8-31-2003

Commissioner or Designee

This Notice Must Be Conspicuously Displayed At Site Of Work

Virginia Marine Resources Commission
Habitat Management Division
2600 Washington Avenue
Post Office Box 756
Newport News VA 23607-0756

Attention: Tony Watkinson, Deputy Chief, HM
~~Environmental Engineer~~

U.S. Army Corps of Engineers
Norfolk District, Southern Virginia Regulatory Section
803 Front Street
Norfolk, Virginia 23510

August 8, 2000

Project Number: 00-V0431

Waterway: James River

1. Participant:
Virginia Power
Innsbrook Technical Center
5000 Dominion Blvd
Glen Allen, Virginia 23060

2. Authorized Agent:
Annette Christian
Environmental Division, Virginia Power

3. Address of Job Site:
On the south side of the James River just downstream from Proctor Creek in Chesterfield County.

4. Project Description:
Request for permit to conduct maintenance dredging in a barge slip at the Chesterfield Power Station.

5. Findings

A review of your permit application as described in part 4. above indicates that it qualifies for Norfolk District's Regional Permit 97-RP-19. A copy of the regional permit is enclosed with your drawings. Provided you follow the special and general conditions listed in this regional permit, no additional Corps permit will be required. The permitee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

Enclosed is a "compliance certification" form, which must be signed and returned within 30 days of completion of the project, including any required mitigation. Your signature on this form certifies that you have completed the work in accordance with the regional permit terms and conditions.

Your authorization to perform work under this regional permit expires on August 12, 2003. This authorization will be valid until the regional permit is modified, reissued, or revoked prior to its expiration. If you are unable to complete the permitted work within this time frame, you must contact the Corps to verify the status of the regional permit. If the regional permit is modified or revoked so that the activity listed above would no longer be authorized and you have commenced or are under contract to commence the work, you will have twelve months from the date of the modification or revocation to complete the activity under the present terms and conditions of the regional permit.

YOU MAY NOT BEGIN WORK UNTIL YOU HAVE OBTAINED A PERMIT FROM THE VIRGINIA MARINE RESOURCES COMMISSION AND/OR THE LOCAL WETLANDS BOARD. If you have any questions please call your Corps contact at the phone number noted below. Thank you.

6. Corps Contact: Ken Kimidy at (757) 441-7832.

R. Harold Jones
Chief, Southern Virginia Regulatory Section

NAO FL 13 REVISED DEC 90

U.S. Army Corps
Of Engineers
Norfolk District

CERTIFICATE OF COMPLIANCE
WITH
ARMY CORPS OF ENGINEERS PERMIT

Permit Number:	00-V0431-02
Name of Permittee:	Virginia Power
Date of Issuance:	August 8, 2000
Permit Type:	Regional Permit 19

Within 30 days of completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Kenneth M. Kimidy
c/o Regulatory Branch
Norfolk District Corps of Engineers
803 Front Street
Norfolk, Va. 23510-1096

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification or revocation.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation has been completed in accordance with the permit conditions.

Signature of Permittee

Date

U.S. Army Corps
Of Engineers
Norfolk District

Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

CENAO-CO-R
97-RP-19

STATE PROGRAM REGIONAL PERMIT

Effective date: August 12, 1997

Expiration Date: August 12, 2003

Authorized Activities:

1. Submerged utility lines and associated dredging or excavation.
2. Aerial transmission lines and other overhead lines.
3. Groins and spurs or baffles.
4. Maintenance dredging for previously authorized projects.
5. Bulkheads, riprap and associated backfill and/or excavation, including bulkhead repair and/or replacement, and bioengineering projects to prevent erosion.
6. Open-pile piers at community, commercial or government facilities for recreational or commercial use.
7. Boat ramps and accessory structures, including any fill or excavation for installation.
8. Recreational or Commercial boathouses and covered boat lifts.
9. Mooring piles/dolphins, fender piles and camels.
10. Crab pounds.
11. Submerged sills.
12. Low breakwaters.
13. Aquaculture/Mariculture activities.
14. Commercial moorings associated with a permitted project and temporary in nature.
15. State owned and operated artificial reefs within State waters.

The people of the Commonwealth of Virginia are hereby authorized by the Secretary of the Army and the Chief of Engineers pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344) to perform certain work in waters of the Commonwealth as described herein.

In order to obtain authorization for any of the activities covered by this regional permit, the applicant must complete a Joint Local-State-Federal Permit Application. If the proposed activity qualifies for this regional permit, the Corps of Engineers will send the applicant a letter acknowledging the qualification and stating that the applicant must first obtain a <u>permit</u> (not a waiver) from the Virginia Marine Resources Commission and/or the local wetlands board before the proposed work may begin. (Those activities on the Potomac River extending beyond the mean low water line must be authorized by the Maryland Department of Natural Resources and/or the Potomac River Fisheries Commission in order to comply with this regional permit.) In the event the proposed project or any portion of the project receives a <u>waiver</u> (or exemption under the grandfather clause), the project would not qualify for this regional permit and an individual Corps permit will be required.

This regional permit recognizes that the listed activities are usually of State or local impact only and that State or local agencies are the appropriate regulatory bodies. However, it is conceivable that in rare instances the District Engineer may determine that overriding national factors of the public interest would require an individual permit (in accordance with 33 CFR 325) for a particular project which would normally qualify for this regional permit. The Norfolk District will monitor the activities authorized under this regional permit in order to evaluate their cumulative impacts.

This regional permit shall not be interpreted as authorizing any work other than that which is contained in this document. All work undertaken outside the following conditions, standards and limitations will require separate Department of the Army authorization.

TO QUALIFY FOR THIS REGIONAL PERMIT, THE ABOVE ACTIVITIES WOULD HAVE TO SATISFY ALL OF THE SPECIAL AND GENERAL CONDITIONS LISTED BELOW:

SPECIAL CONDITIONS:

1. Submerged utility lines and associated dredging or excavation:

a. For the purpose of this regional permit, a submerged utility line is defined as any pipeline for the transportation of any gaseous, liquid, liquefiable, or slurry substance, for any purpose, and any cable, line or wire for the transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. This regional permit encourages, where feasible, the use of directional drilling techniques for utility lines that otherwise meet the special conditions.

b. This regional permit does not include the dredging of access channels. No submerged utility line installation which involves either temporary or permanent stream rechannelization is authorized by this regional permit. Also, water intake and outfall structures are not authorized by this regional permit. Such work will require separate Department of the Army authorization.

c. When the blasting of bedrock is necessary in order to create a trench for the installation of a utility line, it shall all be performed within the same day, if possible. The Virginia Department of Environmental Quality, Water Division (at telephone (804) 527-5000) must be notified at least one week prior to blasting so that a representative may be at the site to observe blasting operations and evaluate fish kills, if necessary.

d. Utility lines should be routed to avoid disturbance to vegetated wetlands. Wetlands unavoidably impacted during the installation of the pipeline must be restored to their original elevation. Displaced herbaceous wetland species which do not naturally revegetate within one year from the completion of the project must be replanted to the satisfaction of the District Engineer.

e. Under this regional permit, no submerged utility line installation is authorized between 1 March and 30 June in portions of Virginia's river systems where anadromous fish spawning and nursery habitat have been documented. Applicants will be notified by the Corps of Engineers as to the applicability of this condition to their proposal.

f. Submerged utility lines shall be routed to minimize disturbance to beds of submerged aquatic vegetation. Under this regional permit, no utility line installation is authorized between 1 March and 30 June in areas where major beds of submerged aquatic vegetation occur. Communities of submerged aquatic vegetation impacted during pipeline installation must be restored to their original elevation. No dredged or excavated material shall be stockpiled on submerged aquatic vegetation beds. Applicants will be notified by the Corps of Engineers as to the applicability of this condition to their proposal.

g. Submerged utility lines must be adequately anchored in deep enough water or buried deep enough below the bottom to prevent their being a hazard to navigation.

h. The pouring of concrete for backfill of utility line trenches must be accomplished within a cofferdam unless the activity can be performed completely in the dry, such as during seasonal low flow periods. The introduction of uncured concrete into surface waters is prohibited.

i. Note that the discharge of material for backfill or bedding for submerged utility lines is authorized by Nationwide Permit 12 - Utility Line Backfill and Bedding, provided the requirements contained in the Norfolk District Regional Condition are met. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241of the Federal Register dated December 13, 1996. The Norfolk District Regional Condition is as follows: "Whenever possible, excavated material shall be placed on an upland site. However, when this is not feasible, temporary stockpiling is hereby authorized provided that: (a) All excavated material stockpiled in a vegetated wetland area is placed on filter cloth, mats, or some other semi-permeable surface. The material will be stabilized with straw bales, filter cloth, etc. to prevent reentry into the waterway. (b) The excavated material must be placed back into the trench to the original contour and all excess excavated material must be completely removed from the wetlands within 30 days after the utility line has been installed through the wetlands area. Permission must be granted by the District Engineer or his authorized representatives if the material is to be stockpiled longer than 30 days."

j. Note that the discharge of material for the construction of submerged utility transmission line footings is authorized by Corps Nationwide Permit 25 - Structural Discharge. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996.

k. Note that the discharge of material for the construction of temporary cofferdams is authorized by Corps Nationwide Permit 33 - Temporary Construction, Access and Dewatering, provided the requirements contained in the "Notification" General Condition are met. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996.

Separate notification is not required for temporary cofferdams in association with submerged utility lines covered by this regional permit provided the application includes a restoration plan of reasonable measures to avoid and minimize impacts to aquatic resources as outlined in Nationwide Permit 33.

l. For linear pipeline projects, the applicant must supply the U. S. Fish and Wildlife Service with information concerning the intended route of the entire project so that they may, if necessary, exercise their authority under Section 9 of the Endangered Species Act.

2. Aerial transmission lines and other overhead lines:

a. The following minimum clearances are required for aerial electric power transmission lines crossing navigable waters of the United States. These clearances are related to the clearances over the navigable channel provided by existing fixed bridges, or the clearances which would be required by the U.S. Coast Guard for new fixed bridges, in the vicinity of the proposed power line crossing. The clearances are based on the low point of the line under conditions which produce the greatest sag, taking into consideration temperature, load, wind, length of span, and type of supports as outlined in the National Electrical Safety Code.

Minimum additional clearance above clearance required for bridges

Nominal system voltage, kilovolt:	Feet
115 and below	20
138	22
161	24
230	26
350	30
500	35
700	42
750 to 765	45

Clearances for communication lines, stream gauging cables, and other aerial crossings are usually required to be a minimum of ten feet above clearances required for bridges. Overhead lines which require fill not authorized by Corps Nationwide Permit 25 and/or 33, or projects which require dredging for construction access will not qualify for this regional permit.

b. Note that the discharge of material for the construction of aerial transmission line footings is authorized by Corps Nationwide Permit 25 - Structural Discharge. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996.

c. Note that the discharge of material for the construction of temporary access fills is authorized by Corps Nationwide Permit 33 - Temporary Construction, Access and Dewatering, provided the requirements contained in the "Notification " General Condition are met. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996. Separate notification is not required for temporary access fills in association with aerial transmission lines covered by this regional permit if the application includes a restoration plan of reasonable measures to avoid and minimize impacts to aquatic resources as outlined in Nationwide Permit 33.

d. In addition, the Federal Aviation Administration has responsibility for the marking of aerial transmission lines. Therefore, for those projects involving such work, an appropriate application should be submitted to the Federal Aviation Administration Eastern Regional Office, Air Traffic Division, JFK International Airport Federal Building, Jamaica, New York 11430 (Telephone 212-995-3390).

e. For linear aerial transmission line projects, the applicant must supply the U. S. Fish and Wildlife Service with information concerning the intended route of the entire project so that they may, if necessary, exercise their authority under Section 9 of the Endangered Species Act.

3. Groins and spurs or baffles constructed along with and connected to groins:

a. For this regional permit, groins are defined as structures constructed perpendicular (or nearly so) to a shoreline and extending seaward from the shoreline whose sole purpose is to protect the shoreline from erosion. Groins may merely stop further erosion of a shoreline or they may actually build a sand beach by trapping sand moving in the near shore zone. A jetty is a structure which may appear similar to a groin, but whose primary purpose is to stabilize and protect an inlet or harbor. Jetties are not included in this regional permit. Spurs and baffles are defined as short (less than 20 feet) structures constructed perpendicular to groins for the sole purpose of dampening diffracted wave energy. Groins may be constructed of quarry stone, gabion baskets, concrete or timber. As the design and location of groins is site specific, it is suggested that the Shoreline Erosion Advisory Service or the Virginia Institute of Marine Science be consulted for advice.

b. This regional permit does not authorize artificial nourishment (filling) between or around any groins herein permitted. The placement of fill channelward of the high tide line requires individual Department of the Army authorization under Section 10 of the Rivers and Harbors Act of 1899 and/or Section 404 of the Clean Water Act.

c. Special Conditions 1 - 8 for Discharges and Special Conditions 9 and 10 for Structures apply to this activity.

4. Maintenance dredging for previously authorized projects:

a. This regional permit authorizes maintenance dredging of projects which received an individual Department of the Army permit for the initial dredging. Areas to be dredged and dredged depths shall not exceed those specified by the original authorization or exceed controlling depths for ingress/egress whichever is less. This regional permit does not eliminate the requirement to obtain a Virginia Water Protection Permit from the Virginia Department of Environmental Quality, Water Division for this activity.

b. For maintenance dredging to qualify under this regional permit, the dredged material must be disposed of in an upland area which has been properly designed to contain the material.

c. If the applicant proposes to use the Craney Island Dredged Material Management Area for placement of the dredged material, the special conditions which must be adhered to and forms which must be completed in order to use Craney Island will be added to this permit for those projects for which it applies.

d. Under this regional permit, periodic maintenance dredging may be performed for 5 years from the date of the acknowledgment letter in order to coincide with the expiration of the Virginia Marine Resources Commission maintenance dredging permit which is issued for a maximum of 5 years.

e. The Norfolk District will be advised in writing by the permittee at least two weeks before each maintenance dredging activity is undertaken so that the intended disposal area may be inspected.

f. Barges and scows used to transport dredged material may be filled only to a point where no overflow occurs. No overflow pipes are allowed.

g. A copy of this permit must be on board the vessel used for the transportation and placement of the dredged material.

h. Special Conditions 1-8 for Discharges apply to this activity if the dredging is performed by hydraulic method.

5. Bulkheads, riprap and associated backfill and/or excavation, including repair and/or replacement of existing deteriorated bulkheads and bioengineering projects to prevent erosion:

a. The work must be necessary to combat an existing erosion problem.

b. The total amount of vegetated wetlands which may be filled, in square feet, must not exceed the length of the activity along the shoreline in linear feet (e.g. 100 square feet maximum for a 100-foot-long bulkhead.)

c. The structure and backfill must be placed as closely to the shoreline as is practicable. No material may be placed in excess of the minimum necessary for erosion protection.

d. The activity must not impair surface flows.

e. Only clean, non-metallic, non-organic, non-floatable fill may be used.

f. The activity must be a single and complete project.

g. This regional permit also covers all bulkhead repair and/or replacement up to two feet channelward of existing deteriorated bulkheads which are still functional. For sheet pile bulkheads, this shall generally mean that at least fifty (50) percent of the sheeting must be standing. This authorization includes no limitation on length, nor does it exclude bulkheads which may result in the filling of wetland vegetation as long as there is an apparent existing erosion problem. As above, the total amount of vegetated wetlands which may be filled, in square feet, must not exceed the length of the activity along the shoreline in linear feet. This total does not include wetlands landward of the existing bulkhead. This portion of the work complies with Corps Nation Wide Permit Number 3. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996. The filling of wetlands behind free-standing bulkheads that have never been backfilled is prohibited as part of this permit, and will require an individual Department of the Army permit.

h. For projects where bioengineering is to be utilized in lieu of bulkheading or riprap, grading or excavating wetlands shall be limited to one square foot of vegetated wetlands per linear foot of shoreline.

i. Special Conditions 1-8 for Discharges apply to this activity.

6. Open-pile piers at community, commercial or government facilities for recreational or commercial use:

a. This authorization covers all open-pile piers, docks, wharfs associated with the construction or expansion of any community, commercial, or government facility whose primary use is commercial or recreational. This would include, but not be limited to, piers at seafood processing facilities, boat repair facilities, marine terminals, military installations or military associated operational facilities utilized for training, aggregate handling facilities, and other non-recreational facilities. (Marine railways are excluded from this regional permit.)

b. If the original purpose of the structure or facility changes, the permittee must submit a request for a permit modification (i.e. a recreational marina to a grain loading facility or coal handling facility).

c. This work does not qualify for the regional permit if it involves any dredging or filling. In that event, an individual Department of the Army permit will be required.

d. Special Conditions 9 and 10 for Structures apply to this activity.

7. Boat ramps and accessory structures, including associated fill and excavation necessary for installation:

a. This regional permit covers all boat ramps (concrete or open-pile timber), whether private, public, commercial or government-owned. Accessory structures are covered for all <u>but</u> private boat ramps. For this regional permit, accessory structures include catwalks, pilings and small piers whose sole purpose is to make it easier to get boats into or out of the water. Permanent or semi-permanent mooring facilities are not covered.

b. This permit authorizes excavation and/or filling within the limits of the boat ramp only (e.g. for bedding). Dredging or filling for access to the ramp is <u>not</u> covered under this regional permit and will require separate Department of the Army authorization. Authorization of the boat ramp does not imply that a future dredging proposal to provide access to the structure would be approved.

c. All boat ramps and accessory structures shall be located so as to eliminate or minimize impacts to vegetated wetlands.

d. The pouring of concrete for the construction of boat ramps must be accomplished within a cofferdam unless the activity can be performed completely in the dry, such as during lake drawdown periods. The introduction of uncured concrete into surface waters is prohibited.

e. Special Conditions 1-8 for Discharges, and Special Conditions 9 and 10 for Structures apply to this activity.

8. Recreational or commercial boathouses and covered boat lifts:

a. This authorization covers any boathouse or covered boat lift whose purpose is recreational or commercial.

b. If the original purpose of the structure or facility changes, the permittee must submit a request for a permit modification (i.e. a recreational marina to a grain loading facility or coal handling facility).

c. This work does not qualify for the regional permit if it involves any dredging or filling. In that event, separate Department of the Army authorization will be required. Authorization of the boathouse or covered boat lift does not imply that a future dredging proposal to provide access to the structure would be approved.

d. Special Conditions 9 and 10 for Structures apply to this activity.

9. Mooring piles/dolphins, fender piles and camels (wooden floats serving as fenders alongside piers):

a. This authorization includes all such structures, either isolated or part of large facilities, whose primary purpose is commercial or recreational. This would include, but no be limited to, mooring piles, dolphins, fender piles, and camels at seafood processing facilities, boat repair facilities, marine terminals, military installations and other non-recreational facilities. Pilings installed to establish osprey nests are also included. Should primary use of the permitted structure change, a permit modification must be requested.

b. This work does not qualify for the regional permit if it involves dredging or filling. In that event, separate Department of the Army authorization will be required. Authorization of such structures does not imply that a future dredging proposal to provide access would be approved.

c. Special Conditions 9 and 10 for Structures apply to this activity.

10. Crab pounds:

a. Crab pounds are authorized by this regional permit, but crab pounds in Mailboat Harbor and adjacent waterways at Tangier Island, Virginia must be constructed outside the hatched areas shown on the map entitled "Structures at Mailboat Harbor" which may be obtained from the Corps Eastern Shore Field Office in Accomac, Virginia 23301, at telephone (757) 787-3133.

b. Special Conditions 9 and 10 for Structures apply to this activity.

11. Submerged sills:

a. For the purpose of this regional permit, a submerged sill is defined as a low, detached structure constructed near shore and parallel to the shoreline for the purpose of building up an existing beach by trapping and retaining sand in the littoral zone. Because a sill acts like a natural bar, it is most effective when constructed at or near the mean low water line and low enough to allow wave overtopping.

b. Submerged sills are usually constructed of sand bags, but may be constructed of riprap, gabion baskets, concrete, or timber. The materials should be of sufficient weight or adequately anchored to prevent their being dislodged and carried about by wave action. Asphalt and materials containing asphalt or other toxic substances shall not be used in the construction of sills. As the design and location of sills is site specific, it is suggested that the Shoreline Erosion Advisory Service or the Virginia Institute of Marine Science be consulted for advice.

c. Because of potential swimming and boating hazards, it may be necessary to mark submerged sills in some areas.

d. Submerged sills may not be connected to the upland or constructed in conjunction with groins or other erosion control structures. Such structures will require individual Department of the Army review.

e. Special Conditions 1 - 8 for Discharges and Special Conditions 9 and 10 for Structures apply to this activity.

12. Low breakwaters:

a. For the purpose of this regional permit, a breakwater is defined as a structure constructed parallel to and channelward of a shoreline for the purpose of reducing incoming wave energy.

b. This regional permit authorizes low breakwaters constructed close to shore for the purpose of erosion protection by reducing wave height and thereby reducing the erosive power of the waves reaching the shoreline. This permit does not include high breakwaters constructed farther offshore for the purpose of creating quiet water for the protection of a boat harbor.

c. Low breakwaters should be marked in areas frequented by boaters and swimmers.

d. Under this regional permit, a breakwater may be a single structure or a series of structures separated by gaps, but may not be connected to the upland or constructed in conjunction with other land attached structures. Such structures will require individual Department of the Army review.

e. Breakwaters may be constructed of quarry stone, gabion baskets, concrete or timber. However, as breakwaters are barriers to the forces of waves, they should be massive enough to resist the full power of the maximum expected wave energy. Asphalt and materials containing asphalt or other toxic substances shall not be used in the construction of breakwaters. As the design and location of breakwaters is site specific, it is suggested that the Shoreline Erosion Advisory Service or the Virginia Institute of Marine Science be consulted for advice.

f. Included in this permit are floating breakwaters which filter energy from the incoming waves as they pass through the device, thereby reducing wave energy reaching a shoreline or harbor. Floating breakwaters should be adequately anchored to prevent their being dislodged by wave action.

g. Special Conditions 1 - 8 for Discharges and Special Conditions 9 and 10 for Structures apply to this activity.

13. Aquaculture/Mariculture activities:

a. This authorization is limited to the bottom and suspended culturing and harvesting of bivalve mollusks in the intertidal and subaqueous areas of navigable waters. Activities covered include: deployment and maintenance of buoys, rafts, trays, and other equipment associated with the activity, and work including temporary wet storage, and harvesting.

b. The aquaculture activity area and any elevated structures within the area shall be marked as prescribed by the United States Coast Guard in accordance with 33 CFR 64. The permittee must contact the United States Coast Guard, Aids to Navigation Branch at (757) 398-6230 to ascertain the proper markings for the activity. Aids to navigation shall be deployed and maintained as appropriate.

c. Note that traditional shellfish seeding activities are authorized by Nationwide Permit 4 - Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities, provided the activity does not occur in wetlands or vegetated shallows. The Corps Nationwide Permits and Conditions can be found in 33 CFR 330 Appendix A published in Volume 61, Number 241 of the Federal Register dated December 13, 1996.

d. No aquaculture activity shall occur within beds of submerged aquatic vegetation or saltmarsh, nor shall such vegetation be damaged or removed. Should an area become colonized by submerged aquatic vegetation or saltmarsh after an authorized aquaculture activity is installed, the activity shall be allowed to remain, however, no expansion into newly colonized areas is authorized by this regional permit. Information on the location of submerged aquatic vegetation can be obtained from the Norfolk District Corps of Engineers (at telephone (757) 441-7652) and from the Virginia Institute of Marine Science (at telephone (804) 642-7332).

e. An aquaculture activity shall be deemed not applicable under this regional permit if it will have more than minimal adverse effects on avian resources such as, but not limited to: shore birds, wading birds, or members of the waterfowl group. This is meant to include nesting, feeding or resting activities by migratory birds identified at 50 CFR 10.13.

f. An aquaculture activity shall be deemed not applicable under this regional permit if it will have more than minimal adverse effects on existing or naturally occurring beds or population of shellfish, marine worms or other invertebrates that could be used by man, other mammals, birds, reptiles, or predatory fish.

g. No aquaculture activity or vehicular access to the activity shall occur in such a way as to negatively impact coastal or wetland vegetation.

h. Special Conditions 9 and 10 for Structures apply to this activity.

14. Commercial moorings associated with another project and temporary in nature.

a. This permit may only be used if the request is directly associated with a permitted project such as a bridge, construction, or dredging project.

b. This authorization is valid only for the duration of the associated project. Once the project is completed, the mooring must be removed.

c. Special condition 9 and 10 for structures apply to this activity as well as the general conditions listed in the regional permit.

15. State owned and operated artificial reefs within State waters.

a. This authorization is limited to State owned and operated reefs located exclusively in waters of the Commonwealth of Virginia and are limited to fin fishing reefs and reefs established for oyster replenishment or research.

b. The Corps of Engineers will evaluate each proposal to ensure impact to the environment, navigation, endangered species, historical resource or special aquatic sites are not more than minimal.

c. Materials used in the construction of these reefs are limited to materials historically used for shell and fin fishing reefs. They must be free of hazardous materials unless specifically authorized by the Corps of Engineers. Activities covered include but are not limited to deployment and maintenance of buoys, rafts , trays, and other equipment associated with the activity, and work including temporary wet storage and harvesting.

d. Special condition 9 and 10 for structures apply to this activity as well as the general conditions listed in the regional permit.

SPECIAL CONDITIONS FOR DISCHARGES:

1. If the activity involves a discharge of dredged or fill material, the discharge will be carried out in conformity with the goals and objectives of the EPA Guidelines established pursuant to Section 404(b) of the Clean Water Act and published in 40 CFR 230.

2. No discharge of dredged or fill material may consist of unsuitable material (e.g.: trash, debris, car bodies, asphalt etc.) and material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

3. No discharge of dredged or fill material may occur in the proximity of a public water supply intake except where the discharge is for adjacent bank stabilization.

4. No discharge of dredged or fill material may occur in areas of concentrated shellfish production.

5. Discharges in spawning areas during spawning seasons must be avoided to the maximum extent practicable.

6. To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water.

7. Discharges into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

8. Any temporary fills must be removed in their entirety and the affected areas returned to their pre-existing elevation.

SPECIAL CONDITIONS FOR STRUCTURES:

9. The permittee must install and maintain, at his expense, any safety lights and signals prescribed by the United States Coast Guard (USCG), through regulations or otherwise, on the authorized facilities. The USCG may be reached at the following address and telephone number: Commander (oan), Fifth Coast Guard District, Federal Building, 431 Crawford Street, Portsmouth, Virginia 23704, telephone number (757) 398-6230.

10. The permittee hereby recognizes the possibility that the structures permitted herein may be subject to damage by wave wash from passing vessels. The issuance of this permit does not relieve the permittee from taking all proper steps to ensure the integrity of the structure permitted herein and the safety of boats moored thereto from damage by wave wash and the permittee shall not hold the United States liable for any such damages.

GENERAL CONDITIONS:

1. This regional permit will authorize work undertaken within the geographical limits of the Commonwealth of Virginia under the regulatory jurisdiction of the Norfolk District.

2. A copy of this permit and any verification letter must be provided to the contractor and made available at the project site to any regulatory representative.

3. (a) No activity is authorized under this permit which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the Norfolk District if any listed species or critical habitat might be affected or is in the vicinity of the project and shall not begin work until notified by the district engineer that the requirements of the Endangered Species Act have been satisfied and that the activity is authorized.

(b) Authorization of an activity by a this permit does not authorize the "take" of a threatened or endangered species as defined under the Federal Endangered Species Act. In the absence of separate authorization (e.g. an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service, both lethal and non-lethal "takes" of protected species are in violation of the Endangered Species Act. Information on the location of threatened and endangered species and their critical habitat can be obtained from the U.S. Fish and Wildlife Service and National Marine Fisheries Service.

4. No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized until the Norfolk District has complied with the provisions of 33 CFR 325, Appendix C. The prospective permittee must notify the Norfolk District if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the Norfolk District that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the Virginia Department of Historic Resources and the National Register of Historic Places.

5. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify the Norfolk District of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

6. No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely effect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the National Park Service and the U.S. Forest Service.

7. No activity may cause more than a minimal adverse effect on navigation.

8. No activity may substantially disrupt the movement of those species of aquatic life indigenous to the waterbody, including those species which normally migrate through the area, unless the activity's primary purpose is to impound water.

9. Appropriate erosion and siltation controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date.

10. The construction or work authorized by this permit will be conducted in a manner so as to avoid any degradation of water quality and/or damage to aquatic life where possible, and minimize any degradation where unavoidable. Also, you will employ measures to prevent or control spills of fuels or lubricants from entering the waterway.

11. Permittees are expected to fully comply with Virginia Regulation 680-21-00, Water Quality Standards and all other appropriate laws and regulations of the Commonwealth of Virginia pertaining to water quality.

12. The permittee will make every reasonable effort to conduct the construction or operation of the work authorized by this permit in a manner so as to minimize any adverse impact on fish, wildlife and natural environmental values.

13. Heavy equipment working in wetlands must be placed on mats or other measures must be taken to minimize soil disturbance.

14. The permittee shall allow the District Engineer or his authorized representative(s) or designee(s) to make periodic inspections at any time deemed necessary in order to assure that the activity being performed under authority of this permit is in accordance with the terms and conditions prescribed herein.

15. Failure to comply with the terms and conditions of this permit can result in enforcement actions against the permittee and/or contractor.

16. The permittee shall maintain the structure or fill authorized herein in good condition and in reasonable accordance with the plans and drawings attached hereto, including maintenance to ensure public safety.

17. The provisions of this permit shall be binding on any assignee or successor in interest of the permittee.

18. In order to transfer this permit, the transferee must supply the Norfolk District with a written request to transfer the permit.

19. Should you be unable to complete the authorized activity in the time limit provided, you must submit your request for a time extension to this office for consideration at least one month before the permit expiration date.

20. In granting an authorization pursuant to this permit, the Norfolk District has relied on the information and data provided by the permittee. If, subsequent to notification by the Corps that a project qualifies for this permit, such information and data proves to be materially false or materially incomplete, the authorization may be suspended or revoked, in whole or in part, and/or the Government may institute appropriate legal proceedings.

21. Limits of this authorization:
   a. This permit does not obviate the need to obtain other Federal, State or local authorizations required by law.
   b. This permit does not grant any property rights or exclusive privileges.
   c. This permit does not authorize any injury to the property or rights of others.
   d. This permit does not authorize interference with any existing or proposed Federal projects.
   e. This permit does not grant any Corps real estate rights. If real estate rights are needed from the Corps, please contact Norfolk District's Real Estate Division at the address listed on the front page or telephone (757) 441-7735.

22. In issuing this permit, the Federal Government does not assume any liability for the following:
   a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.
   b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.
   c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
   d. Design or construction deficiencies associated with the permitted work.
   e. Damage claims associated with any future modification, suspension, or revocation of this permit.

23. The Norfolk District may reevaluate its decision on your authorization under this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:
   a. You fail to comply with the terms and conditions of this permit.
   b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 19 above).
   c. New information is obtained which this office did not consider in reaching the original decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost. In addition, unpermitted work or violation of permit conditions may result in civil, criminal or administrative penalties (33 U.S.C. 1319 c, d, and g).

24. This letter of permission, unless further modified, suspended or revoked, will be in effect until August 12, 2003. Upon expiration, it may be considered for revalidation.

14 AUG 97
Date

FRANK A. JORDANO
Major, U.S. Army
Acting District Engineer

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
http://www.deq.state.va.us

Dennis H. Treacy
Director

Gerard Seeley, Jr.
Piedmont Regional Director

AUG 0 4 2000

Virginia Power
Attn: Marty L. Bowling, Vice President of Fossil & Hydro Operations
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060

RE: **Joint Permit Application No. 00-0431, Virginia Power- Chesterfield**

Dear Marty L. Bowling,

The Virginia Department of Environmental Quality-Piedmont Regional Office received your application dated April 25, 2000 to maintenance dredge by hydraulic or clamshell methods approximately 8,000 cubic yards of silty sand material. The existing barge mooring area is used for unloading fuel at the Chesterfield Power Station on the James River in Chesterfield County.

Our review of the information provided indicates that the water quality impacts of the proposed project should be minimal and temporary in nature. Consequently, a Virginia Water Protection Permit will not be required by the Department of Environmental Quality for this project provided you receive and comply with either a Corps of Engineers Regional or Nationwide permit for which DEQ has waived or issued certification. **Please be advised that additional impacts to State waters associated with this project may require a permit from this agency**. You are advised that this does not give you the authority to violate the State's Water Quality Standards (9 VAC 25-260 et seq.). Other agencies may also require permits.

If you have any questions, please do not hesitate to call me at (804) 527-5115.

Sincerely,

S. Rene' Hypes

S. Rene' Hypes
Environmental Engineer

CC: U.S. Army Corps of Engineers
VMRC

Primary Laboratories, Inc.
Results

01-Aug-00

Date Sampled: 20-Jul-00
Work Order No: 0007109-03
Client ID: 600 Chesterfield Oil D

Test Description	Final Result	Reporting Limit	Units of Measure	EPA Test Method	Date Analyzed	Tech. Initials
PCB 1016	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1221	<0.0067	0.0067	mg/Kg	8082	25-Jul-00	PH
PCB 1232	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1242	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1248	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1254	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1260	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
Kepone	<0.0017	0.0017	mg/Kg	608	25-Jul-00	PH
TPH, Diesel Range	<10.0	10.0	mg/Kg	3550/8015M	24-Jul-00	SH
Tributyltin	<1.86	1.86	ug/Kg	NOAA 1993	27-Jul-00	SC*

* Analysis sub-contracted, reported on dry weight basis.

Signature: Parry Bragg Date: 8/1/00

Parry L. Bragg
Laboratory Manager

These analytical results are based upon materials provided by the client and are intended for the exclusive use of the client. These analytical results represent the best judgement of Primary Laboratories, Inc. Primary Laboratories, Inc. assumes no responsibility, express or implied, as to the interpretation of the analytical results contained in this report. This report is not to be reproduced except with the written approval of Primary Laboratories, Inc.

Primary Laboratories, Inc.
Results

01-Aug-00

Date Sampled: 20-Jul-00
Work Order No: 0007109-02
Client ID: **400 Chesterfield Oil Dock**

Test Description	Final Result	Reporting Limit	Units of Measure	EPA Test Method	Date Analyzed	Tech. Initials
PCB 1016	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1221	<0.0067	0.0067	mg/Kg	8082	25-Jul-00	PH
PCB 1232	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1242	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1248	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1254	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1260	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
Kepone	<0.0017	0.0017	mg/Kg	608	25-Jul-00	PH
TPH, Diesel Range	<10.0	10.0	mg/Kg	3550/8015M	24-Jul-00	SH
Tributyltin	<1.86	1.86	ug/Kg	NOAA 1993	27-Jul-00	SC*

* Analysis sub-contracted, reported on dry weight basis.

Primary Laboratories, Inc.

2087 Dabney Road • Richmond, VA 23230 • Telephone (804) 213-0831 • Fax (804) 213-0842

ANALYTICAL LABORATORY REPORT

01-Aug-00

Virginia Power
Attn: Annette Christian
5000 Dominion Blvd.
Glen Allen, Virginia 23060

Date Received:	20-Jul-00
Project:	Chesterfield
Date Sampled:	20-Jul-00
Work Order No:	0007109-01
Client ID:	**200 Chesterfield Oil D**

Test Description	Final Result	Reporting Limit	Units of Measure	EPA Test Method	Date Analyzed	Tech. Initials
PCB 1016	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1221	<0.0067	0.0067	mg/Kg	8082	25-Jul-00	PH
PCB 1232	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1242	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1248	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1254	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
PCB 1260	<0.0033	0.0033	mg/Kg	8082	25-Jul-00	PH
Kepone	<0.0017	0.0017	mg/Kg	608	25-Jul-00	PH
TPH, Diesel Range	<10.0	10.0	mg/Kg	3550/8015M	24-Jul-00	SH
Tributyltin	<1.86	1.86	ug/Kg	NOAA 1993	27-Jul-00	SC*

* Analysis sub-contracted, reported on dry weight basis.

RECD MAY 19 2011 ABF

Ken Roller
copy: Dawn
Garber

COMMONWEALTH of VIRGINIA

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

Douglas W. Domenech
Secretary of Natural Resources

May 16, 2011

Dominion Resources Services, Inc.
Attn: Cathy C. Taylor
Director Electric Environmental Services
5000 Dominion Boulevard
Glen Allen, VA 23060

RE: VMRC Permit #03-0742

Dear Ms. Taylor:

In response to your letter dated April 14, 2011, the expiration date for the above-referenced permit which authorized the maintenance dredging, on an as needed basis, a maximum of 3,000 cubic yards per year of State-owned subaqueous bottomland adjacent to your cooling water withdrawal structures along the James River in Chesterfield County has been extended until August 31, 2013.

Please attach this letter to the previously issued permit as evidence of the authorization contained herein. Additionally, this represents the final extension for this permit and you will have to submit a new joint permit application for any work required after August 31, 2013. Should you have any questions or if we may be of further assistance, please do not hesitate to contact Mr. Randy Owen of my staff at (757) 247-2251.

Sincerely,

Tony W

Tony Watkinson
Chief, Habitat Management

TW/lra
HM
cc: U. S. Army Corps of Engineers #9

COMMONWEALTH *of* VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
www.deq.state.va.us

Robert G. Burnley
Director

Gerard Seeley, Jr.
Piedmont Regional Director

May 16, 2003

M. G. Deacon, Jr.
Vice President-Fossil & Hydro
Dominion Generation
5000 Dominion Blvd.
Glen Allen, VA 23060

RE: Joint Permit Application Number 03-0742
Notification of No Permit Required

Dear Mr. Deacon:

The Department of Environmental Quality has received your application to remove build up of silty sand from the entrances of cooling water withdrawal structures on the James River in Chesterfield County, Virginia.

Because the water quality impacts should be minimal and temporary in nature, and the project as presented qualifies for a general permit from the USACE on which DEQ has provided unconditional § 401 Certification, a Virginia Water Protection (VWP) general or individual permit will not be required for this project. This letter constitutes the § 401 Certification of your § 404 permit for this project. You are advised that this does not give you the authority to violate Virginia's State Water Quality Standards.

Please note that a VWP general or individual permit may be required if the size and scope of the project changes. If you have any questions, please do not hesitate to contact me at 804-527-5074 or ajcario@deq.state.va.us.

Sincerely,

Anthony J. Cario

Anthony J. Cario
Environmental Specialist

cc: Todd Miller U.S. Army Corps of Engineers
Joyce Livingstone, Dominion Environmental Services
VWP Permit File

Pamela F. Faggert
Vice President and Chief Environmental Officer

5000 Dominion Boulevard, Glen Allen, VA 23060
Phone: 804-273-3467

Dominion[SM]

Certified Mail
Return Receipt Requested

April 11, 2003

Mr. Ben Stagg
Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, VA 23607-0756

RE: Intake Maintenance Dredging – Joint Permit Application
Chesterfield Power Station
Chesterfield, Virginia

Dear Mr. Stagg:

Enclosed please find a Joint Permit Application for maintenance dredging of accumulated sediment from the intake structures at Chesterfield Power station.

If you need additional information, please contact Joyce B. Livingstone at (804) 273-2985 of Dominion Environmental Services.

Sincerely,

Cathy Taylor for

Pamela F. Faggert

Enclosures

bc: with enclosures

Mr. John Ely – CPS
Mr. Mike Pantele – CPS
Mr. Bennie Tomlinson – CPS
Mr. Michael Lott – INNS
Ms. Cathy Taylor – INNS
Mr. Judson White – INNS JW
Ms. Joyce Livingstone – INNS

File Code – Chesterfield / ENV 50 / Dredging

Pamela F. Faggert
Vice President and Chief Environmental Officer
5000 Dominion Boulevard, Glen Allen, VA 23060
Phone: 804-273-3467

FILE COPY

Dominion

Certified Mail
Return Receipt Requested

May 5, 2003

Mr. Ben Stagg
Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, VA 23607-0756

RE: Intake Maintenance Dredging – Joint Permit Application - Revision
Chesterfield Power Station, Chesterfield, Virginia

Dear Mr. Stagg:

Enclosed please find the revised Appendix J for the above mentioned Joint Permit Application, per your telephone conversation with Joyce Livingstone last week. Approximately 3000 cubic yards per year of accumulated material will be removed as needed. You indicated that this permit could be issued for a five-year term (instead of the usual three) upon request. We wish to request the five-year term.

If you have any other questions or need additional information, please contact Joyce B. Livingstone at (804) 273-2985 of Dominion Environmental Services.

Sincerely,

Pamela F. Faggert

Pamela F. Faggert

Enclosures

ebc: with enclosures

Mr. John Ely – CPS
Mr. Mike Pantele – CPS
Mr. Bennie Tomlinson – CPS
Mr. Michael Lott – INNS
Ms. Cathy Taylor – INNS
Mr. Judson White – INNS
Ms. Joyce Livingstone – INNS

File Code – Chesterfield / ENV 50 / Dredging

APPENDIX J - DREDGING, MINING, & EXCAVATING

Questions:

1. Complete the table below with the volumes (cu. yds.) and areas (sq. ft.) of material to be removed from waters by each method, for each category:

NEW

	Hydraulic	Dragline	Clamshell	Other
Vegetated Wetlands*				
Nonveg. Wetlands*				
Subaqueous Land*				
Totals:				

MAINTENANCE

Hydraulic	Dragline	Clamshell	Other
	3,000 CY (6,757 SF)	Optional	
	3,000 CY (6,757 SF)	Optional	

* Report tidal and/or nontidal

2. State the composition of the material (e.g. clay 25%, sand 25%, silt 50%): 60% silt, 40% sand

3. How will the dredged material be retained to prevent re-entry into the waterway?
Transported by truck to approved disposal area. See Figure 4

4. Will the dredged material be used for any commercial purpose? __ Yes X No

5. For mining projects: Explain the operation plans on a separate sheet of paper. Include the frequency (e.g. every 6 wks), duration (e.g. Apr - Sep), and volume (cu. yds.) to be removed per operation; the temporary storage and handling methods of dredged material; and how equipment will access the dredge site. Have you applied for a permit from the VA Dept of Mines, Minerals, & Energy?
__ Yes __ No

6. For maintenance dredging projects: When was dredging last performed? 1990
Provide permit number 88-0622-13. Attach a copy of the permit.

7. What is the approximate drainage area and average stream flow? 6,758 sq mi 6,934 cfs

Specific Information for Plan View Drawing:

- width of the waterway, measuring from mean high water to mean high water (tidal areas) or ordinary high water to ordinary high water (nontidal areas)
- location and dimensions of area proposed to be dredged
- location of existing channels
- location of dredged material disposal area if located on-site** (for off-site areas: Provide a drawing
- that includes the location, dimensions, benchmarks, berms, and/or spillways. Also provide an explanation of how the material will be transported, including the location of the proposed transfer site(s). For non-commercially owned/operated disposal areas, attach local approvals for proposed disposal areas.
- location and dimensions of buffer zone between dredge cut and vegetated wetlands
- existing and proposed depths in the project area based on mean low water (tidal) or ordinary high water (nontidal)

JOINT PERMIT APPLICATION

TABLE OF CONTENTS

No. of Pages

BASIC APPLICATION FORM 6

FIGURES
Figure 1: Site Location Map
Figure 2: Plan View of Chesterfield Power Station
Figure 3: Cross Section of Chesterfield Power Station
Figure 4: Disposal Site Plan View and Cross Sections

ATTACHMENTS
Attachment A: Appendix J -Dredging, Mining & Excavating
Attachment B: Threatened and Endangered Species Correspondence
Attachment C: Department of Historic Resources Correspondence
Attachment D: Adjacent Property Owners
Attachment E: Previous Permit

JOINT PERMIT APPLICATION
INTAKE MAINTENANCE DREDGING
CHESTERFIELD POWER STATION
CHESTERFIELD, VIRGINIA

Prepared for:
Dominion Generation
5000 Dominion Boulevard
Glen Allen, Virginia 23060

MARCH, 2003

P.N. 95058.70

RESOURCE
INTERNATIONAL, LTD.
ENVIRONMENTAL CONSULTANTS & DESIGNERS
P.O. BOX 6160 • 9560 KINGS CHARTER DRIVE • ASHLAND, VA 23005
(804) 550-9200 • FAX (804) 550-9259

JOINT PERMIT APPLICATION

TABLE OF CONTENTS

No. of
Pages

BASIC APPLICATION FORM 6

FIGURES
Figure 1: Site Location Map
Figure 2: Plan View of Chesterfield Power Station
Figure 3: Cross Section of Chesterfield Power Station
Figure 4: Disposal Site Plan View and Cross Sections

ATTACHMENTS
Attachment A: Appendix J -Dredging, Mining & Excavating
Attachment B: Threatened and Endangered Species Correspondence
Attachment C: Department of Historic Resources Correspondence
Attachment D: Adjacent Property Owners
Attachment E: Previous Permit

JOINT PERMIT APPLICATION

PART I - GENERAL INFORMATION

PLEASE PRINT OR TYPE ALL ANSWERS: *If a question does not apply to your project, **please print N/A (not applicable) in the block or space provided**. If additional space is needed, attach extra 8-1/2" x 11" sheets of paper.*

If using JPA as Pre-Construction Notification, please indicate so here: ___ PCN

1. Applicant's name and complete mailing address: M.G. Deacon, Jr. Vice President - Fossil & Hydro Dominion Generation 5000 Dominion Blvd. Glen Allen, VA 23060	Contact Information: Home (____) N/A Work (804) 273-2225 Fax (____) Mobile/Pager (____) E-mail
2. Property Owner's name and complete mailing address: Dominion Virginia Power 5000 Dominion Blvd. Glen Allen, VA 23060	Contact Information: Home (____) N/A Work (804) 273-2225 Fax (____) Mobile/Pager (____) E-mail
3. Authorized agent's name and complete mailing address (if applicable): Joyce B. Livingstone Dominion Environmental Services 5000 Dominion Blvd. Glen Allen, VA 23060	Contact Information: Home (____) N/A Work (804) 273-2985 Fax (____) Mobile/Pager (____) E-mail

FOR AGENCY USE ONLY	
	NOTES:
	JPA #:

4. Have you obtained a contractor for the project? __Yes X_No. If your answer is "yes" complete the remainder of this question and submit the Applicant's and Contractor's Acknowledgement Form on page __ with your application.

Contractor's name and complete mailing address:

N/A

Contact Information:
Home (____)____________
Work (____)____________
Fax (____)____________
Mobile/Pager(____)____________
E-mail ____________

5. List the name, address, and telephone number of the newspaper having general circulation in the area of the project. Failure to complete this question may delay Local and State processing.

Name and complete mailing address:

Richmond Times Dispatch
318 East Cary Street
Richmond, VA 21219

Telephone number:
(804) 748-6389

6a. Give the following project location information:
Street Address 500 Coxendale Road
Lot/Block/Parcel # N/A
Subdivision N/A
City/County Chester, Virginia

b. If project is located in a rural area, please give driving directions

From Richmond I-95 south, exit 61A (Hopewell), east on Rt. 10, 1/2 mile turn left on Old Stage Road, 2 1/2 miles to stop sign, take a right, see plant on the left.

c. List the waterbody(ies) within the project boundaries:
James River
Tributary(ies) of ____________

NOTE: IF THE PROJECT IS IN AN UNDEVELOPED SUBDIVISION OR PROPERTY, CLEARLY STAKE AND IDENTIFY PROPERTY LINES AND LOCATION OF PROPOSED PROJECT. A SUPPLEMENTAL MAP SHOWING HOW THE PROPERTY IS TO BE SUBDIVIDED SHOULD ALSO BE PROVIDED.

7. Provide a detailed description of the project and primary and secondary purposes. For example, a description may be "construction of a timber bulk head, 125 linear feet, 6 feet high, etc." and the purpose may be "to protect a property from erosion due to boat wakes".

To remove build up of silty sand from the entrances of cooling water withdrawal structures on the James River. Such maintenance dredging is necessary for cooling water to be withdrawn at the five entrances, in order to allow for reliable and efficient generation of electricity.

Approximately 3000 cubic yards per year of accumulated material will be removed as needed.

8. Proposed use (check one):
__ single user (private, non-commercial, residential)
X multi-user (community, commercial, industrial, government)

9. Attach a description of the measures taken during project design and development both to avoid and minimize impacts to surface waters, including wetlands, to the maximum extent practicable.

10. Have you previously had a site visit, applied to, or obtained a permit from any agency (Federal, State, or Local) for any portion of the project described in this application or any other project at the site?
X Yes __ No If your answer is "Yes", provide the following information:

Agency/Representative	Activity	Application No.	Action* & Date
Norfolk District Corps	Dredging	88-0662-13	Issued May 26, 1988

* Issued, Denied, Withdrawn, or Site Visit

11a. Has any work commenced or has any portion of the project for which you are seeking a permit been completed? __ Yes X No

b. Are you submitting this application at the direction of any state, local or federal agency? __ Yes X No

If your answer to either question above is "YES", give details below stating when the work was completed, who performed the work, and which agency (if any) directed you to submit the application. Please clearly differentiate between completed work and proposed work on your application drawings.

12. Approximate cost of the entire project (materials, labor, etc): $ 40,000 per event
Approximate cost of only that portion of the project which affects State Waters (below mean low water in tidal areas or ordinary high water in nontidal areas): $ 40,000 per dredging event

13a. Will the project be located at the site of any historic property? (Note: historic properties include but are not limited to archeological sites, Civil War earthworks, graveyards, buildings, bridges, canals, etc.) __ Yes X No. If "Yes", please provide a map showing the location.

b. Is your project located within a historic district? __ Yes X No __ Uncertain. If "Yes", please indicate which district: ____________________

c. Have you previously contacted the Virginia Department of Historic Resources concerning this project? X_ Yes __ No. If "Yes", please provide copies of all correspondence concerning your project.

d. Has a survey to locate archeological sites and/or historic structures been carried out on the property? __ Yes X_ No. If "Yes", please provide the following information:
Date of survey: ____________________________
Name of firm: ____
Is there a report on file with the Virginia Department of Historic Resources? Yes__________
Was any historic property located? No_________

---

14. List the name and complete mailing address, including zip code, of each adjacent property owner (APO) to the project (other than yourself).

See Attachment E.

SIGNATURES

I. APPLICANTS AND PROPERTY OWNERS (REQUIRED)

PRIVACY ACT STATEMENT: The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972. These laws require that individuals obtain permits that authorize structures and work in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters prior to undertaking the activity. Information provided in the joint permit application will be used in the permit review process and is a matter of public record once the application is filed. Disclosure of the requested information is voluntary; but it may not be possible to evaluate the permit application or issue a permit if the information requested is not provided.

I hereby apply for all necessary permits for the activities I have described herein. I agree to allow the duly authorized representatives of any regulatory or advisory agency to enter upon the premises of the project site at reasonable times to inspect and photograph site conditions. I certify that the information submitted in this application is true and accurate to the best of my knowledge.

M. G. Deacon. Jr.
APPLICANT'S NAME (PRINTED/TYPED) — (use if more than one applicant)

MGD
APPLICANT'S SIGNATURE — (use if more than one applicant)

4/10/03
DATE

Dominion Generation
PROPERTY OWNER'S NAME (if different from above) (PRINTED/TYPED) — (use if more than one owner)

PROPERTY OWNER'S SIGNATURE — (use if more than one owner)

DATE

II. APPLICANTS HAVING AGENTS (IF APPLICABLE)

CERTIFICATION OF AUTHORIZATION

I, M. G. Deacon, Jr. (APPLICANT'S NAME), hereby certify that I have authorized Joyce B. Livingstone (AGENT'S NAME) to act on my behalf and take all actions necessary to the processing, issuance, and acceptance of this permit and any and all standard and special conditions attached.

We hereby certify that the information submitted in this application is true and accurate to the best of our knowledge.

Joyce B. Livingstone

AGENT'S SIGNATURE

April 4, 2003

DATE

M. [illegible]

APPLICANT'S SIGNATURE

(use if more than one applicant)

April 10, 03

DATE

III. APPLICANTS HAVING CONTRACTORS (IF APPLICABLE)

CONTRACTOR ACKNOWLEDGEMENT N/A

I, ______________________________, have contracted ______________________________
(APPLICANT'S NAME) (CONTRACTOR/COMPANY NAME)
to perform the work described in this Joint Permit Application, signed and dated ___________.

We will read and abide by all conditions as set forth in all Federal, State, and Local permits as required for this project. We understand that failure to follow the conditions of the permits may constitute a violation of applicable Federal, State, and Local statutes and that we will be liable for any civil and/or criminal penalties imposed by these statutes.

In addition, we agree to make available a copy of any permit to any regulatory representative visiting the project site to ensure permit compliance. If we fail to provide the applicable permit upon request, we understand that the representative will have the option of stopping our operation until it has been determined that we have a properly signed and executed permit and are in full compliance with all terms and conditions.

CONTRACTOR'S NAME OR NAME OF FIRM (PRINTED/TYPED)

CONTRACTOR'S OR FIRM'S ADDRESS

CONTRACTOR'S LICENSE NO.

CONTRACTOR'S SIGNATURE AND TITLE

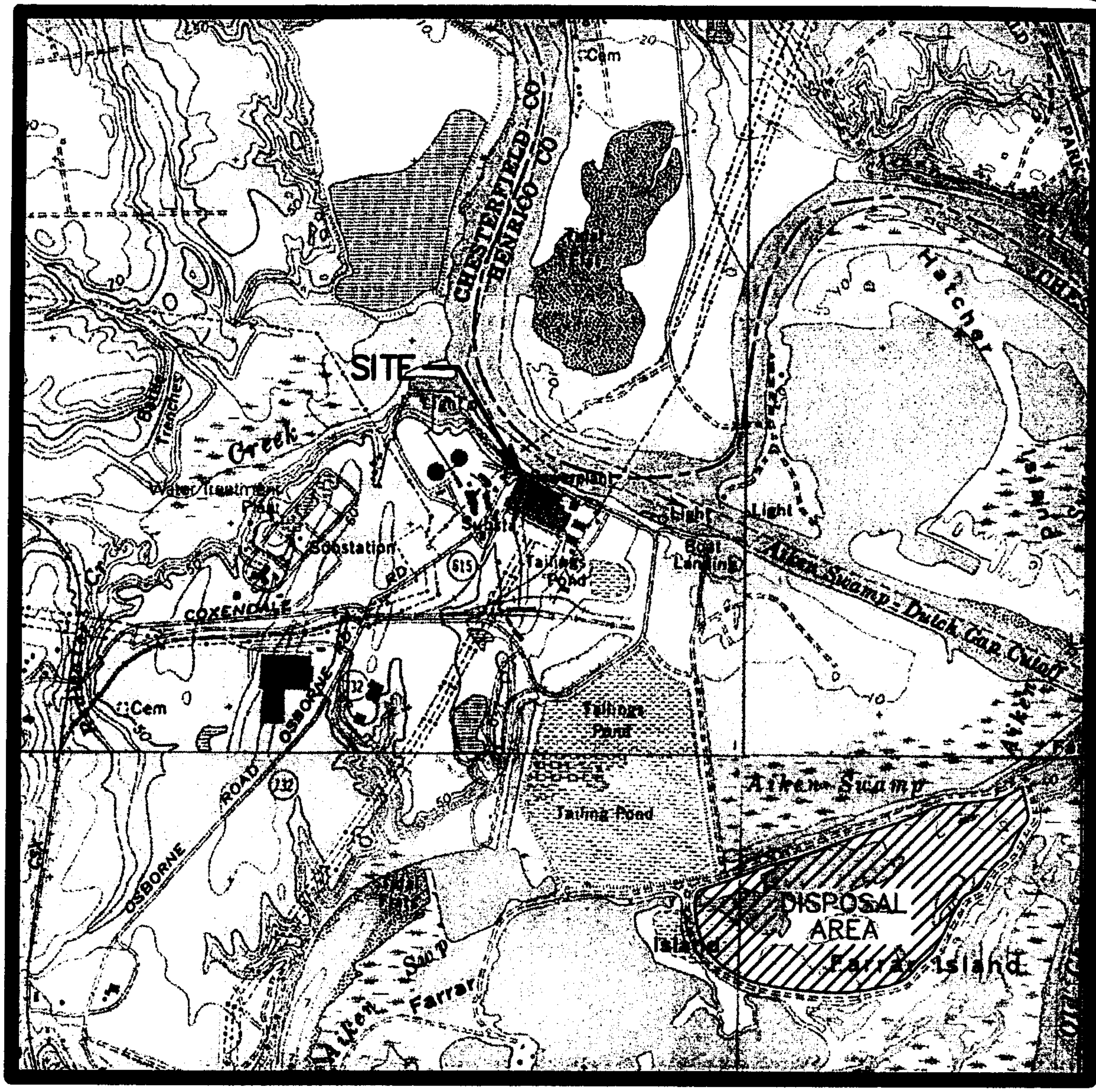
DATE

APPLICANT'S SIGNATURE

(use if more than one applicant)

DATE

FIGURES



U.S.G.S. 7.5 MINUTE SERIES QUADRANGLES
DREWRYS BLUFF, VIRGINIA 1969 (PHOTOREVISED 1994)
DUTCH GAP, VIRGINIA 1969 (PHOTOREVISED 1994)
CHESTER, VIRGINIA 1969 (PHOTOREVISED 1987)
HOPEWELL, VIRGINIA 1969 (PHOTOREVISED 1987)
SCALE: 1" = 2000'

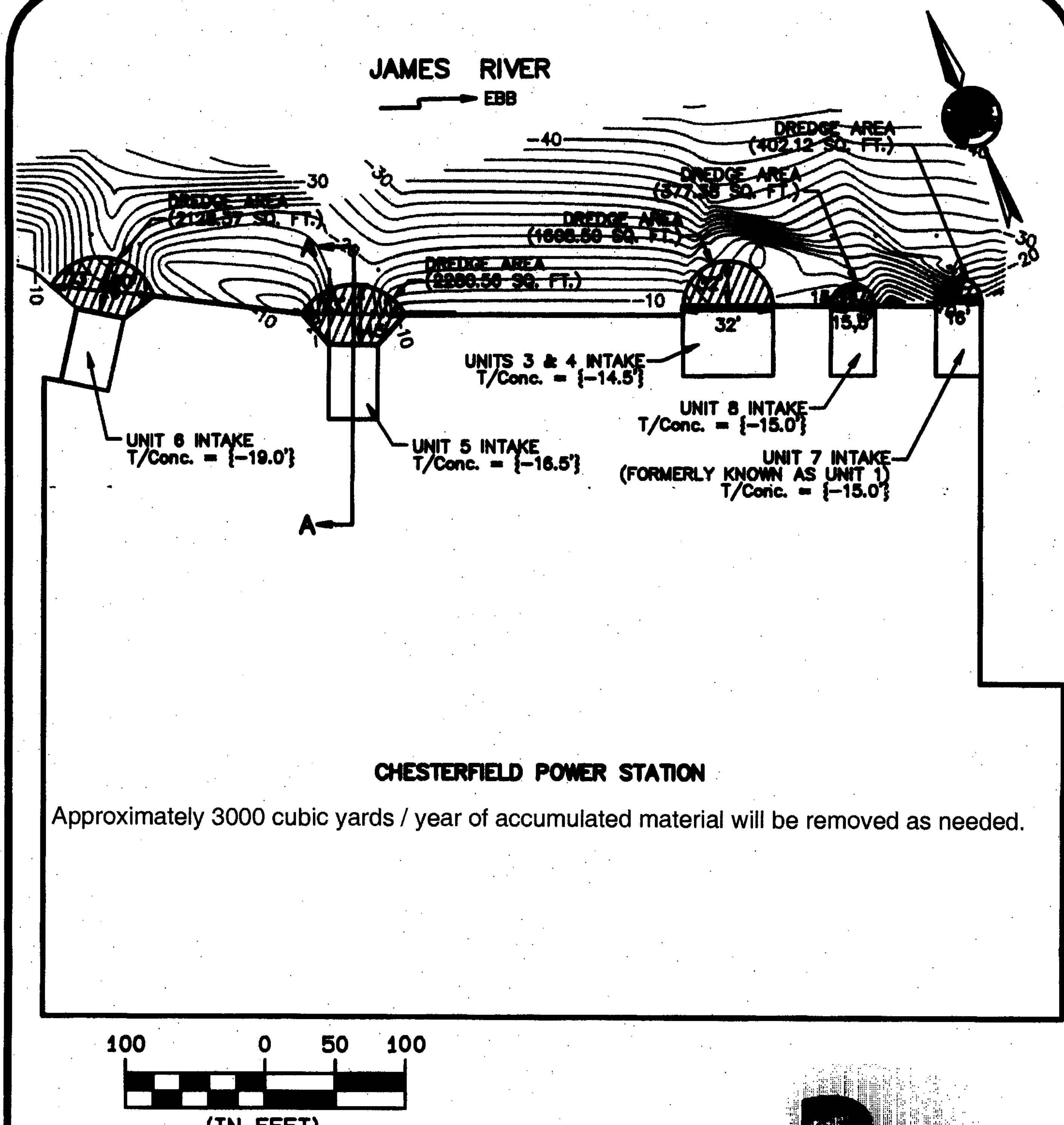
Dominion

NOTE: ALL LOCATIONS ARE APPROXIMATE.

FIGURE 1
SITE LOCATION
CHESTERFIELD POWER STATION
CHESTER, VIRGINIA
SCALE: 1" = 2000'
FEBRUARY 12, 2003

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS
P.O. BOX 6160 • 9560 KINGS CHARTER DRIVE • ASHLAND, VA 23005
(804) 550-9200 • FAX (804) 550-9259

H:\95058.70\SITE.PRO



NOTE: ALL LOCATIONS ARE APPROXIMATE.

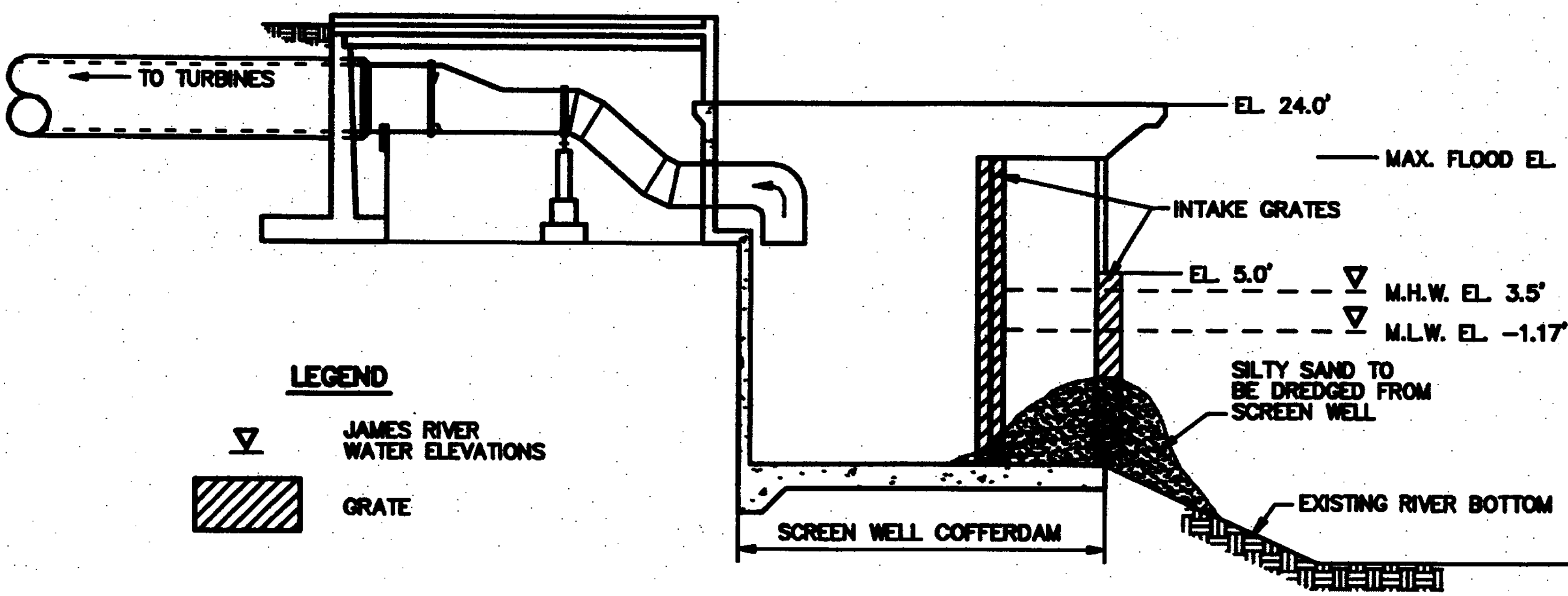
FIGURE 2
PLAN VIEW OF PROJECT
CHESTERFIELD POWER STATION
CHESTER, VIRGINIA
FEBRUARY 12, 2003

Dominion

RESOURCE INTERNATIONAL, LTD.

ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

H:\95058.70\SITE.PRO



NOTE : Approximately 3000 cubic yards per year of accumulated material will be removed as needed.

TYPICAL CROSS-SECTION A-A

2' 0 1' 2'
(IN FEET)
1/2" = 1'-0"

Dominion

H:\95058.70\SITE.PRO

FIGURE 3
TYPICAL CROSS-SECTION A-A
CHESTERFIELD POWER STATION
CHESTER, VIRGINIA
FEBRUARY 12, 2003

RESOURCE INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS
P.O. BOX [illegible] • [illegible] • [illegible], VA [illegible]
(804) [illegible] • FAX (804) [illegible]

Note: Spoils from intake maintenance dredging project will be placed in the Upper Fly Ash Pond in accordance with the current closure plan approved by the Department of Environmental Quality.

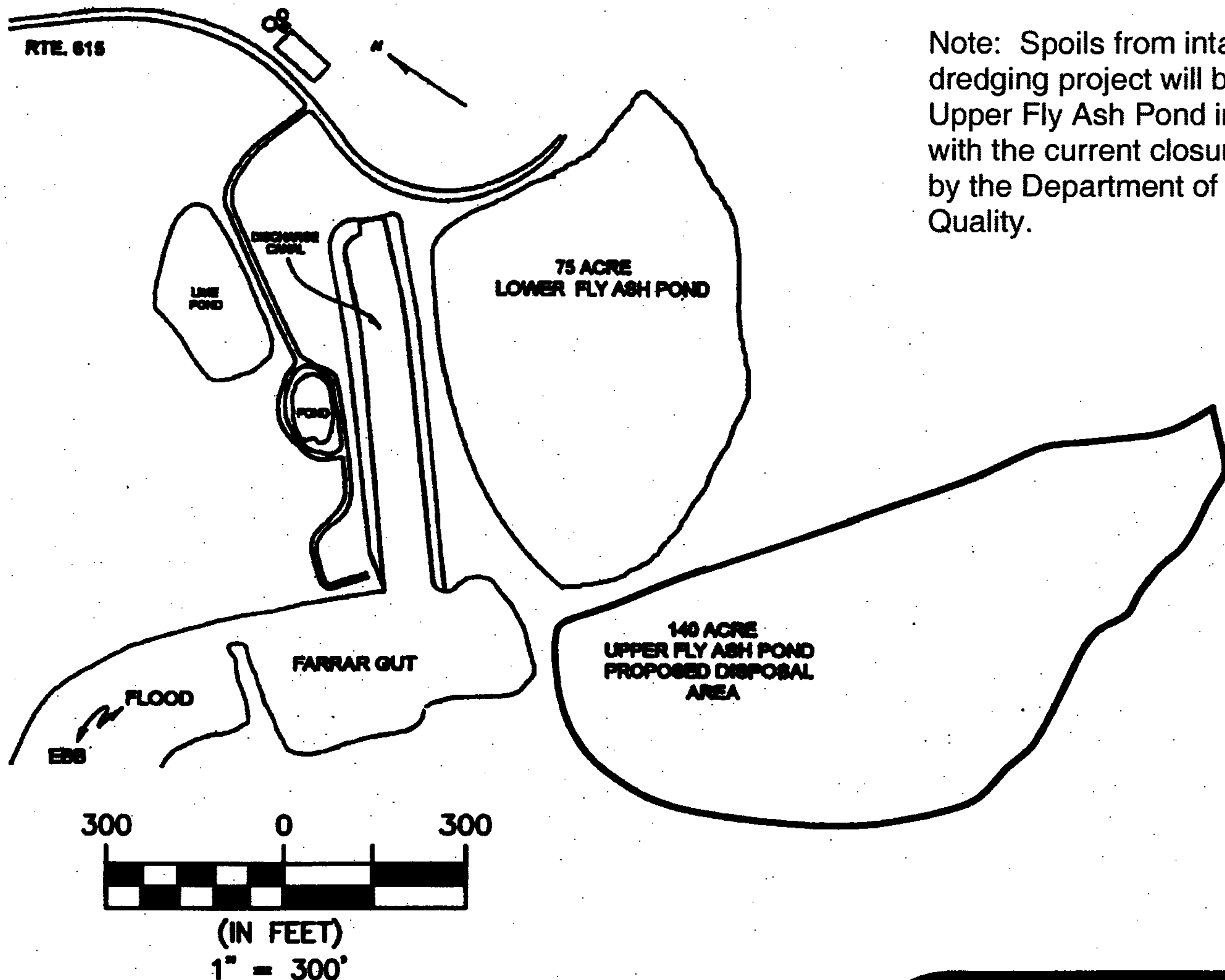


FIGURE 4
DISPOSAL SITE PLAN VIEW
AND CROSS-SECTION
CHESTERFIELD POWER STATION
CHESTER, VIRGINIA
SCALE: AS SHOWN
FEBRUARY 12, 2003

H:\95058.70\SITE.PRO

RESOURCE
INTERNATIONAL, LTD.

ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

P.O. BOX [illegible] • [illegible] KINGS CHARTER DRIVE • ASHLAND, VA [illegible]
(804) [illegible] • FAX (804) [illegible]

ADJACENT PROPERTY OWNERS

JOINT PERMIT APPLICATION

PART III - ADJACENT PROPERTY OWNER (APO) INFORMATION

When determining whether to grant or deny any permit for the use of state-owned bottomlands, the Virginia Marine Resources Commission must consider, among other things, effects of a proposed project on adjacent or nearby properties. Accordingly, in addition to the adjacent waterfront property owner information requested in Part I, question 13, please list the name and complete mailing address of each property owners across the waterway where the waterway is less than 500 feet wide, and/or all of those property owners within the cove, if your property is on a cove.

Discussing the proposed project with these property owners can be done on your own using the Adjacent Property Owner's (APO) Acknowledgement Form provided on the following page. Local wetland boards also consider the effects on adjacent properties. The completed form will assist VMRC and local wetlands boards in processing your application. Please indicate whether or not you have discussed the proposed project with all APO's: _x__ Yes ____ No.
If yes, please attach the completed acknowledgement forms. (The APO form may be photocopied if extra copies are needed).

ADJACENT PROPERTY OWNERS

Donald R & Martha H Beverley
5201 Ashton Creek Rd.
Chester, VA 2383 1

F&S Elec Motor & Transf Co.
203 1 Westwood Ave.
Richmond, VA 23230

Kendall T & Caralyn A Wilmoth
1610 Coxendale Rd.
Chester, VA 23836

Larry S & Sandra J Bosher
1608 Coxendale Rd.
Chester, VA 23836

Old Stage Road LLC
2415 Grenoble Rd.
Richmond, VA 23294

Development Co of America
P.O. Box 520
Westrninister, MD 21158

County of Chesterfield
1200 Coxendale Rd.
Chesterfield, VA 23836

Reynolds Real Est Ventures LLC
P.O. Box 40
Rockville, VA 23 146

Algonquin Sand & Gravel Co LLC
3029 Lincoln Ave.
Richmond, VA 23228

Seaboard Coast Line RR Co.
500 Water St.
Jacksonville, FL 32202

ATTACHMENTS

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion™

April 1, 2003

Donald R. & Martha H. Beverley
5201 Ashton Creek Road
Chester, VA 23831

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Mr. & Mrs. Beverley:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

MGD

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

F&S Elec Motor & Transf Co.
2031 Westwood Ave.
Richmond, VA 23230

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Kendall T & Caralyn A Wilmoth
1610 Coxendale Rd.
Chester, VA 23836

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Mr. & Mrs. Wilmoth:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Larry S & Sandra J. Bosher
1608 Coxendale Rd.
Chester, VA 23836

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Mr. & Mrs. Bosher:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Old Stage Road LLC
2415 Grenoble Rd.
Richmond, VA 23294

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Development Co of America
P.O. Box 520
Westrninister, MD 21158

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion

April 1, 2003

County of Chesterfield
1200 Coxendale Rd.
Chesterfield, VA 23836

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Reynolds Real Est Ventures LLC
P.O. Box 40
Rockville, VA 23146

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Algonquin Sand & Gravel Co LLC
3029 Lincoln Avenue
Richmond, VA 23228

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

M.G. Deacon, Jr.
Vice President
Fossil & Hydro

Dominion Generation
Innsbrook Technical Center
5000 Dominion Boulevard, Glen Allen, VA 23060

Dominion℠

April 1, 2003

Seaboard Coast Line RR Co.
500 Water St.
Jacksonville, FL 32202

RE: Adjacent Property Owner Notification
Intake Maintenance Dredging at Chesterfield Power Station

Dear Sir or Madam:

You have been identified as an owner of property adjacent to the referenced project. The permit application requires that all adjacent property owners be notified of the permit application and afforded the opportunity to provide comments to the permitting agencies. Dominion is seeking permits to perform maintenance dredging as necessary in the vicinity of the Chesterfield Power Station cooling water intake structure in the James River, etc. Drawings of the proposed work are provided for your review.

An Adjacent Property Owner's Acknowledgment Form is provided for your comments. In the event you desire to offer comments on the proposed activities, please do so on the form and return it to:

Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, Virginia 23607
Attention: Mr. Ben Stagg

If you have any questions or concerns about the nature of this project, please do no hesitate to contact Joyce B. Livingstone at (804) 273-2985 of our Dominion Environmental Services.

Sincerely,

M.G. Deacon, Jr.

Enclosures

APPENDIX J
DREDGING,MINING, & EXCAVATING

APPENDIX J - DREDGING, MINING, & EXCAVATING

Questions:

1. Complete the table below with the volumes (cu. yds.) and areas (sq. ft.) of material to be removed from waters by each method, for each category:

	NEW				MAINTENANCE			
	Hydraulic	Dragline	Clamshell	Other	Hydraulic	Dragline	Clamshell	Other
Vegetated Wetlands*								
Nonveg. Wetlands*								
Subaqueous Land*						3,000 CY (6,757 SF)	Optional	
Totals:						3,000 CY (6,757 SF)	Optional	

* Report tidal and/or nontidal

2 State the composition of the material (e.g. clay 25%, sand 25%, silt 50%): 60% silt, 40% sand

3 How will the dredged material be retained to prevent re-entry into the waterway?
Transported by truck to approved disposal area. See Figure 4

4 Will the dredged material be used for any commercial purpose? __ Yes X No

5. For mining projects: Explain the operation plans on a separate sheet of paper. Include the frequency (e.g. every 6 wks), duration (e.g. Apr - Sep), and volume (cu. yds.) to be removed per operation; the temporary storage and handling methods of dredged material; and how equipment will access the dredge site. Have you applied for a permit from the VA Dept of Mines, Minerals, & Energy? __ Yes __ No

6. For maintenance dredging projects: When was dredging last performed? 1990
Provide permit number 88-0622-13. Attach a copy of the permit.

7. What is the approximate drainage area and average stream flow? 6,758 sq mi 6,934 cfs

Specific Information for Plan View Drawing:

- width of the waterway, measuring from mean high water to mean high water (tidal areas) or ordinary high water to ordinary high water (nontidal areas)
- location and dimensions of area proposed to be dredged
- location of existing channels
- location of dredged material disposal area if located on-site** (for off-site areas: Provide a drawing
- that includes the location, dimensions, benchmarks, berms, and/or spillways. Also provide an explanation of how the material will be transported, including the location of the proposed transfer site(s). For non-commercially owned/operated disposal areas, attach local approvals for proposed disposal areas.
- location and dimensions of buffer zone between dredge cut and vegetated wetlands
- existing and proposed depths in the project area based on mean low water (tidal) or ordinary high water (nontidal)

THREATENED AND ENDANGERED SPECIES CORRESPONDENCE

Direct Dial (804) 550-9233
tkraska@resourceintl.com
http://www.resourceintl.com

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

January 16, 2003

P.N. 95058.70

Mr. Ray Fernald
Environmental Service Manager
Virginia Department of Game and Inland Fisheries
Non-game and Endangered Wildlife Program
P.O. Box 11104
Richmond, VA 23230-1104

RE: Request for Database Search
Proposed Dredging Project
Chesterfield County, Virginia

Dear Mr. Fernald:

On behalf of our client, Resource International, Ltd., is requesting a data search of your files to identify occurrences or habitat of threatened and/or endangered species on the above referenced site. The site is identified on the attached site location map.

I trust that this information meets your needs. If you have any questions, feel free to contact me at the above referenced sources.

Sincerely,

Thaddeus J. Kraska
Staff Scientist

/sbd

Attachment

Apr. 1. 2003 12:33PM RESOURCE INTERNATIONAL No.7573 P. 3/9

RECEIVED
RESOURCE INTERNATIONAL

ORIGINAL 95058.70
COPY

COMMONWEALTH of VIRGINIA

Mark R. Warner
Governor

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

February 13, 2003

Thaddeus J. Kraska
Staff Scientist
Resource International, Ltd.
9560 Kings Charter Drive
Ashland, Virginia 23005-6160

RE: Chesterfield County Dredging
ESSLOG #18507

Dear Mr. Kraska:

We have reviewed the subject project and offer the following comments and recommendations. The Department of Game and Inland Fisheries (VDGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over those resources, inclusive of state or federally endangered or threatened species, but excluding listed insects. We are a consulting agency under the U.S. Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and we provide environmental analysis of projects or permit applications coordinated through the Virginia Department of Environmental Quality, the Virginia Marine Resources Commission, the Virginia Department of Transportation, the Corps, the Federal Energy Regulatory Commission, and other state or federal agencies. Our role in these procedures is to determine likely impacts upon fish and wildlife resources and habitats, and to recommend appropriate measures to avoid, reduce, or compensate for those impacts.

According to our records, the federally and state *threatened* bald eagle (*Haliaeetus leucocephalus*) has been documented within two miles of the project area. Considering the scope of the project and the distance to the eagle nest, we do not anticipate significant adverse impacts to bald eagle nesting as a result of the proposed project.

The James River at the project site contains documented occurrences of the following anadromous fish: striped bass (*Morone saxatilis*), alewife (*Alosa pseudoharengus*), American shad (*A. sapidissima*), hickory shad (*A. mediocris*), and blueback herring (*A. aestivalis*). We recommend an in-stream work time-of-year restriction from 15 February through 30 June to protect these fish during the spawning period.

Thank you for the opportunity to comment on this proposed project. Please call me or Brian Moyer at (804) 367-6913 if we may be of further assistance.

Sincerely,

Brian D. Moyer

for Raymond T. Fernald, Manager
Nongame and Environmental Programs

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

Direct Dial (804) 550-9233
tkraska@resourceintl.com
http://www.resourceintl.com

January 16, 2003

P.N. 95058.70

Ms. Karen Mayne
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061

RE: Request for Database Search
Proposed Dredging Project
Chesterfield County, Virginia

Dear Ms. Mayne:

On behalf of our client, Resource International, Ltd. is requesting a data search of your files to identify occurrences or habitat of threatened or endangered species on the above referenced site. The site is identified on the attached location map.

If you have any questions, feel free to contact me at the above referenced sources.

Sincerely,

Thaddeus J. Kraska
Staff Scientist

/sbd

Enclosure

9560 Kings Charter Drive • P.O. Box 6160 • Ashland, VA 23005-6160
(804) 550-9200 • Fax (804) 550-9259

United States Department of the Interior

RECEIVED
FEB - 3 2003
RESOURCE INTERNATIONAL

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061

ORIGINAL 93058.70
COPY TJK

January 31, 2003

Mr. Thaddeus J. Kraska
Resource International, Ltd.
P.O. Box 6160
Ashland, Virginia 23005-6160

Greetings:

The U.S. Fish and Wildlife Service (Service) has received your request to review the attached project for potential impacts to Federally listed or proposed endangered and threatened species and designated critical habitat in Virginia pursuant to the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.). Attached are lists of species with Federal status and species of concern that have been documented or may occur in the county(s) where your project is located. These lists were prepared by this office and are based on information obtained from previous surveys for rare and endangered species.

In order to ensure coordination with the State agencies, we consistently recommend that individuals contact the Virginia Department of Conservation and Recreation, Division of Natural Heritage **and** the Virginia Department of Game and Inland Fisheries, since each agency maintains a different database and has differing expertise and/or regulatory responsibility. You can contact these agencies at the following addresses:

Virginia Department of Game and Inland Fisheries
Environmental Services Section
P.O. Box 11104
Richmond, VA 23230
(804) 367-1000

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 2nd Floor
Richmond, VA 23219
(804) 786-7951

If either of these agencies determines that your project may impact a Federally listed, proposed, or candidate species OR Federally designated critical habitat, please contact this office and provide a copy of the response letter from each agency; otherwise, further contact with this office is not necessary.

If you have any questions or need further assistance, please contact Ms. Jolie Harrison at (804) 693-6694, extension 208.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

Enclosures

KEY

LE - federally listed endangered.

LT - federally listed threatened.

PE - federally proposed endangered.

PT - federally proposed threatened.

EX - believed to be extirpated in Virginia.

LE(S/A) - federally listed endangered due to similarity of appearance to a federally listed species.

LT(S/A) - federally listed threatened due to similarity of appearance to a federally listed species.

C - candidate species; the U.S. Fish and Wildlife Service has enough information to list the species as threatened or endangered, but this action is precluded by other listing activities.

SOC - species of concern; those species that have been identified as potentially imperiled or vulnerable throughout their range or a portion of their range. These species are not protected under the Endangered Species Act.

G - global rank; the species rarity throughout its total range.

G1 - extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.

G2 - very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction.

G3 - either very rare and local throughout its range or found locally (abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.

G_T_ - signifies the rank of a subspecies or variety. For example, a G3T1 would apply to a subspecies of a species that is very rare and local throughout its range or found locally in a restricted range (G3) but the subspecies warrants a rank of T1, critically imperiled.

G_Q - The taxon has a questionable taxonomic assignment.

CHESTERFIELD COUNTY, VIRGINIA
Federally Listed, Proposed, and Candidate Species

SCIENTIFIC NAME	COMMON NAME	STATUS
BIRDS		
Haliaeetus leucocephalus[1]	Bald eagle	LT
INVERTEBRATES		
Alasmidonta heterodon[2]	Dwarf wedgemussel	LE
VASCULAR PLANTS		
Aeschynomene virginica	Sensitive joint-vetch	LT
Rhus michauxii[2]	Michaux's sumac	LE

Species of Concern

INVERTEBRATES		
Elliptio lanceolata	Yellow lance	G3
Speyeria diana	Diana fritillary	G3
VASCULAR PLANTS		
Chamaecrista fasciculata var. macrosperma	Marsh senna	G5T2
Desmodium ochroleucum	Creamflower tick-trefoil	G2G3
Trillium pusillum var virginianum	Virginia least trillium	G3T2

[1]Nesting occurs in this county; concentrated shoreline use has been documented on the James River.
[2]This species has been documented in an adjacent county and may occur in this county.

May 29, 2001
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

Bald Eagle

Haliaeetus leucocephalus

Description - The bald eagle occurs throughout the United States. It is a large bird-of-prey with dark brown plumage, a white head and tail, and a yellow bill, feet, and eyes. Juvenile eagles generally have a dark brown body, sometimes with white patches on the tail, belly, and underwings. The head and tail become completely white when full adult plumage is reached at four to five years of age.

Life History - The majority of Virginia's eagle population is found on the coastal plain. The bald eagle breeding season begins in mid-November when large nests are built (or the previous year's nest is repaired) usually in loblolly pine trees that are in close proximity to water. Eagles lay one to three eggs between mid-January and late March. In March, most eggs hatch and by June or July most young have fledged. However, the young will continue to use the nest for several weeks. In Virginia, during the summer and winter months, juvenile and nonbreeding adult eagles congregate along large rivers in areas with abundant food and little human disturbance. During the day, these eagles feed and perch along the river shoreline. In late afternoon, they move inland to roost either singly or communally. Roosts are typically located away from human disturbance and near water and a food source. Bald eagles feed primarily on fish, but will also eat carrion, waterfowl, small mammals, snakes, and turtles.

Conservation - The bald eagle was federally listed as an endangered species in the Chesapeake Bay Region on March 11, 1967. On July 12, 1995, the bald eagle was reclassified to threatened throughout the 48 lower states because the population had increased due to the banning persistent pesticides, habitat protection, and other recovery activities. On July 6, 1999, the bald eagle was proposed for removal from the list of endangered and threatened wildlife in the lower 48 states. This action was proposed because the available data indicated that this species has recovered. The recovery is due in part to habitat protection and management actions initiated under the Endangered Species Act. It is also due to reduction in levels of persistent pesticides occurring in the environment. If and when the eagle is no longer protected by the Endangered Species Act, it will still be protected by the Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and state laws. Until the eagle is officially delisted, it will continue to receive protection pursuant to the Endangered Species Act. Bald eagles in the Chesapeake Bay are increasing. However, habitat destruction through urban and residential development and human disturbance in nesting, roosting, and foraging habitats continue to be a threat.

What You Can Do To Help - If you know of a bald eagle nest on or near property proposed for clearing, development, or logging please contact one of the following agencies for assistance:

Virginia Department of Game and Inland Fisheries
P.O. Box 11104
Richmond, Virginia 23230
(804) 367-1000

U. S. Fish and Wildlife Service
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694

References

U.S. Fish and Wildlife Service. 1990. Chesapeake Bay Region bald eagle recovery plan: first revision. Newton Corner, Massachusetts.

U.S. Fish and Wildlife Service. 1999. Proposed rule to remove the bald eagle in the lower 48 states from the list of endangered and threatened wildlife. Federal Register 64(128): 36453-36464.

Watts, B.D., K.W. Cline, and M.A. Byrd. 1994. The bald eagle in Virginia: An information booklet for land planners. The Center for Conservation Biology, College of William and Mary, Williamsburg, Virginia.

U.S. FISH & WILDLIFE SERVICE

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694
http://www.fws.gov
August 1999

Dwarf Wedge Mussel

Alasmidonta heterodon

B. Windsor

Description - The dwarf wedge mussel has a spotty distribution in Atlantic coast drainage rivers and their tributaries from Canada to North Carolina. It is a small mussel whose shell rarely exceeds 1.5 inches in length. The shell outline is ovate or trapezoidal. The female shell is shorter, trapezoidal, and inflated in the back whereas the male shell is elongate, compressed, and ovate. The outer shell layer is brown to yellowish-brown, with greenish rays in young or pale-colored specimens. This mussel is unique in that it has two lateral teeth on its right valve and only one tooth on its left valve (opposite of all other North American mussel species).

Life History - The dwarf wedge mussel lives in shallow to deep rivers and creeks of various sizes where the current is slow to moderate. This mussel lives on muddy sand, sandy, and gravel stream bottoms that are nearly silt free. Like other freshwater mussels,
this species is a filter feeder. It feeds on plankton collected from water

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694
http://www.fws.gov
August 1999

that is passed over its gills. Reproduction occurs sexually.

Females carry eggs in
their gills. During spawning, the male releases sperm into the water column and the sperm is taken into the female through the gills. The resulting larvae (known as glochidia) are released from the female into the water column and must attach to a fish host to survive. While attached to the fish host, development of the glochidia continues. Once metamorphosis is complete, the juvenile mussel drops off the fish host and continues to develop on the stream bottom. Fish hosts for this species include the mottled sculpin (*Cottus bairdi*), slimy sculpin (*Cottus cognatus*), tessellated darter (*Etheostoma olmstedi*), and johnny darter (*Etheostoma nigrum*).

Conservation - The dwarf wedge mussel was federally listed as an endangered species on March 14, 1990. The decline of this species is due to human degradation of habitat and water quality which have resulted in the continuing decline and subsequent loss of this species from previously occupied habitat. Threats to the species include agricultural, domestic, organic, and industrial pollution; impoundments that destroy habitat and cause silt deposits, low oxygen levels, and fluctuations in water levels and temperatures of the flooded area; and erosion and siltation from land clearing and construction of bridges or roads.

What You Can Do To Help - If you reside on property that borders a stream or other waterway, avoid using chemicals or fertilizers. To help control erosion and reduce runoff, maintain a buffer of natural vegetation along streambanks. Install fencing to prevent livestock from enter
ing streams to reduce trampling of mussels, siltation, and input of waste products. Protecting water quality is the most effective way to conserve mussels.

To find out more about the dwarf wedge mussel contact:

Virginia Department of Game and
Inland Fisheries
P.O. Box 11104
Richmond, Virginia 23230
(804) 367-1000

References

Michaelson, D.L. and R.J. Neves. 1995. Life history and habitat of the endangered dwarf wedgemussel *Alasmidonta heterodon* (Bivalvia:Unionidae). Journal of the North American Benthological Society 14(2):324-340.

U.S. Fish and Wildlife Service. 1993. Dwarf wedge mussel (*Alasmidonta heterodon*) recovery plan. Hadley, Massachusetts.

Sensitive Joint-Vetch

Aeschynomene virginica

© M. Rollins

Description - The sensitive joint-vetch is an annual legume native to the eastern United States. Populations currently exist in Maryland, New Jersey, North Carolina, and Virginia. The historical range for the species extended to Delaware and Pennsylvania. In Virginia, populations are found along the Potomac, Mattaponi, Pamunkey, Rappahannock, Chickahominy, and James Rivers and their tributaries. This plant usually attains a height of three to six feet in a single growing season, but may grow as tall as eight feet. The flowers are yellow, streaked with red and the fruit is a pod, turning dark brown when ripe.

Life History - The joint-vetch occurs in fresh to slightly brackish tidal river systems, within the intertidal zone where populations are flooded twice daily. It typically occurs at the outer fringe of marshes or shores; its presence in marsh interiors may be a result of nutrient deficiencies, ice scouring, or muskrat herbivory. The sensitive joint-vetch is found in localities where plant diversity is high and annual species are prevalent. Bare to sparsely vegetated substrates appear to be a habitat feature of critical importance for establishment and growth of this species. Plants flower from July through September and into October in some years. Fruits are produced from July through late October, concurrent with flowering.

Conservation - The sensitive joint-vetch was federally listed as a threatened species on June 19, 1992. Threats to the species include sedimentation, competition from non-native plant species, dams, dredging, filling, recreational activities, shoreline stabilization, shoreline structures, road and bridge construction, commercial and residential development, water withdrawal projects, water quality degradation, agricultural practices, introduced pest species, mining, timber harvest, over-visitation, declines in muskrat populations, rise in sea level (this may also be a result of natural cycles), and collection. Natural threats are often identified with disturbances, such as wave and ice action associated with severe storm events, competition, herbivory, channel migration, sea level rise and natural sedimentation processes. Adequate habitat conservation for this species will only be achieved through on-site protection of marshes supporting plant populations when coupled with protection of the natural ecological processes responsible for creating and maintaining habitat for the sensitive joint-vetch.

What You Can Do To Help - Avoid the use of herbicides in or near waterways. If you are planning construction or stabilization activities along the shoreline in one of the counties indicated on the attached map, please contact the U.S. Fish and Wildlife Service.

References

Davison, S.E. and L.P. Bruderle. 1984. Element stewardship abstract for *Aeschynomene virginica* - sensitive joint vetch. The Nature Conservancy. Arlington, Virginia.

Hershner, C. and J.E. Perry. 1987. Population status of potentially threatened vascular plants from coastal plain tidal rivers in Virginia. College of William and Mary, Virginia Institute of Marine Science, Gloucester Point, Virginia.

Rouse, G.D. 1994. Sensitive joint-vetch life history and habitat study, 1993 Field Season, Mattaponi and Rappahannock River systems, Virginia. Schnabel Environmental Services. Richmond, Virginia.

U.S. Fish and Wildlife Service. 1995. Sensitive joint-vetch (*Aeschynomene virginica*) recovery plan. Hadley, Massachusetts.

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694
http://www.fws.gov
August 1999

Michaux's Sumac

Rhus michauxii

Description - Michaux's sumac is a small, deciduous shrub found in the inner coastal plain and piedmont areas of Georgia, North Carolina, South Carolina, and Virginia. This species was found in Virginia in 1993. This shrub grows up to three feet in height. The Virginia populations are the largest and represent the northernmost range of the species.

Life History - Michaux's sumac grows in sparsely wooded oak-hickory stands, grassy hardwood savannas, and old clearings. This species can tolerate acidic or basic soils, and appears to select sites due to their open canopies rather than soil type. Some form of disturbance, such as fire, is required to maintain the habitat for this species. Flowering occurs in June and July and the flowers are greenish-yellow to white in color. The fruit is red and is similar in appearance to other, more common sumac species.

Conservation - The Michaux's sumac was federally listed as an endangered species on Semptember 28, 1989.

Since the discovery of the species, many of the known populations have become extinct been partly as a result of conversion of habitat for silvicultural and agricultural purposes and for industrial and residential development. Threats include fire suppression, habitat loss due to conversion for silviculture and agriculture, geographic isolation of small populations, hybridization with other speecies, accidental distruction of roadside populations, trampling, fungal disease, and stem borers.

What You Can Do To Help - If you find a plant that appears to be the Michaux's sumac, take note of the location and photograph the plant, if possible. Please do not remove the plant! Contact one of the following agencies for assistance:

Virginia Department of Agriculture
and Consumer Services
Office of Plant Protection
P.O. Box 1163
Richmond, Virginia 23209
(804) 786-3515

Virginia Department of Conservation
and Recreation
Division of Natural Heritage
217 Governor Street, 3rd Floor
Richmond, Virginia 23219
(804) 786-7951

U.S. Fish and Wildlife Service
Virginia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694

References

Flemming, G.P. 1995. Michaux's sumac. Page 43 in K. Terwilliger and J. Tate, ed. A guide to endangered and threatened species of Virginia. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

Savage, S., M. Bucher, C. Mayes, J. Moore, and R. Sutter. 1991. Preliminary results of a demographic and genetic analysis of *Rhus michauxii.* Draft report to The Nature Conservancy, North Carolina Field Office, Carrboro, North Carolina.

U.S. Fish and Wildlife Service. 1993. Michaux's sumac recovery plan. Atlanta, Georgia.

U.S. Fish and Wildlife Service
Virglnia Field Office
6669 Short Lane
Gloucester, Virginia 23061
(804) 693-6694
http://www.fws.gov
August 1999

RECEIVED
FEB 14
RESOURCE INTERNATIONAL

ORIGINAL ______
COPY ___Ted K___

COMMONWEALTH of VIRGINIA

Mark R. Warner
Governor

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

February 13, 2003

Thaddeus J. Kraska
Staff Scientist
Resource International, Ltd.
9560 Kings Charter Drive
Ashland, Virginia 23005-6160

RE: Chesterfield County Dredging
ESSLOG #18507

Dear Mr. Kraska:

We have reviewed the subject project and offer the following comments and recommendations. The Department of Game and Inland Fisheries (VDGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over those resources, inclusive of state or federally endangered or threatened species, but excluding listed insects. We are a consulting agency under the U.S. Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and we provide environmental analysis of projects or permit applications coordinated through the Virginia Department of Environmental Quality, the Virginia Marine Resources Commission, the Virginia Department of Transportation, the Corps, the Federal Energy Regulatory Commission, and other state or federal agencies. Our role in these procedures is to determine likely impacts upon fish and wildlife resources and habitats, and to recommend appropriate measures to avoid, reduce, or compensate for those impacts.

According to our records, the federally and state *threatened* bald eagle (*Haliaeetus leucocephalus*) has been documented within two miles of the project area. Considering the scope of the project and the distance to the eagle nest, we do not anticipate significant adverse impacts to bald eagle nesting as a result of the proposed project.

The James River at the project site contains documented occurrences of the following anadromous fish: striped bass (*Morone saxatilis*), alewife (*Alosa pseudoharengus*), American shad (*A. sapidissima*), hickory shad (*A. mediocris*), and blueback herring (*A. aestivalis*). We recommend an in-stream work time-of-year restriction from 15 February through 30 June to protect these fish during the spawning period.

Thank you for the opportunity to comment on this proposed project. Please call me or Brian Moyer at (804) 367-6913 if we may be of further assistance.

Sincerely,

Brian D. Moyer

for Raymond T. Fernald, Manager
Nongame and Environmental Programs

Direct Dial (804) 550-9233
tkraska@resourceintl.com
http://www.resourceintl.com

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

January 16, 2003

P.N. 95058.70

Ms. Karen Mayne
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061

RE: Request for Database Search
Proposed Dredging Project
Chesterfield County, Virginia

Dear Ms. Mayne:

On behalf of our client, Resource International, Ltd. is requesting a data search of your files to identify occurrences or habitat of threatened or endangered species on the above referenced site. The site is identified on the attached location map.

If you have any questions, feel free to contact me at the above referenced sources.

Sincerely,

Thaddeus J. Kraska
Staff Scientist

/sbd

Enclosure

9560 Kings Charter Drive • P.O. Box 6160 • Ashland, VA 23005-6160
(804) 550-9200 • Fax (804) 550-9259

Apr. 1. 2003 12:33PM RESOURCE INTERNATIONAL No. 7573 P. 4/9

RECEIVED
FEB - 3 2003
RESOURCE INTERNATIONAL

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
6669 Short Lane
Gloucester, VA 23061

January 31, 2003

ORIGINAL 03058.70
COPY

Mr. Thaddeus J. Kraska
Resource International, Ltd.
P.O. Box 6160
Ashland, Virginia 23005-6160

Greetings:

The U.S. Fish and Wildlife Service (Service) has received your request to review the attached project for potential impacts to Federally listed or proposed endangered and threatened species and designated critical habitat in Virginia pursuant to the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). Attached are lists of species with Federal status and species of concern that have been documented or may occur in the county(s) where your project is located. These lists were prepared by this office and are based on information obtained from previous surveys for rare and endangered species.

In order to ensure coordination with the State agencies, we consistently recommend that individuals contact the Virginia Department of Conservation and Recreation, Division of Natural Heritage and the Virginia Department of Game and Inland Fisheries, since each agency maintains a different database and has differing expertise and/or regulatory responsibility. You can contact these agencies at the following addresses:

Virginia Department of Game and Inland Fisheries
Environmental Services Section
P.O. Box 11104
Richmond, VA 23230
(804) 367-1000

Virginia Department of Conservation and Recreation
Division of Natural Heritage
217 Governor Street, 2nd Floor
Richmond, VA 23219
(804) 786-7951

If either of these agencies determines that your project may impact a Federally listed, proposed, or candidate species OR Federally designated critical habitat, please contact this office and provide a copy of the response letter from each agency; otherwise, further contact with this office is not necessary.

If you have any questions or need further assistance, please contact Ms. Jolie Harrison at (804) 693-6694, extension 208.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

Enclosures

Apr. 1. 2003 12:35PM RESOURCE INTERNATIONAL No.7573 P. 9/9

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

Direct Dial (804) 550-9233
tkraska@resourceintl.com
http://www.resourceintl.com

FILE

January 16, 2003

P.N. 95058.70

Ms. S. Rene Hypes
DCR Division of Natural Heritage
203 Governor Street, Suite 402
Richmond, VA 23219-2010

RE: Request for Database Search
Proposed Dredging Project
Chesterfield County, Virginia

Dear Ms. Hypes:

On behalf of our client, Resource International, Ltd., is requesting a data search of your files to identify occurrences or habitat of threatened and/or endangered species on the above referenced site, in accordance with the attached Information Services Order Form. The site is identified on the attached site location map.

I trust that this information meets your needs. If you have any questions, feel free to contact me at the above referenced sources.

Sincerely,

Thaddeus J. Kraska
Staff Scientist

/sbd

Enclosures

9560 Kings Charter Drive • P.O. Box 6160 • Ashland, VA 23005-6160
(804) 550-9200

Apr. 1. 2003 12:33PM RESOURCE INTERNATIONAL No.7573 P. 5/9

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

RECEIVED
FEB - 3 2003
RESOURCE INTERNATIONAL

Resource International
Date Received
Verified For Payment
Project #
Date PO Ck#

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

217 Governor Street
Richmond, Virginia 23219-2010
Telephone (804) 786-7951 FAX (804) 371-2674 TDD (804) 786-2121

ORIGINAL
COPY

January 30, 2003

Thaddeus J. Kraska
Resource International, Ltd.
9560 Kings Charter Drive, P.O. Box 6160
Ashland, VA 23005

Re: Proposed Dredging Project Chesterfield County

Dear Mr. Kraska:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biological and Conservation Data System (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

BCD documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Any absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks additional natural heritage resources. New and updated information is continually added to BCD. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

A fee of $60.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, Department of Conservation and Recreation, 203 Governor Street, Suite 414, Richmond, VA 23219, ATTN: Cashier. Payment is due within thirty days of the invoice date.

Should you have any questions or concerns, feel free to contact me at 804-692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Elizabeth Locklear
Locality Liaison

DEPARTMENT OF HISTORIC RESOURCES CORRESPONDENCES

Direct Dial (804) 550-9233
tkraska@resourceintl.com
http://www.resourceintl.com

RESOURCE
INTERNATIONAL, LTD.
ENGINEERS • SCIENTISTS • SURVEYORS • PLANNERS

January 16, 2003

P.N. 95058.70

Mr. Quatro Hubbard
Archives Search Services
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

RE: Request for Database Search
Proposed Dredging Project
Chesterfield County, Virginia

Dear Mr. Hubbard:

In reference to General Condition 13 of the U.S. Army Corps of Engineers Nationwide Permit Program (33CFR 330.4(g)), Resource International, Ltd., requests a data search of your files to identify occurrences of significant archaeological or cultural resources on the referenced site. The site is identified on the attached site location map. A signed copy of the Conditions for Use of Digital and other DHR Locational Data Form is also attached. Please invoice Resource for the associated fees.

I trust that this information meets your needs. If you have any questions, feel free to contact me at the above referenced sources.

Sincerely,

Thaddeus J. Kraska
Staff Scientist

/sbd

Enclosures

Apr. 1. 2003 12:33PM RESOURCE INTERNATIONAL No.7573 P. 2/9

COMMONWEALTH of VIRGINIA

Department of Historic Resources

2801 Kensington Avenue, Richmond, Virginia 23221

H. Tayloe Murphy, Jr.
Secretary of Natural Resources

Kathleen S. Kilpatrick
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386
www.dhr.state.va.us

January 30, 2003

Mr. Thaddeus J. Kraska
Resource International, Ltd.
9560 Kings Charter Drive
Ashland, VA 23005

RE: Detailed Archives Search –
Proposed Dredging Project

Dear Mr. Kraska:

Thank you for your recent request for information from our archives on previously recorded archaeological and architectural resources within the area of potential effect, as delineated on your map, for the above referenced project. Please note that your request for information from the Department of Historic Resources archives concerning the location of historic resources does not relieve you or your client from possible obligations under state or federal historic preservation regulations. I strongly recommend that you contact Dr. Ethel Eaton of the DHR's Resource Services and Review Division at (804) 367-2323, extension 112, if you have any questions concerning state and federal regulatory requirements.

Enclosed are the maps showing the location of any archaeological or architectural resources. Since no sites or structures were found to have been previously identified in your project area, no records were copied for inclusion in this packet. An invoice is enclosed for the charges incurred.

DHR serves as the official state repository on historic resources. This information has been compiled primarily by independent cultural resource consultants. DHR makes no warranty as to the fitness of the data for any purpose. The absence of historic resources in DHR records does not necessarily mean that no historic properties are present. It is advisable to check with local government planning offices for information on any properties that may meet the age and significance tests of the National Register criteria and have not yet been recorded in the DHR archives. Also, the area in question may not have been systematically surveyed for resources, possibly necessitating a survey and submittal of that data with your Project Review application.

Please contact me at (804) 367-2323, extension 125, if I can be of further assistance.

Sincerely,

Chris Wiles

Christina Wiles
Archives - DHR

PREVIOUS PERMIT

MFK
Distribute to File
and as needed
GOV 04-06

DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

May 26, 1988

Permits Section (James River)
88-0662-13

NOTED MAY 27 1988 B.M.M.

NOTED MAY 31 1988 M.F.K.

Mr. B. M. Marshall
Virginia Power
5000 Dominion Boulevard
Glen Allen, Virginia 23061

Dear Mr. Marshall:

This is to acknowledge the receipt of your Application Number 88-0662-13 for a Department of the Army permit to dredge on the James River in Chesterfield County Virginia.

It has been determined that your proposed work satisfies the criteria contained in the Corps Nationwide Permit 33 CFR 330.5(a)(19) published in Volume 51, Number 219 of the Federal Register dated November 13, 1986. Provided the special conditions (33 CFR 33.5(b)) and management practices (33 CFR 330.6) are followed (enclosure), an individual Department of the Army permit will not be required.

However, before you proceed with the work, you should obtain all required local permits and a permit from the Virginia Marine Resources Commission, Habitat Management Division, Post Office Box 756, Newport New, Virginia 23607, telephone (804) 247-2200.

Should you have any questions, you may call Mr. Gregory G. Wilda at (804) 441-7605.

Sincerely,

Bruce F. Williams

Bruce F. Williams
Chief, Permits Section

Enclosures

Copies Furnished w/dwgs:

Virginia Marine Resources Commission, Newport News
Building Official, Chesterfield County

330.5 NATIONWIDE PERMITS FOR SPECIFIC ACTIVITIES (QUOTED IN PART)

a. Authorized activities. The following activities are hereby permitted provided the conditions specified in this paragraph and listed in paragraph (b) of this section are met:

(18) . . .

(19) Dredging of no more than ten cubic yards from navigable waters of the United States as part of a single and complete project, This permit does not authorize the connection of canals or other artificial waterways to navigable waters of the United States (see Section 33 CFR 322.5 (g)). (Section 10)

(20) . . .

b. Conditions. The following special conditions must be followed in order for the nationwide permits identified in paragraph (a) of this section to be valid:

(1) That any discharge of dredged or fill material will not occur in the proximity of a public water supply intake.

(2) That any discharge of dredged or fill material will not occur in areas of concentrated shellfish production unless the discharge is directly related to a shellfish harvesting activity authorized by paragraph (a)(4) of this section.

(3) That the activity will not jeopardize a threatened or endangered species as identified under the Endangered Species Act (ESA), or destroy or adversely modify the critical habitat of such species. In the case of federal agencies, it is the agencies' responsibility to comply with the requirements of the ESA. If the activity may adversely affect any listed species or critical habitat, the district engineer must initiate Section 7 consultation in accordance with the ESA. In such cases, the district engineer may:

(i) Initiate section 7 consultation and then, upon completion, authorize the activity under the nationwide permit by adding, if appropriate, activity specific conditions, or

(ii) Prior to or concurrent with Section 7 consultation he may recommend discretionary authority (See Section 330.8) or use modification, suspension, or revocation procedures (See 33 CFR 325.7).

(4) That the activity shall not significantly disrupt the movement of those species of aquatic life indigenous to the waterbody (unless the primary purpose of the fill is to impound water).

(5) That any discharge of dredged or fill material shall consist of suitable material free from toxic pollutants (see Section 307 of the Clean Water Act) in toxic amounts.

330.6 MANAGEMENT PRACTICES

a. In addition to the conditions specified in Sections 330.4 and 330.5 of this Part, the following management practices should be followed, to the maximum extent practicable, in the discharge of dredged or fill material under nationwide permits in order to minimize the adverse effects of these discharges on the aquatic environment. Failure to comply with these practices may be cause for the district engineer to take discretionary authority to regulate the activity on an individual or regional basis pursuant to Section 330.8 of this Part.

(1) Discharges of dredged or fill material into waters of the United States shall be avoided or minimized through the use of other practical alternatives.

(2) Discharges in spawning areas during spawning seasons shall be avoided.

(3) Discharges shall not restrict or impede the movement of aquatic species indigenous to the waters or the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound water).

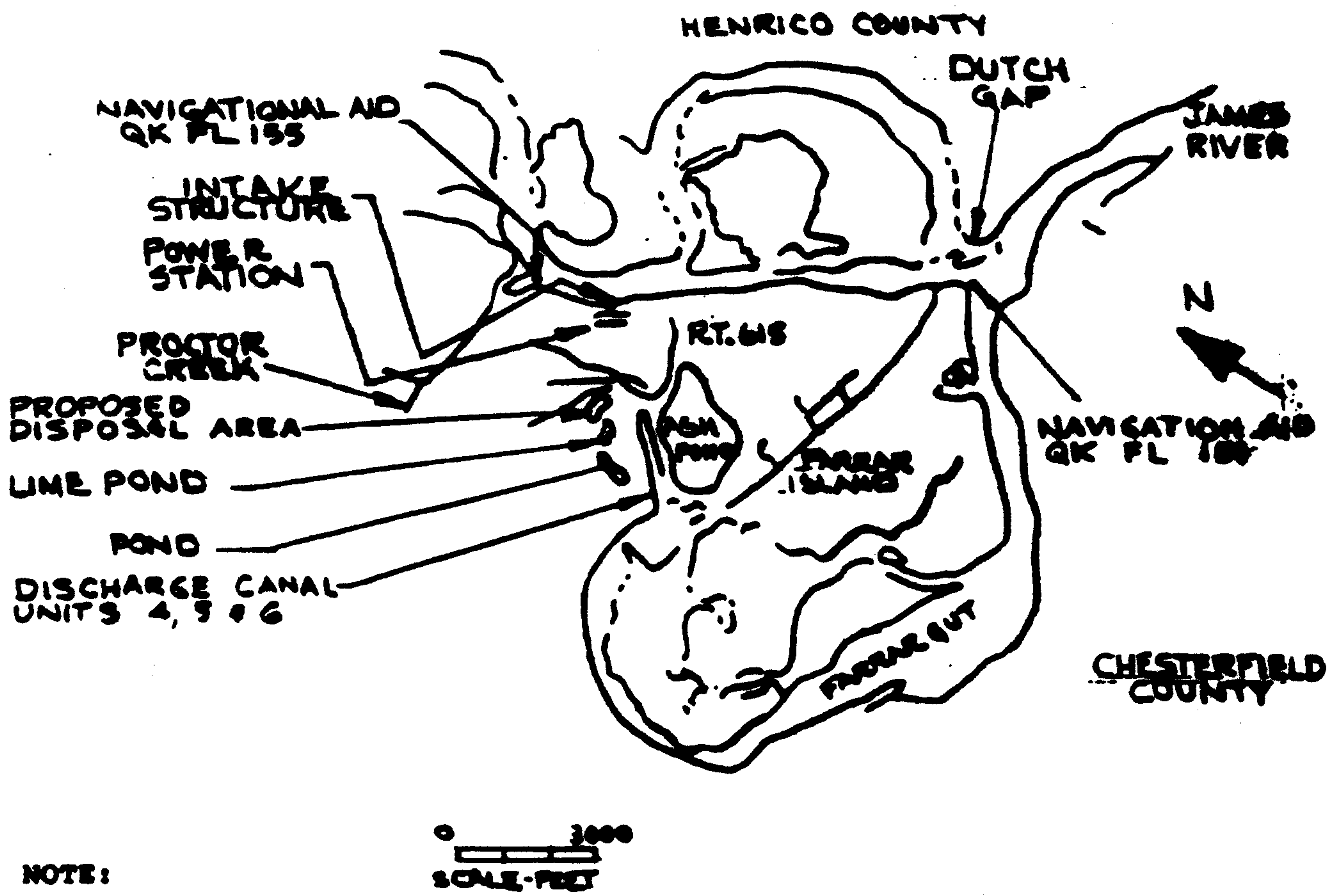
(4) If the discharge created an impoundment of water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow, shall be minimized.

(5) Discharge in wetland areas shall be avoided.

(6) Heavy equipment working in wetlands shall be placed on mats.

(7) Discharges into breeding areas for migratory waterfowl shall be avoided.

(8) All temporary fills shall be removed in their entirety.



NOTE:

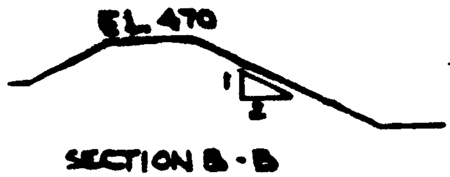
CHESTERFIELD POWER STATION, LONG. 77°20'50" LAT. 37°10'50", LOCATED ON RT. 615, APPROXIMATELY 6 MILES FROM CHESTER, VIRGINIA.

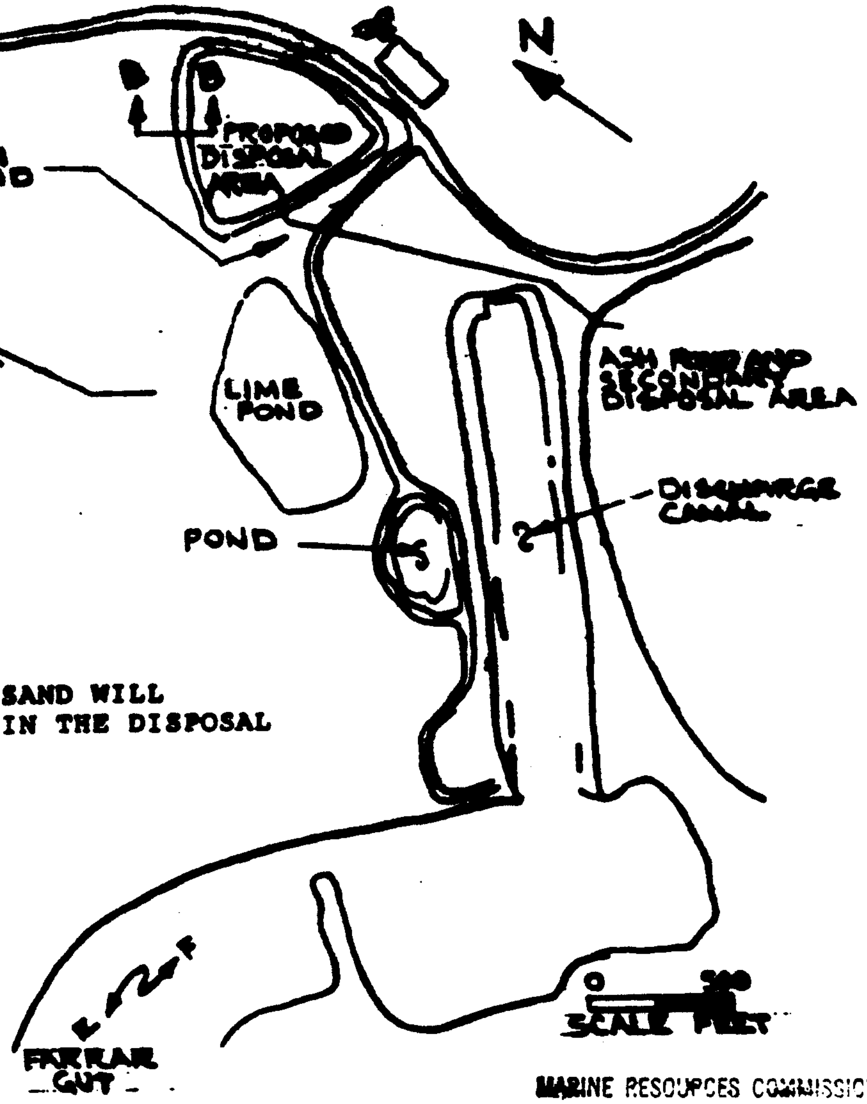
FROM NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NAUTICAL CHART NO. 12291

VICINITY MAP

MARINE RESOURCES COMMISSION
RECEIVED
4 1988
By________________

PURPOSE: TO CLEAN SILT FROM UNIT #1 INTAKE SYSTEM DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929 ADJACENT PROPERTY OWNERS: THIS PROJECT INVOLVES MAINTENANCE TO AN EXISTING FACILITY ON AND ADJACENT TO VIRGINIA POWER COMPANY PROPERTY	COMMERCIAL PROJECT APPLICATION BY: VIRGINIA ELECTRIC AND POWER COMPANY P.O. BOX 26666 RICHMOND, VIRGINIA 23261	MAINTENANCE DREDGING: UNIT #1 COOLING WATER INTAKE STRUCTURE IN JAMES RIVER NEAR CHESTER CHESTERFIELD COUNTY, VIRGINIA SHEET 1 OF 5 DATE: 2/24/88





NOTE:

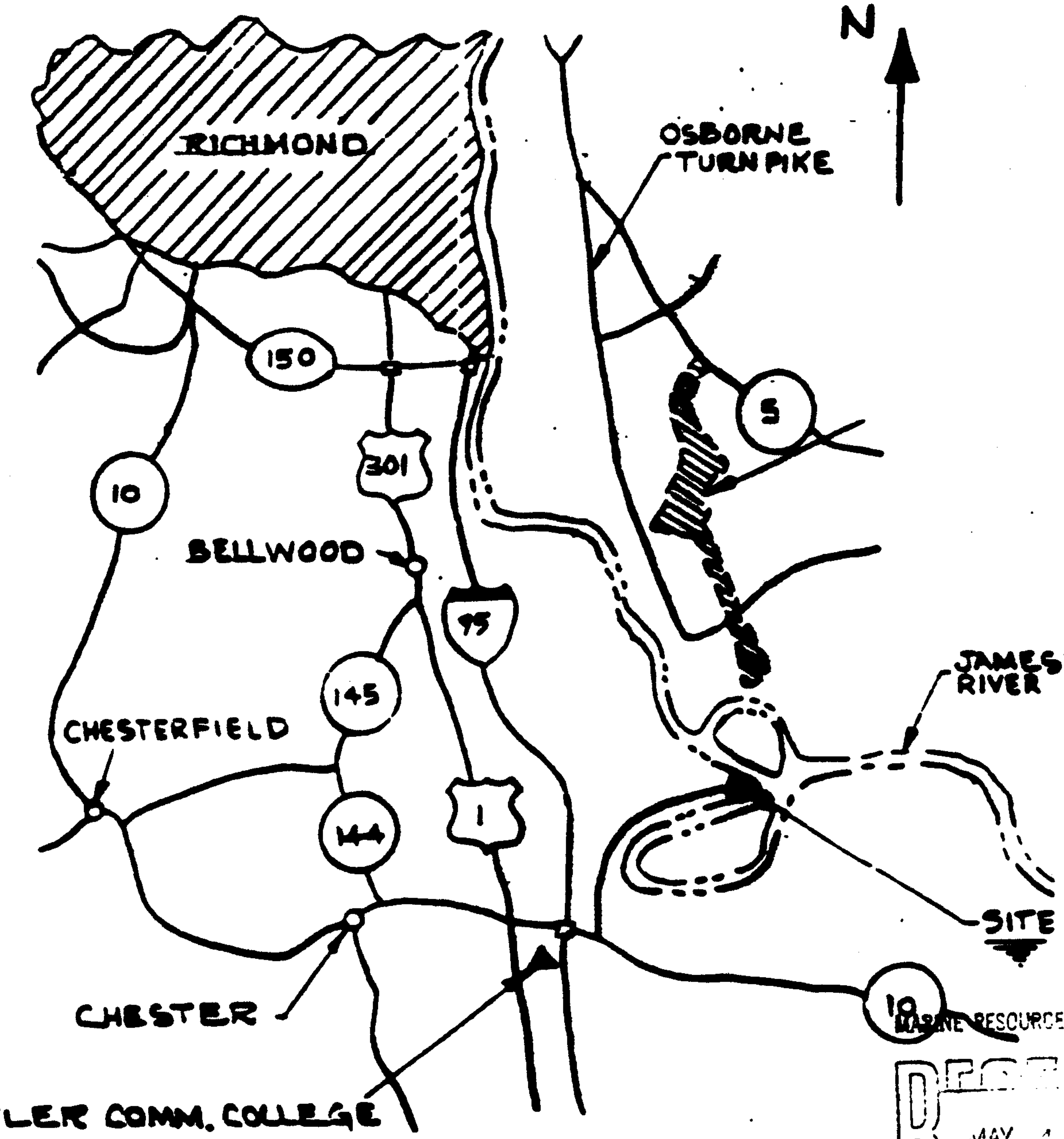
10 CU. YARDS OF SILTY SAND WILL BE DREDGED AND PLACED IN THE DISPOSAL AREA SHOWN.

PLAN AND SECTIONAL VIEWS PROPOSED DISPOSAL AREA

MARINE RESOURCES COMMISSION
RECEIVED
MAY 4 1988

By________________

PURPOSE: TO CLEAN SILT FROM UNIT #1 INTAKE SYSTEM DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929 ADJACENT PROPERTY OWNERS: THIS PROJECT INVOLVES MAINTENANCE TO AN EXISTING FACILITY ON AND ADJACENT TO VIRGINIA POWER COMPANY PROPERTY	COMMERCIAL PROJECT APPLICATION BY: VIRGINIA ELECTRIC AND POWER COMPANY P.O. BOX 26666 RICHMOND, VIRGINIA 23261	MAINTENANCE DREDGING: UNIT #1 COOLING WATER INTAKE STRUCTURE IN JAMES RIVER NEAR CHESTER CHESTERFIELD COUNTY, VIRGINIA SHEET 2 OF 5 DATE: 2/24/88



MARINE RESOURCES COMMISSION
MAY 4 1988

EXPANDED VICINITY AREA MAP

PURPOSE:
TO CLEAN SILT FROM UNIT #1 INTAKE SYSTEM

DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929

ADJACENT PROPERTY OWNERS:
THIS PROJECT INVOLVES MAINTENANCE TO AN EXISTING FACILITY ON AND ADJACENT TO VIRGINIA POWER COMPANY PROPERTY

COMMERCIAL PROJECT APPLICATION BY:

VIRGINIA ELECTRIC AND POWER COMPANY

P.O. BOX 26666
RICHMOND, VIRGINIA 23261

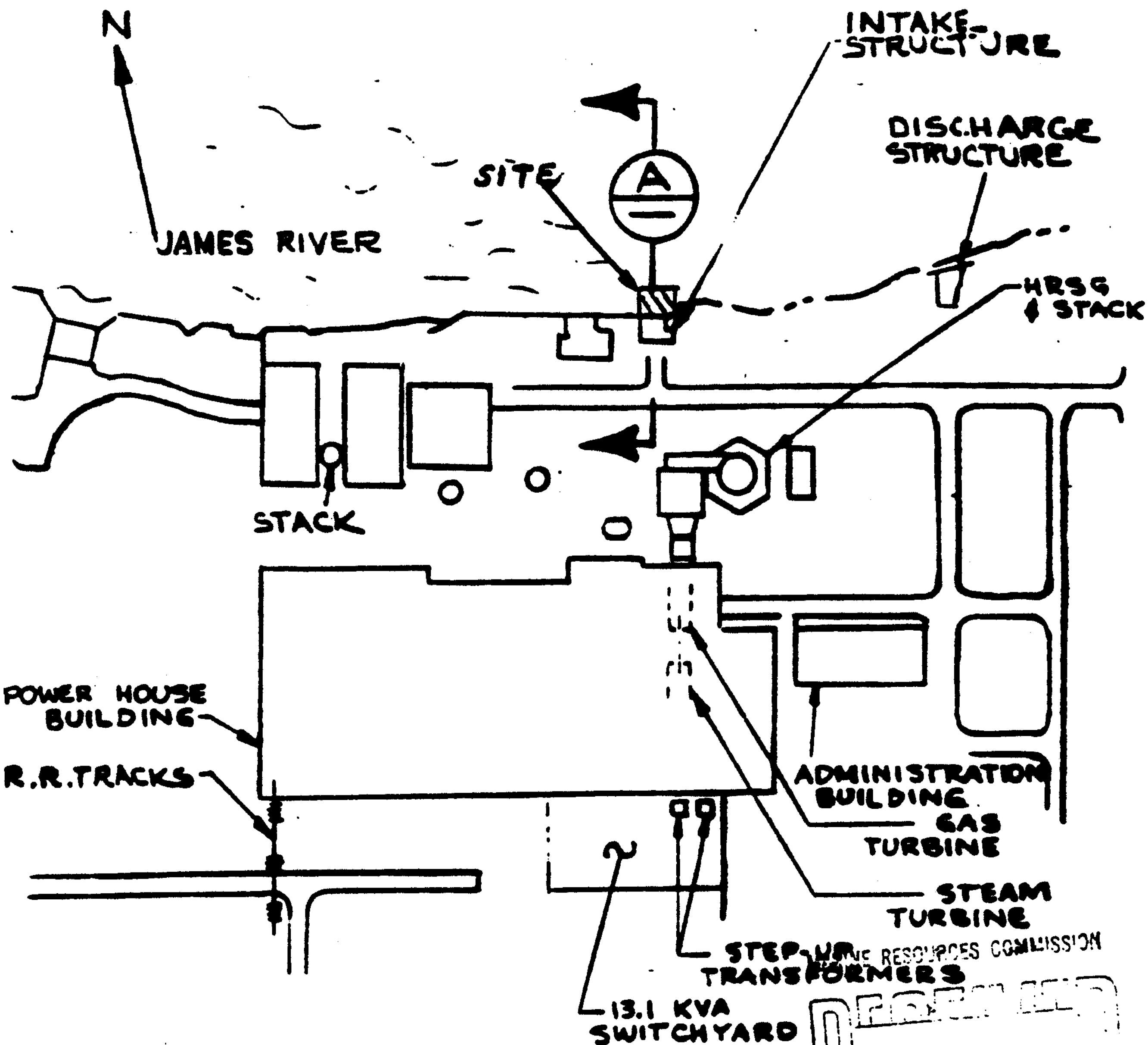
MAINTENANCE DREDGING:
UNIT #1 COOLING WATER INTAKE STRUCTURE

IN JAMES RIVER

NEAR CHESTER

CHESTERFIELD COUNTY, VIRGINIA

SHEET 3 OF 5 DATE: 2/24/88

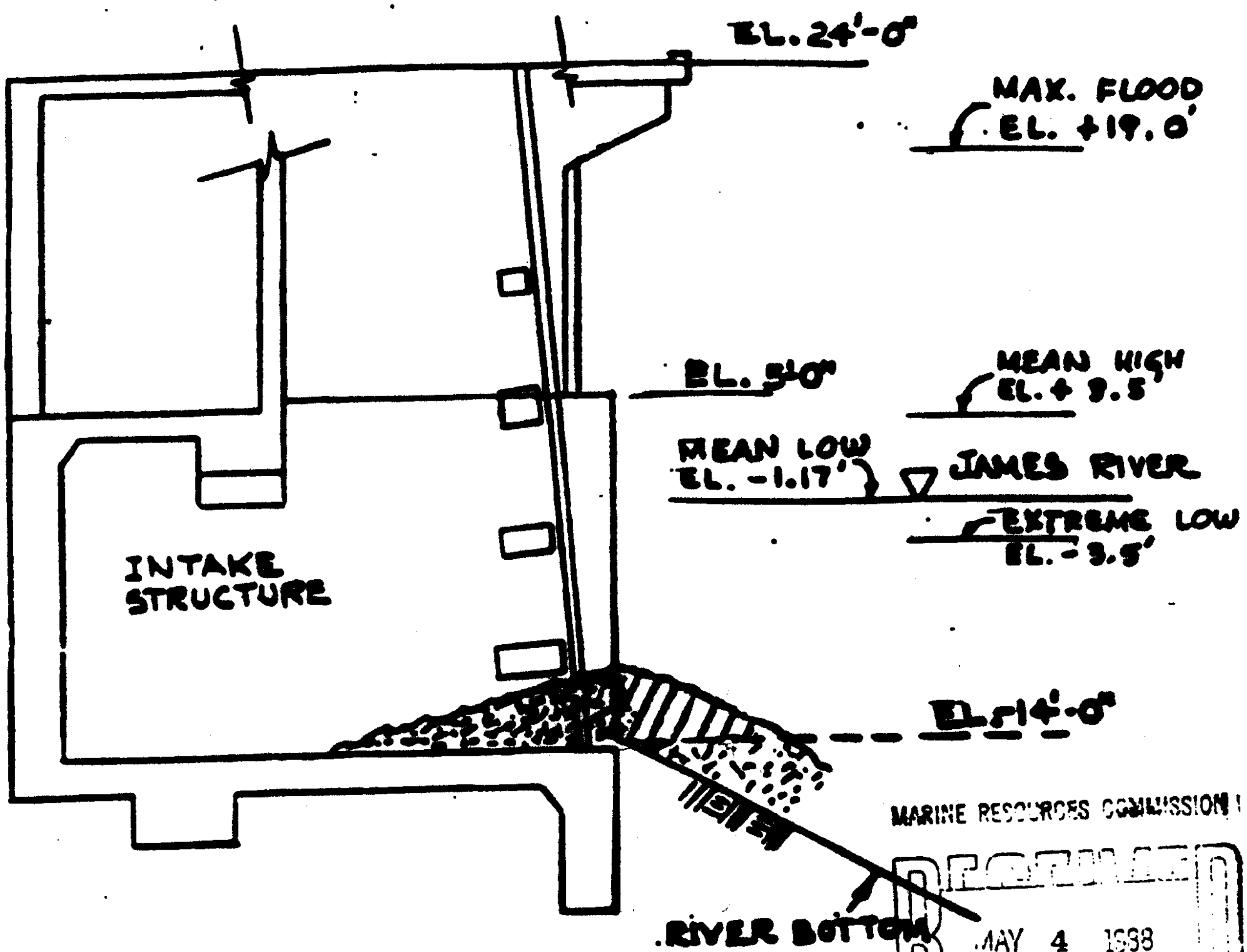


KEY PLAN

SCALE: NONE

MARINE RESOURCES COMMISSION
RECEIVED
MAY 4 1988
By

PURPOSE: TO CLEAN SILT FROM UNIT #1 INTAKE SYSTEM DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929 ADJACENT PROPERTY OWNERS: THIS PROJECT INVOLVES MAINTENANCE TO AN EXISTING FACILITY ON AND ADJACENT TO VIRGINIA POWER COMPANY PROPERTY	COMMERCIAL PROJECT APPLICATION BY: VIRGINIA ELECTRIC AND POWER COMPANY P.O. BOX 26666 RICHMOND, VIRGINIA 23261	MAINTENANCE DREDGING: UNIT #1 COOLING WATER INTAKE STRUCTURE IN JAMES RIVER NEAR CHESTER CHESTERFIELD COUNTY, VIRGINIA SHEET 1 OF 5 DATE: 2/24/88



MARINE RESOURCES COMMISSION
RECEIVED
MAY 4 1988
By

SECTION (A)
SCALE: 3/32"=1'-0"

NOTE:

10 CU. YARDS OF SILTY SAND WILL BE DREDGED BY EITHER HYDRAULICALLY OR BY CLAMSHELL/DRAGLINE METHOD AND PLACED IN THE DISPOSAL AREA.
THIS PROJECT IS ADJACENT TO THE JAMES RIVER SHIPPING CHANNEL.
DEPTH OF SOIL MATERIAL TO BE DREDGED VARIES FROM 0.0' TO 4.0' FROM THE BOTTOM OF THE INTAKE STRUCTURE.

PURPOSE: TO CLEAN SILT FROM UNIT #1 INTAKE SYSTEM DATUM: NATIONAL GEODETIC VERTICAL DATUM OF 1929 ADJACENT PROPERTY OWNERS: THIS PROJECT INVOLVES MAINTENANCE TO AN EXISTING FACILITY ON AND ADJACENT TO VIRGINIA POWER COMPANY PROPERTY	COMMERCIAL PROJECT APPLICATION BY: VIRGINIA ELECTRIC AND POWER COMPANY P.O. BOX 26666 RICHMOND, VIRGINIA 23261	MAINTENANCE DREDGING: UNIT #1 COOLING WATER INTAKE STRUCTURE IN JAMES RIVER NEAR CHESTER CHESTERFIELD COUNTY, VIRGINIA SHEET 5 OF 5 DATE: 2/24/88

Appendix D: VPDES Permit No. VA00004146 -

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Permit No. VA0004146

Effective Date: October 01, 2016
Expiration Date: September 30, 2021

AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA POLLUTION DISCHARGE ELIMINATION SYSTEM AND THE VIRGINIA STATE WATER CONTROL LAW

In compliance with the provisions of the Clean Water Act as amended and pursuant to the State Water Control Law and regulations adopted pursuant thereto, the following owner is authorized to discharge in accordance with the information submitted with the permit application, and with this permit cover page, and Parts I and II of this permit, as set forth herein.

OWNER:	Virginia Electric and Power Company
FACILITY NAME:	Dominion Chesterfield Power Station
COUNTY:	Chesterfield
FACILITY LOCATION:	500 Coxendale Road

The owner is authorized to discharge to the following receiving stream:

STREAM:	James River
RIVER BASIN:	James River
RIVER SUBBASIN:	James River (Lower)
SECTION:	1
CLASS:	II
SPECIAL STANDARDS:	bb

Deputy Regional Director, Piedmont Regional Office

23 SEPTEMBER 2016

Date

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning with the permit's effective date and lasting until the permit's expiration date the permittee is authorized to discharge from outfall serial number 001 – Condenser Cooling Water from Units 7 and 8.

a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	Continuous	Calculated
(005) Total Residual Chlorine (µg/L) (2)	22	NA	NA	32	1 per Week	Grab(3)
(078) Temperature (ºF) (4)	NA	NA	NA	NL	Continuous	Measured
(082) Heat Rejected (BTU/Hour)	Heat rejected shall not exceed a maximum of $11.3 * 10^8$				Continuous(1)	Recorded(1)

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

(1) The heat rejected calculation requires the following information: The gross turbine-generator loading and the condenser backpressure. These values are continually measured and recorded.

(2) Also see Part I.C.4.

(3) While chlorinating.

(4) The maximum unit discharge temperature from any of the contributing units shall be reported. The unit discharge temperatures from all units shall be continuously recorded utilizing an existing electronic data storage system (which cannot be calibrated to a NIST reference thermometer).

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

c. Effluent samples shall be collected downstream from the point of dechlorination.

d. When Part I.A.2 is effective, process wastewater from internal Outfall 101 may be discharged through Outfall 001.

e. Sampling for the parameters listed above may take place prior to commingling with treated process wastewater from internal Outfall 101.

2. During the period beginning with the commencement of drawdown at the Upper Ash Pond (UAP) or Lower Ash Pond (LAP), whichever occurs first, and lasting until completion of dewatering activities, or the permit's expiration date, whichever occurs sooner, the permittee is authorized to discharge from outfall serial number 101 – UAP and LAP Effluent – Closure (see Part I.C.24 for the definition of Closure).

 a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM		FREQUENCY(3)	SAMPLE TYPE
(001) Flow (MGD)	NL		NA	NA	5.0		Continuous	Measured
(002) pH (SU)	NA		NA	6.0	9.0		3 per Week	Grab
(004) Total Suspended Solids	30 mg/l(1)	560 Kg/d(1)	NA	NA	88 mg/l(6)	1670 Kg/d(6)	3 per Week	Grab
(005) Total Residual Chlorine (µg/L)	18		NA	NA	32		3 per Week	Grab
(007) Dissolved Oxygen (mg/L)	NA		NA	NL	NA		3 per Week	Grab
(019) Total Recoverable Copper (µg/L)	11		NA	NA	20(1)		3 per Week	4-HC
(023) Dissolved Chromium VI (µg/L)(7)	17		NA	NA	32		3 per Week	4-HC
(059) Total Organic Carbon (mg/L)	NA		NA	NA	110(1)		1 per Month	Grab
(090) Total Recoverable Molybdenum (µg/L)	NL		NA	NA	NL		1 per Month	24-HC
(137) Total Hardness (as $CaCO_3$) (mg/L)	NL		NA	NA	NL		3 per Week	4-HC
(145) Chloride (mg/L)	360(1)		NA	NA	660(1)		3 per Week	4-HC
(151) Total Recoverable Barium (µg/L)	NL		NA	NA	NL		1 per Month	24-HC
(185) Total Recoverable Nickel (µg/L)	26		NA	NA	48		3 per Week	4-HC
(186) Total Recoverable Silver (µg/L)	2.7		NA	NA	5.0		3 per Week	4-HC

(193) Total Recoverable Thallium (µg/L)	0.90	NA	NA	0.90	3 per Week	4-HC
(196) Total Recoverable Zinc (µg/L)	100(1)	NA	NA	190(1)	3 per Week	4-HC
(202) Total Recoverable Cadmium (µg/L)	1.4	NA	NA	2.6	3 per Week	4-HC
(212) Total Recoverable Arsenic (µg/L)	240(1)	NA	NA	440(1)	3 per Week	4-HC
(232) Total Recoverable Chromium III (µg/L)(7)	100(1)	NA	NA	190(1)	3 per Week	4-HC
(233) Total Recoverable Lead (µg/L)	17	NA	NA	31	3 per Week	4-HC
(235) Total Recoverable Mercury (µg/L)	1.2	NA	NA	2.2	3 per Week	Grab
(237) Total Recoverable Cobalt (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(257) Total Petroleum Hydrocarbons (TPH) (mg/L)(4) (5)	NA	NA	NA	NL	1 per Year	Grab
(361) Total Recoverable Iron (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(372) Total Recoverable Boron (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(408) Total Recoverable Selenium (µg/L)	7.7	NA	NA	14	3 per Week	4-HC
(409) Total Recoverable Vanadium (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(410) Total Recoverable Aluminum (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(500) Oil and Grease (mg/L)	15	NA	NA	20(1)	3 per Week	Grab
(704) WET Limitation, *Ceriodaphnia dubia* (NOAEC) (2)	NA	NA	100%	NA	1 per Month	24-HC
(705) WET Limitation, *Pimephales promelas* (NOAEC) (2)	NA	NA	100%	NA	1 per Month	24-HC
(720) WET Limitation, *Ceriodaphnia dubia* (TU_c) (2)	NA	NA	NA	2.85	1 per Month	24-HC
(721) WET Limitation, *Pimephales promelas* (TU_c) (2)	NA	NA	NA	2.85	1 per Month	24-HC

(796) Total Recoverable Beryllium (µg/L)	NL	NA	NA	NL	1 per Month	24-HC
(797) Total Recoverable Antimony (µg/L)	1,300(1)	NA	NA	1,300(1)	3 per Week	4-HC

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable
"3 per Week" shall occur at least three (3) days per week with a minimum of 48 hours between sampling events. A sampling week extends Sunday through Saturday. The permittee shall receive results for parameters identified with a monitoring frequency of "3 per Week" within four business days of taking the sample. Results of the weekly sampling shall be reported to DEQ no later than the close of business Friday of the week following sample collection.   This reporting requirement does not substitute for, or alter, Part II.C concerning the monthly reporting of monitoring results with the Discharge Monitoring Report.
"1 per Month" monitoring means the composite period for parameters identified with a frequency of 1 per Month for Outfall 101 shall occur within the composite period for the WET monitoring.

(1) Limitation expressed in two significant figures.

(2) See Part I.C.17.b.

(3) See Part I.C.27 for drawdown requirements.

(4) TPH is the sum of individual gasoline range organics and diesel range organics (or TPH-GRO and TPH-DRO) to be measured by EPA SW846 Method 8015 for gasoline and diesel range organics, or by EPA SW846 Methods 8260 Extended and 8270 Extended.

(5) At least one sample shall be taken during closure activities.

(6) Limitation expressed in three significant figures.

(7) Both Chromium III and Chromium VI may be measured by the total chromium analysis. The total chromium analytical test QL shall be less than or equal to the lesser of the Chromium III or Chromium VI method QL listed in Part I.C.14.a.

If the result of the total chromium analysis is less than the analytical test QL, both Chromium III and Chromium VI can be reported as "<[QL]", where the actual analytical test QL is substituted for [QL].

If the result of the total chromium analysis is detectable, both Chromium III and Chromium VI shall be reported as the number measured.

If the result of the total chromium analysis exceeds effluent limitations for Chromium III, Chromium VI, or both, the result shall be considered a violation of the respective limitations.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

c. This facility has Total Nitrogen and Total Phosphorus calendar year load limits associated with this outfall included in the current Registration List under registration number VAN040086, enforceable under the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia.

d. See Part I.C.24 for details on when closure monitoring and limits become effective.

e. The discharge from internal Outfall 101 is authorized to discharge through Outfall 001 or 002.

f. There shall be no discharge of bottom ash or fly ash transport wastewaters generated at this facility on or after November 1, 2018. On or after November 1, 2018, any bottom ash or fly ash transport wastewaters generated at this facility prior to that date shall be regarded as legacy wastewaters, which may be discharged in accordance with the above respective Part I.A. subpart requirements for this outfall.

3. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 002 – Condenser Cooling Water from Unit 3.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	Continuous	Calculated
(005) Total Residual Chlorine (µg/L) (2)	22	NA	NA	32	1 per Week	Grab(3)
(019) Dissolved Copper (µg/L)	NL	NA	NA	NL	1 per Quarter	Grab
(078) Temperature (ºF) (4)	NA	NA	NA	NL	Continuous	Measured
(082) Heat Rejected (BTU/Hour)	Heat rejected shall not exceed a maximum of 6.52 $*10^8$				Continuous (1)	Recorded(1)

“NL” means no limitation is established. Monitoring and reporting, however, are required.
“NA” means not applicable
“1 per Quarter” means one sample taken every calendar quarter, in accordance with the following schedule: 1st Quarter (January 1 – March 31, to be reported on the Discharge Monitoring Report (DMR) due no later than April 10th); 2nd Quarter (April 1 – June 30, to be reported on the DMR due no later than July 10th); 3rd Quarter (July 1 – September 30, to be reported on the DMR due no later than October 10th); 4th Quarter (October 1 – December 31, to be reported on the DMR due no later than January 10th).

(1) The heat rejected calculation requires the following information: The gross turbine-generator loading and the condenser backpressure. These values are continually measured and recorded.

(2) Also see Part I.C.4.

(3) While chlorinating.

(4) The maximum unit discharge temperature shall be reported. The unit discharge temperature shall be continuously recorded utilizing an existing electronic data storage system (which cannot be calibrated to a NIST reference thermometer).

   b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

   c. Effluent samples shall be collected downstream from the point of dechlorination.

   d. When Part I.A.2 is effective, process wastewater from internal Outfall 101 may be discharged through Outfall 002.

   e. Sampling for the parameters listed above may take place prior to commingling with treated process wastewater from internal Outfall 101.

4. During the period beginning with the permit's effective date and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 003 – Condenser Cooling Water from Units 4, 5, and 6.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NL	NL	Continuous	Calculated
(005) Total Residual Chlorine (µg/L) (2)	11	NA	NA	16	1 per Week	Grab(3)
(078) Temperature (ºF) (4)	NA	NA	NA	NL	Continuous	Measured
(083) Heat Rejected (BTU/Hour)	Heat rejected shall not exceed a maximum of 5.55 $*10^9$				Continuous (1)	Recorded(1)

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

(1) The heat rejected calculation requires the following information: The gross turbine-generator loading and the condenser backpressure. These values are continually measured and recorded.

(2) Also see Part I.C.4.

(3) While chlorinating.

(4) The maximum unit discharge temperature from any of the contributing units shall be reported. The unit discharge temperatures from all units shall be continuously recorded utilizing an existing electronic data storage system (which cannot be calibrated to a NIST reference thermometer).

   b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

   c. Effluent samples shall be collected downstream from the point of dechlorination.

5. During the period beginning with the commencement of discharge from the Low Volume Wastewater Treatment System (LVWWTS) and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 301 – Effluent from LVWWTS.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	6.0	Continuous	Calculated
(002) pH (SU)	NA	NA	6.0	9.0	1 per Day	Grab
(004) Total Suspended Solids (TSS) (mg/L)	30(1)	NA	NA	50(1)	1 per Month	Grab
(005) Total Residual Chlorine (µg/L)	180(1)	NA	NA	180(1)	1 per Month	Grab
(019) Interim – Total Recoverable Copper (µg/L)(2)	NL	NA	NA	NL	1 per Month	24-HC
(019) Final – Total Recoverable Copper (µg/L)(2)	72	NA	NA	72	1 per Month	24-HC
(039) Ammonia as N (kg/d)	NA	NA	NA	235 kg/d	1 per Week	Grab
(145) Interim – Chloride (mg/L)(2)	NL	NA	NA	NL	1 per Month	24-HC
(145) Final – Chloride (mg/L)(2)	3100(1)	NA	NA	3100(1)	1 per Month	24-HC
(185) Interim – Total Recoverable Nickel (µg/L)(2)	NL	NA	NA	NL	1 per Month	24-HC
(185) Final – Total Recoverable Nickel (µg/L)(2)	230(1)	NA	NA	230(1)	1 per Month	24-HC
(196) Interim – Total Recoverable Zinc (µg/L)(2)	NL	NA	NA	NL	1 per Month	24-HC
(196) Final – Total Recoverable Zinc (µg/L)(2)	900(1)	NA	NA	900(1)	1 per Month	24-HC
(349) Heptachlor (µg/L)	NL	NA	NA	NL	1 per 6 Months	24-HC
(500) Oil and Grease (mg/L)	15	NA	NA	20(1)	1 per Month	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable
"24-HC" means 24 hour composite sample.
"1 per 6 Months" means one sample collected every calendar semiannual period in accordance with the following schedule: January 1 through June 30 to be reported on the DMR due July 10^{th} and July 1 through December 31 to be reported on the DMR due January 10^{th}.

(1) Limitation expressed in two significant figures.

(2) See Part I.B.1 for details regarding the compliance schedule.

b. No discharge of fly ash transport water or bottom ash transport water is permitted from this outfall. Transport water does not include low volume, short duration discharges of wastewater from minor leaks (e.g., leaks from valve packing, pipe flanges, or piping) or minor maintenance events (e.g., replacement of valves or pipe sections).

c. See Part I.C.25 regarding commencement of discharge.

d. Discharge from this outfall is prohibited when the daily flow of Outfall 003 is less than 57.28 MGD.

e. This facility has Total Nitrogen and Total Phosphorus calendar year load limits associated with wastestreams that will be relocated to this outfall and are included in the current Registration List under Registration Number VAN040086, enforceable under the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia.

6. During the period beginning with the commencement of discharge from Outfall 301 and lasting until the permit's expiration, the permittee is authorized to discharge from outfall serial number 302 – Effluent from the flue gas desulfurization wastewater treatment plant (FGD WWTP).

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM		FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL		NA	NA	NL		1 per Day	Calculated
(002) pH (SU)	NA		NA	NL	NL		1 per Month	Grab
(004) Total Suspended Solids	30 mg/l(2)	12 Kg/d(3) 34 Kg/d(4)	NA	NA	100 mg/l(3)	42 Kg/d(3) 114 Kg/d(4)	1 per Week	Grab
(212) Interim - Total Recoverable Arsenic (µg/L)	NL		NA	NA	NL		1 per Month	2G/24–HC
(212) Final - Total Recoverable Arsenic (µg/L)(1)	8		NA	NA	11		1 per Week	24–HC
(235) Interim - Total Recoverable Mercury (ng/L)	NL		NA	NA	NL		1 per Month	Grab
(235) Final - Total Recoverable Mercury (ng/L)(1)	356		NA	NA	788		1 per Week	Grab
(389) Interim - Nitrate/Nitrite as N (mg/L)	NL		NA	NA	NL		1 per Month	2G/24–HC
(389) Final - Nitrate/Nitrite as N (mg/L)(1)	4.4		NA	NA	17		1 per Week	24-HC
(408) Interim - Total Recoverable Selenium (µg/L)	NL		NA	NA	NL		1 per Month	2G/24–HC
(408) Final - Total Recoverable Selenium (µg/L)(1)	12		NA	NA	23		1 per Week	24–HC
(500) Oil and Grease (mg/L)	15		NA	NA	20(2)		1 per Week	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

"24-HC" means 24 hour composite sample.
"2G/24-HC" means two flow proportioned grab samples collected with a minimum of 8 hours between the two samples within a 24 hour period.

(1) See Part I.B.2 for details regarding the compliance schedule.

(2) Limitation expressed in two significant figures.

(3) Limitation expressed in three significant figures and is applicable if combustion residual leachate is separately treated and discharged to Outfall 301.

(4) Limitation expressed in three significant figures and is applicable if combustion residual leachate from the Fossil Fuel Combustion Product (FFCP) Management Facility is directed to the FGD WWTP for treatment and discharge through Outfall 302.

7. During the period beginning with the commencement of discharge from Outfall 301 and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 303 – Effluent from Metal Cleaning Waste Treatment Basin.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	1 per Day	Calculated
(002) pH (SU)	NA	NA	NL	NL	1 per Week	Grab
(004) Total Suspended Solids (mg/L)	30(1)	NA	NA	100(2)	1 per Week	Grab
(019) Total Recoverable Copper (mg/L)	1.0	NA	NA	1.0	1 per Week	Grab
(031) Total Recoverable Iron (mg/L)	1.0	NA	NA	1.0	1 per Week	Grab
(500) Oil and Grease (mg/L)	15	NA	NA	20(1)	1 per Week	Grab

“NL” means no limitation is established. Monitoring and reporting, however, are required.
“NA” means not applicable

(1) Limitation expressed in two significant figures.

(2) Limitation expressed in three significant figures.

8. During the period beginning with the commencement of discharge from Outfall 301 and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 304 – Combustion residual leachate from the Fossil Fuel Combustion Product (FFCP) Management Facility.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	1 per Day	Calculated
(002) pH (SU)	NA	NA	NL	NL	1 per Week	Grab
(004) Interim – Total Suspended Solids (mg/L)(2)	NL	NA	NA	NL	1 per Month	Grab
(004) Final – Total Suspended Solids (mg/L)(2)	30 (1)	NA	NA	100(3)	1 per Week	Grab
(212) Interim – Total Recoverable Arsenic (µg/L)(2)	NL	NA	NA	NL	1 per Month	Grab
(212) Final – Total Recoverable Arsenic (µg/L)(2)	8	NA	NA	11	1 per Week	Grab
(235) Interim – Total Recoverable Mercury (ng/L)(2)	NL	NA	NA	NL	1 per Month	Grab
(235) Final – Total Recoverable Mercury (ng/L)(2)	356	NA	NA	788	1 per Week	Grab
(500) Interim – Oil and Grease (mg/L)(2)	NL	NA	NA	NL	1 per Month	Grab
(500) Final – Oil and Grease (mg/L)(2)	15	NA	NA	20(1)	1 per Week	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

(1) Limitation expressed in two significant figures.

(2) See Part I.B.3 for details regarding the compliance schedule.

(3) Limitation expressed in three significant figures.

9. During the period beginning with the commencement of discharge from the Coal Pile Runoff Metals Treatment System and lasting until the permit's expiration date, the permittee is authorized to discharge from outfall serial number 305 – Coal Pile Runoff Metals Treatment System.

   a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	1 per Day	Calculated
(004) Total Suspended Solids (mg/L)	50(1)	NA	NA	50(1)	1 per Week	Grab

“NL” means no limitation is established. Monitoring and reporting, however, are required.
“NA” means not applicable

(1) Limitation expressed in two significant figures

(2) Commencement of discharge does not include testing and commissioning of the Coal Pile Runoff Metals Treatment System. The permittee shall notify DEQ within 72 hours of the commencement of discharge of the Coal Pile Runoff Metals Treatment System.

10. During the period beginning with the permit's effective date and lasting until drawdown begins or the permit's expiration date, whichever occurs sooner, the permittee is authorized to discharge from outfall serial number 004 – LAP Effluent – Pre-Drawdown.

    a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	2 per Month	Calculated
(002) pH (SU)	NA	NA	6.0	9.0	2 per Month	Grab
(004) Total Suspended Solids (mg/L)	30[1] | 1200 Kg/d[1,5]	NA	NA	88 | 3400 Kg/d[1,5]	2 per Month	Grab
(007) Dissolved Oxygen (mg/L)	NA	NA	NL	NA	1 per Month	Grab
(039) Ammonia as N (kg/d)	NA	NA	NA	235	1 per Week	Grab
(039) Interim - Ammonia as N (mg/L) [4]	13	NA	NA	19	1 per Week	Grab
(039) Final - Ammonia as N (mg/L) [4]	0.61	NA	NA	0.80	2 per Month	24-HC
(059) Total Organic Carbon (mg/L)	NA	NA	NA	110[1]	1 per Month	Grab
(193) Interim - Total Recoverable Thallium (µg/L) [4]	NL	NA	NA	NL	2 per Month	Grab
(193) Final - Total Recoverable Thallium (µg/L) [4]	0.47	NA	NA	0.47	2 per Month	Grab
(257) Total Petroleum Hydrocarbons (TPH)[3]	NA	NA	NA	NL	1 per Year	Grab
(408) Interim - Total Recoverable Selenium (µg/L) [4]	NL	NA	NA	NL	2 per Month	Grab
(408) Final - Total Recoverable Selenium (µg/L) [4]	5.9	NA	NA	7.3	2 per Month	Grab

(500) Oil and Grease (mg/L)	15	NA	NA	20(1)	2 per Month	Grab
(720) Interim – Chronic WET Limitation, *Ceriodaphnia dubia* (TU_c) (2)(4)	NA	NA	NA	50	1 per Quarter	24-HC
(720) Final - Chronic WET Limitation, *Ceriodaphnia dubia* (TU_c) (2)(4)	NA	NA	NA	1.36	1 per Quarter	24-HC

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable
"24-HC" means 24 hour composite sample.
"1 per Quarter" means one sample taken every calendar quarter, in accordance with the following schedule: 1st Quarter (January 1 – March 31, to be reported on the Discharge Monitoring Report (DMR) due no later than April 10th); 2nd Quarter (April 1 – June 30, to be reported on the DMR due no later than July 10th); 3rd Quarter (July 1 – September 30, to be reported on the DMR due no later than October 10th); 4th Quarter (October 1 – December 31, to be reported on the DMR due no later than January 10th).
"1 per Year" means one sample taken every complete calendar year and reported as part of the DMR due no later than January 10th of the subsequent year.

(1) Limitation expressed in two significant figures.

(2) See Special Condition I.C.17.e.

(3) TPH is the sum of individual gasoline range organics and diesel range organics (or TPH-GRO and TPH-DRO) to be measured by EPA SW846 Method 8015 for gasoline and diesel range organics, or by EPA SW846 Methods 8260 Extended and 8270 Extended.

(4) See Part I.B.4 for details regarding the compliance schedule.

(5) Effective date for loading limits is November 1, 2018.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

c. This facility has Total Nitrogen and Total Phosphorus calendar year load limits associated with this outfall included in the current Registration List under registration number VAN040086, enforceable under the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia.

d. See Part I.C.24 for discharge notification requirements and a definition of drawdown.

e. There shall be no discharge of bottom ash or fly ash transport wastewaters generated at this facility on or after November 1, 2018. On or after November 1, 2018, any bottom ash or fly ash transport wastewaters generated at this facility prior to that date shall be regarded as legacy wastewaters, which may be discharged in accordance with the above respective Part I.A. subpart requirements for this outfall.

11. During the period beginning with the permit's effective date and lasting until the commencement of discharge from Outfall 301 or the permit's expiration date, whichever occurs sooner, the permittee is authorized to discharge from outfall serial number 401 – Effluent from Metal Cleaning Waste Treatment Basin.

    a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY AVERAGE	WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM	FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL	NA	NA	NL	1 per Day	Calculated
(002) pH (SU)	NA	NA	NL	NL	1 per Week	Grab
(004) Total Suspended Solids (mg/L)	30(1)	NA	NA	100(2)	1 per Week	Grab
(019) Total Recoverable Copper (mg/L)	1.0	NA	NA	1.0	1 per Week	Grab
(031) Total Recoverable Iron (mg/L)	1.0	NA	NA	1.0	1 per Week	Grab
(500) Oil and Grease (mg/L)	15	NA	NA	20(1)	1 per Week	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

(1) Limitation expressed in two significant figures.

(2) Limitation expressed in three significant figures.

b. Upon commencement of discharge from Outfall 301, discharge from internal Outfall 401 will convert to internal Outfall 303.

12. During the period beginning with the permit's effective date and lasting until completion of the Compliance Schedule detailed in Part I.B or commencement of discharge from Outfall 301, whichever occurs sooner, the permittee is authorized to discharge from outfall serial number 402 – Effluent from the FGD WWTP.

a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM		FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL		NA	NA	NL		1 per Day	Calculated
(002) pH (SU)	NA		NA	NL	NL		1 per Week	Grab
(004) Total Suspended Solids	30 mg/l(2)	12 Kg/d(2)	NA	NA	100 mg/l(3)	42 Kg/d(3)	1 per Week	Grab
(212) Interim - Total Recoverable Arsenic (µg/L) (1)	NL		NA	NA	NL		1 per Month	2G/24-HC
(212) Final - Total Recoverable Arsenic (µg/L)(1)	8		NA	NA	11		1 per Week	24-HC
(235) Interim - Total Recoverable Mercury (ng/L) (1)	NL		NA	NA	NL		1 per Month	Grab
(235) Final - Total Recoverable Mercury (ng/L) (1)	356		NA	NA	788		1 per Week	Grab
(389) Interim - Nitrate/Nitrite as N (mg/L) (1)	NL		NA	NA	NL		1 per Month	2G/24-HC
(389) Final - Nitrate/Nitrite as N (mg/L)(1)	4.4		NA	NA	17		1 per Week	24-HC
(408) Interim - Total Recoverable Selenium (µg/L) (1)	NL		NA	NA	NL		1 per Month	2G/24-HC
(408) Final - Total Recoverable Selenium (µg/L) (1)	12		NA	NA	23		1 per Week	24-HC
(500) Oil and Grease (mg/L)	15		NA	NA	20(2)		1 per Week	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable
"24-HC" means 24 hour composite sample.
"2G/24-HC" means two flow proportioned grab samples collected with a minimum of 8 hours between the two samples within a 24 hour period.

(1) See Part I.B.2 for details regarding the compliance schedule.

(2) Limitation expressed in two significant figures.

(3) Limitation expressed in three significant figures.

b. Upon commencement of discharge from Outfall 301, discharge from internal Outfall 402 will convert to internal Outfall 302.

13. During the period beginning with the permit's effective date and lasting until drawdown begins or the permit's expiration date, whichever occurs sooner, the permittee is authorized to discharge from outfall serial number 005 – UAP Effluent – Pre-Drawdown.

a. Such discharges shall be limited and monitored as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE	DAILY MINIMUM	DAILY MAXIMUM		FREQUENCY	SAMPLE TYPE
(001) Flow (MGD)	NL		NA	NA	NL		1 per Month	Calculated
(002) pH (SU)	NA		NA	6.0	9.0		1 per Month	Grab
(004) Total Suspended Solids	30 mg/l(1)	460 Kg/d(1)	NA	NA	100 mg/l(2)	1530 Kg/d(2)	1 per Month	Grab
(007) Dissolved Oxygen (mg/L)	NA		NA	NL	NA		1 per Month	Grab
(500) Oil and Grease (mg/L)	15		NA	NA	20 (1)		1 per Month	Grab

"NL" means no limitation is established. Monitoring and reporting, however, are required.
"NA" means not applicable

(1) Limitation expressed in two significant figures.

(2) Limitation expressed in three significant figures.

b. There shall be no discharge of floating solids or visible foam in other than trace amounts.

c. This facility has Total Nitrogen and Total Phosphorus calendar year load limits associated with this outfall included in the current Registration List under registration number VAN040086, enforceable under the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia.

B. COMPLIANCE SCHEDULE

1. Outfall 301 – LVWWTS - The permittee shall achieve compliance with the final limits and monitoring requirements for Total Recoverable Copper, Chloride, Total Recoverable Nickel, and Total Recoverable Zinc at Outfall 301 as specified in Part I.A.5 in this permit, in accordance with the following schedule:

a. Submit progress reports to DEQ	**Annually, after the effective date of permit reissuance.**
b. Achieve compliance with effluent limitations	**Within 4 years of the effective date of the permit reissuance**.

In accordance with the dates identified in the above schedule of compliance, the permittee shall submit to the Piedmont Regional Office either a report of progress, or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement. Monitoring for Total Recoverable Copper, Chloride, Total Recoverable Nickel, and Total Recoverable Zinc shall commence in accordance with Part 1.A.5. Final limitations and monitoring requirements shall substitute and supersede all interim limitations and monitoring requirements delineated in Parts I.A.5.a, upon completion of the Part I.B.1.b schedule of compliance period.

2. Outfalls 302 and 402 – FGD WWTP - The permittee shall achieve compliance with the final limits and monitoring requirements for Total Recoverable Arsenic, Total Recoverable Mercury, Nitrate/Nitrite as N, and Total Recoverable Selenium at Outfalls 302 and 402 as specified in Parts I.A.6 and I.A.12 in this permit, in accordance with the following schedule:

a. Submit progress reports to DEQ	**Annually, after the effective date of permit reissuance.**
b. Achieve compliance with effluent limitations	**By March 29, 2022**.

In accordance with the dates identified in the above schedule of compliance, the permittee shall submit to the Piedmont Regional Office either a report of progress, or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement. Monitoring for Total Recoverable Arsenic, Total Recoverable Mercury, Nitrate/Nitrite as N, and Total Recoverable Selenium shall commence in accordance with Parts I.A.6 and I.A.12. Final limitations and monitoring requirements shall substitute and supersede all interim limitations and monitoring requirements delineated in Parts I.A.6.a, and I.A.12.a of this permit upon completion of the Part I.B.2.b schedule of compliance period.

3. Outfall 304 – Combustion residual leachate from FFCP Management Facility - The permittee shall achieve compliance with the final limits and monitoring requirements for Total Suspended Solids, Total Recoverable Arsenic, Total Recoverable Mercury, and Oil and Grease at Outfall 304 as specified in Part I.A.8 in this permit, in accordance with the following schedule:

a. Submit progress reports to DEQ	**Annually, after the effective date of permit reissuance.**
b. Achieve compliance with effluent limitations	**Within 4 years of the effective date of the permit reissuance**.

In accordance with the dates identified in the above schedule of compliance, the permittee shall submit to the Piedmont Regional Office either a report of progress, or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement. Monitoring for Total Suspended Solids, Total Recoverable Arsenic, Total Recoverable Mercury, and Oil and Grease shall commence in accordance with Part 1.A.8. Final limitations and monitoring requirements shall substitute and supersede all interim limitations and monitoring requirements delineated in Parts I.A.8.a, upon completion of the Part I.B.3.b schedule of compliance period.

In the event the leachate is directed to the FGD WWTP for treatment and discharge through Outfall 302 as allowed in Part I.A.6.b, this compliance schedule does not apply and the discharge shall be subject to the compliance schedule in Part I.B.2.

4. Outfall 004 – LAP Effluent Pre-Drawdown - The permittee shall achieve compliance with the final limits and monitoring requirements for Ammonia as N, Total Recoverable Thallium, Total Recoverable Selenium, and Chronic WET at Outfall 004 as specified in Part I.A.10, in accordance with the following schedule:

a. Submit progress reports to DEQ	**Annually, after the effective date of permit reissuance.**
b. Achieve compliance with effluent limitations	**Within 4 years of the effective date of the permit reissuance**.

In accordance with the dates identified in the above schedule of compliance, the permittee shall submit to the Piedmont Regional Office either a report of progress, or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement. Monitoring for Ammonia as N, Total Recoverable Thallium and Total Recoverable Selenium shall commence in accordance with Part I.A.10. Final limitations and monitoring requirements shall substitute and supersede all interim limitations and monitoring requirements delineated in Parts I.A.10.a, upon completion of the Part I.B.4.b schedule of compliance period.

C. OTHER REQUIREMENTS OR SPECIAL CONDITIONS

1. <u>Notification Levels</u>
The permittee shall notify the Department as soon as they know or have reason to believe:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following notification levels:

(1) One hundred micrograms per liter (100 µg/L);

(2) Two hundred micrograms per liter (200 µg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 µg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

(3) Five (5) times the maximum concentration value reported for that pollutant in the permit application; or

(4) The level established by the Board.

b. That any activity has occurred or will occur which would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant which is not limited in this permit, if that discharge will exceed the highest of the following notification levels:

(1) Five hundred micrograms per liter (500 µg/L);

(2) One milligram per liter (1 mg/L) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application; or

(4) The level established by the Board.

2. Nutrient Reopener
The permit may be modified or, alternatively, revoked and reissued:

a. To incorporate technology-based effluent concentration limitations for nutrients in conjunction with the installation of nutrient control technology, whether by new construction, expansion or upgrade; or

b. To incorporate alternative nutrient limitations and/or monitoring requirements, should:

(1) the State Water Control Board adopt new nutrient standards for the water body receiving the discharge, including the Chesapeake Bay or its tributaries, or

(2) a future water quality regulation or statute require new or alternative nutrient control.

3. Materials Handling/Storage
Any and all product, materials, industrial wastes, and/or other wastes resulting from the purchase, sale, mining, extraction, transport, preparation, and/or storage of raw or intermediate materials, final product, by-product or wastes, shall be handled, disposed of, and/or stored in such a manner and consistent with Best Management Practices, so as not to permit a discharge of such product, materials, industrial wastes, and/or other wastes to State waters, except as expressly authorized.

4. Discharge of Chlorine in Cooling Water

a. Total residual chlorine may only be discharged from any single generating unit for more than two hours per day when the permittee demonstrates to DEQ that discharge for more than two hours is required for macroinvertebrate control. If the permittee is dechlorinating, the two hour requirement is nullified.

b. Simultaneous multi-unit chlorination is permitted.

c. Monitoring for total residual chlorine shall only be required when the permittee is chlorinating.

5. Operation and Maintenance Manual Requirement
The permittee shall maintain a current Operations and Maintenance (O&M) Manual for the treatment works that is in accordance with Virginia Pollutant Discharge Elimination System Regulations, 9VAC25-31.

The O&M Manual and subsequent revisions shall include the manual effective date and meet Part II.K.2 and Part II.K.4 Signatory Requirements of the permit. Any changes in the practices and procedures followed by the permittee shall be documented in the O&M Manual within 90 days of the effective date of the changes. The permittee shall operate the treatment works in accordance with the O&M Manual and shall make the O&M manual available to Department personnel for review during facility inspections. Within 30 days of a request by DEQ, the current O&M Manual shall be submitted to the DEQ Regional Office for review and approval.

The O&M manual shall detail the practices and procedures which will be followed to ensure compliance with the requirements of this permit. This manual shall include, but not necessarily be limited to, the following items, as appropriate:

a. Permitted outfall locations and techniques to be employed in the collection, preservation, and analysis of effluent samples taken for compliance with this permit;

b. Procedures for measuring and recording the duration and volume of treated wastewater discharged;

c. Discussion of Best Management Practices, if applicable;

d. Procedures for handling, storing, and disposing of all wastes, fluids, and pollutants characterized in Part I.C.3 that will prevent these materials from reaching state waters. List type and quantity of wastes, fluids, and pollutants (e.g. chemicals) stored in bulk at this facility;

e. Discussion of treatment works design, treatment works operation, routine preventative maintenance of units within the treatment works, critical spare parts inventory and record keeping;

f. Plan for the management and/or disposal of waste solids and residues;

g. Hours of operation and staffing requirements for the plant to ensure effective operation of the treatment works and maintain permit compliance.

h. List of facility, local and state emergency contacts; and,

i. Procedures for reporting and responding to any spills/overflows/treatment works upsets.

6. Discharge of Tank Bottom Waters
There shall be no discharge of tank bottom waters from bulk fuel oil or waste oil storage facilities.

7. Groundwater Monitoring

a. Upper Ash Pond (UAP), Lower Ash Pond (LAP), and Metals Cleaning Pond:
The permittee shall continue sampling in accordance with the groundwater monitoring plan (GWMP) dated September 2001, approved by letter dated October 5, 2001, and modification approved by letter dated November 15, 2001. Any changes to the plan must be submitted for approval to the DEQ Piedmont Regional Office. The approved plan is an enforceable part of the permit. The UAP and LAP portions of the monitoring plan shall remain in effect until such time that they are superseded by a DEQ Solid Waste program-approved plan. In the event that the UAP and LAP portions of the plan are superseded by a Solid Waste program-approved plan, the Metals Pond portion of the plan, as detailed in Appendix B of the approved GWMP, shall remain in effect as an enforceable part of the VPDES permit.

b. Metals Cleaning Pond:
No later than one year following the effective date of this permit, the permittee shall submit for approval a separate GWMP and Groundwater Quality and Risk Assessment Report addressing chloride in the groundwater adjacent to the Metals Cleaning Pond. The report shall include the following:

(1) Assessment of the source of chloride.

(2) Assessment of the spatial extent and concentration of chloride in the groundwater.

(3) Identification of both human health and environmental receptors and an assessment of the risk to each receptor.

Following DEQ review and approval of the Groundwater Quality and Risk Assessment Report, a Corrective Action Plan may be required. The plan shall be due within 180 days of being notified in writing by the Department. The plan shall set forth the steps to be taken by the permittee to ensure that the contamination source is adequately addressed pursuant to the Groundwater Quality and Risk Assessment Report. Once approved, this plan shall be incorporated into the permit by reference and become an enforceable part of this permit.

8. Closure Plan for Upper Ash Pond
By letter dated April 1, 2015, the Department of Environmental Quality approved a revised closure plan for the Upper (East) Ash Pond (also known as the New Ash Pond). The approved plan consists of a Revised Phasing Plan dated April 2015, a Revised Closure Plan dated September 2003, a Revised Phasing Plan dated May 2003, and a Revised Construction Quality Assurance Plan, dated May 2003. This plan shall remain in effect and be an enforceable part of this permit until such time that it is superseded by a solid waste permit in accordance with the Commonwealth's Solid Waste program (9VAC20-81-10 et seq.). If necessary, prior to issuance of a solid waste permit, the closure plan shall be updated as needed to comply with EPA's Final Rule for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities.

9. <u>Discharge of Polychlorinated Biphenyl Compounds</u>
   There shall be no discharge of polychlorinated biphenyl compounds (PCBs) such as those commonly used for transformer fluid. Compliance with this requirement will be determined using EPA Method 608.

10. <u>Low Level PCB Sampling for Internal Outfall 301</u>
    The permittee shall monitor the effluent at Internal Outfall 301 for Polychlorinated Biphenyls (PCBs). DEQ will use these data for development (*or implementation*) of a PCB TMDL for the Lower James River. The permittee shall conduct the sampling and analysis in accordance with the requirements specified below.

    At a minimum:

    a. Monitoring and analysis shall be conducted in accordance with EPA Method 1668 revisions A, B, C or other revisions issued by EPA prior to final promulgation, congener specific results as specified in the DEQ PCB Point Source Monitoring Guidance (GM09-2001). It is the responsibility of the permittee to ensure that proper QA/QC protocols are followed during the sample gathering and analytical procedures.

    b. The permittee shall collect a minimum of 2 wet weather samples according to the PCB Point Source Guidance, Appendix C (Sample Collection Methods for Effluent and Storm Water). These samples shall be taken at Internal Outfall 301 during the term of the permit. Alternatively, samples previously collected and analyzed with Method 1668 may be used in satisfying the total number of samples required even if the collection occurred prior to the current permit term.

    c. The sampling protocol shall be submitted to DEQ-Piedmont Regional Office for review and approval at least 30 days before the commencement of discharge from Outfall 301.

    d. The data shall be submitted to the DEQ-Piedmont Regional Office no later than one (1) year from the commencement of discharge at Outfall 301 according to the DEQ PCB Point Source Guidance, Appendix E (Reporting Requirements for Analytical (PCB) Data Generated Using EPA Method 1668). The submittal shall include the unadjusted and appropriately quantified individual PCB congener analytical results. Additionally, laboratory and field QA/QC documentation and results should be reported. Total PCBs are to be computed as the summation of the reported, quantified congeners.

    e. If the results of this monitoring indicate actual or potential exceedance of the water quality criterion or the Waste Load Allocation specified in the approved TMDL, the permittee shall submit to the DEQ-Piedmont Regional Office within 180 days of notification by DEQ for review and approval a Pollutant Minimization Plan (PMP) designed to locate and reduce sources of PCBs in the collection system. A component of the plan may include an evaluation of the PCB congener distribution in the initial source intake water to determine the net contributions of PCBs introduced to the treatment works.

11. <u>Discharge of Debris from Trash Racks</u>
    Debris collected on the intake trash racks shall not be returned to the waterway.

12. <u>Discharges of Uncontaminated River Water</u>
    The following discharges shall not contain any process wastewater:

    a. The occasional pumping of river water from the intake screen wells to permit access for maintenance.

    b. Discharges associated with the routine testing of the fire fighting system involving withdrawal and direct return of water from the river.

    c. The discharge of river water from one sump pump each in the condenser cooling water intake pump rooms for Units 7 and 8.

    d. Intake screen backwash.

    e. Raw water make-up to the clarifier discharged prior to use.

    f. Service water (untreated river water) discharged prior to use in fly ash conditioning.

13. Licensed Operator Requirement
The permittee shall employ or contract at least one Class 2 licensed wastewater works operator for the facility. The license shall be issued in accordance with Title 54.1 of the Code of Virginia and the regulations for the Board for Waterworks and Wastewater Works Operators and Onsite Sewage System Professionals. The permittee shall notify the Department in writing whenever he is not complying, or has grounds for anticipating he will not comply with this requirement. The notification shall include a statement of reasons and a prompt schedule for achieving compliance.

14. Compliance Reporting

a. The quantification levels (QL) shall be less than or equal to the following concentrations:

Effluent Characteristic*	Quantification Level
Ammonia as N	0.20 mg/L
Chloride	10 mg/L
Nitrate/Nitrite as N	0.5 mg/L
Oil & Grease	5.0 mg/L
Total Petroleum Hydrocarbons	0.5 mg/L
Total Recoverable Antimony	5.0 µg/L
Total Recoverable Arsenic	5.0 µg/L
Total Recoverable Cadmium	1.0 µg/L
Total Recoverable Chromium III	5.0 µg/L
Dissolved Chromium VI	5.0 µg/L
Total Recoverable Copper	5.0 µg/L
Total Recoverable Iron	250 µg/L
Total Recoverable Lead	5.0 µg/L
Total Recoverable Mercury	0.1 µg/L
Total Recoverable Nickel	5.0 µg/L
Total Recoverable Selenium	5.0 µg/L
Total Recoverable Silver	0.4 µg/L
Total Recoverable Thallium	0.47 µg/L
Total Recoverable Zinc	25 µg/L
Total Residual Chlorine	0.10 mg/L
TSS	1.0 mg/L

The QL is defined as the lowest concentration used to calibrate a measurement system in accordance with the procedures published for the method. It is the responsibility of the permittee to ensure that proper quality assurance/quality control (QA/QC) protocols are followed during the sampling and analytical procedures. QA/QC information shall be documented to confirm that appropriate analytical procedures have been used and the required QLs have been attained. The permittee shall use any method in accordance with Part II.A of this permit.

b. **Monthly Average:** Compliance with the monthly average limitations and/or reporting requirements for the parameters listed in subsection a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the QL listed in a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as it is reported. An arithmetic average shall be calculated using all reported data for the month, including the defined zeros. This arithmetic average shall be reported on the Discharge Monitoring Report (DMR) as calculated. If all data are below the QL used for the analysis, then the average shall be reported as "<QL". If reporting for quantity is required on the DMR and the reported monthly average concentration is <QL, then report "<QL" for the quantity. Otherwise use the reported concentration data (including the defined zeros) and flow data for each sample day to determine the daily quantity and report the monthly average of the calculated daily quantities.

Daily Maximum: Compliance with the daily maximum limitations and/or reporting requirements for the parameters listed in subsection a. of this permit condition shall be determined as follows: All concentration data below the QL used for the analysis (QL must be less than or equal to the

QL listed in a. above) shall be treated as zero. All concentration data equal to or above the QL used for the analysis shall be treated as reported. An arithmetic average shall be calculated using all reported data, including the defined zeros, collected within each day during the reporting month. The maximum value of these daily averages thus determined shall be reported on the DMR as the Daily Maximum. If all data are below the QL used for the analysis, then the maximum value of the daily averages shall be reported as "<QL". If reporting for quantity is required on the DMR and the reported daily maximum is <QL, then report "<QL" for the quantity. Otherwise use the reported daily average concentrations (including the defined zeros) and corresponding daily flows to determine daily average quantities and report the maximum of the daily average quantities during the reporting month.

Single Datum - Any single datum required shall be reported as "<QL" if it is less than the QL used in the analysis (QL must be less than or equal to the QL listed in a. above). Otherwise the numerical value shall be reported.

c. **Significant Digits:** The permittee shall report at least the same number of significant digits as the permit limit for a given parameter. Regardless of the rounding convention used by the permittee (i.e., 5 always rounding up or to the nearest even number), the permittee shall use the convention consistently, and shall ensure that consulting laboratories employed by the permittee use the same convention.

15. TMDL Reopener

This permit shall be modified or alternatively revoked and reissued if any approved wasteload allocation procedure, pursuant to Section 303(d) of the Clean Water Act, imposes wasteload allocations, limits or conditions on the facility that are not consistent with the permit requirements.

16. Treatment Works Closure Plan

If the permittee plans an expansion or upgrade to replace the existing treatment works, or if facilities are permanently closed, the permittee shall submit to the DEQ Regional Office a closure plan for the existing treatment works. The plan shall address the following information as a minimum: Verification of elimination of sources and/or alternate treatment scheme; treatment, removal and final disposition of residual wastewater and solids; removal/demolition/disposal of structures, equipment, piping and appurtenances; site grading, and erosion and sediment control; restoration of site vegetation; access control; fill materials; and proposed land use (post-closure) of the site. The plan should contain proposed dates for beginning and completion of the work. The plan must be approved by the DEQ prior to implementation. Once approved, the plan shall become an enforceable part of this permit and closure shall be implemented in accordance with the approved plan. No later than 14 calendar days following closure completion, the permittee shall submit to the DEQ Piedmont Regional Office written notification of the closure completion date and a certification of closure in accordance with the approved plan.

The LAP and UAP closures are excluded from the requirements of this special condition as they will be closed in accordance with solid waste regulations. The temporary dewatering treatment system (CSWTS) discussed in Part I.C.21 is also excluded from the requirements of this special condition.

17. Whole Effluent Toxicity (WET) Testing Program

a. Outfalls 001 and 002:

(1) In accordance with the schedule in I.C.17.g(1) below, the permittee shall perform acute and chronic annual toxicity testing on Outfalls 001 and 002 using 24 hour flow-proportioned composite samples for the duration of the permit.

The acute test to use is:

48 Hour Static Acute test using *Ceriodaphnia dubia*

These acute tests shall be conducted using 5 geometric dilutions of effluent with a minimum of 4 replicates, with 5 organisms in each. The NOAEC (No Observed Adverse Effect Concentration), as determined by hypothesis testing, shall be reported. The LC_{50} should also be determined and noted on the submitted report. Tests in which the control survival is less than 90% are not acceptable.

The chronic test to use is:

Chronic 3-Brood Survival and Reproduction Static Renewal Test using *Ceriodaphnia dubia*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction. Results which cannot be quantified (i.e., a “less than” NOEC value are not acceptable, and a retest will have to be performed. A retest of a non-acceptable test must be performed during the same compliance period as the test it is replacing. Express the test NOEC as TU_c (Chronic Toxicity Units), by dividing 100/NOEC. The LC_{50} at 48 hours and the IC_{25} shall also be reported.

The permittee may provide additional samples to address data variability; these data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

(2) The test dilutions shall be able to determine compliance with the following endpoints:

(a) Acute tests:

Outfall 001 NOAEC = 100% effluent
Outfall 002 NOAEC = 100% effluent

(b) Chronic tests:

Outfall 001 NOEC $\geq$ 35% effluent equivalent to a TU_c of $\leq$2.85
Outfall 002 NOEC $\geq$ 35% effluent equivalent to a TU_c of $\leq$2.85

(3) The test data for each outfall will be evaluated statistically by DEQ for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should DEQ evaluation of the data indicate that a limit is needed, the permit may be modified or, alternatively, revoked and reissued to include a WET limit and compliance schedule for that outfall. Following written notification from DEQ of the need for including a WET limitation, the toxicity tests of Part I.C.17.a(1) for that outfall may be discontinued.

(4) The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

b. Outfall 101 – UAP and LAP Effluent – Closure – Acute and Chronic WET Limit Testing:

(1) The Whole Effluent Toxicity limitations of Part I.A.2 become effective upon commencement of closure activities as defined in Part I.C.24. The permittee shall conduct monthly tests using a composite sample comprised of hourly grabs for the period of discharge, not to exceed 24 hours. WET testing of Outfall 101 shall begin during the first full month following the initiation of discharge.

(2) WET Limits

(a) Acute tests: NOAEC = 100%.

(b) Chronic tests: NOEC $\geq$ 35% effluent, equivalent to a TU_c of ≤2.85.

(3) The acute tests to use are:

48 Hour Static Acute test using *Ceriodaphnia dubia*

48-Hour Static Acute test using *Pimephales promelas*

These single dilution acute tests are to be conducted using a minimum of 4 replicates, with 5 organisms each, for the control and 100% effluent. The NOAEC (No Observed Adverse

Effect Concentration) shall be reported as either =100% or <100% (less than 100%). The effluent will be in compliance if the survival of the test organisms in both the control and 100% effluent exposures equals or exceeds 90%. If the survival in the effluent is less than 90% and this value is significantly different from the control survival, as determined by hypothesis testing, the NOAEC is less than 100% and the effluent is not in compliance. Tests in which control survival is less than 90% are not acceptable. A retest of a non-acceptable test must be performed during the same compliance period as the .test it is replacing. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40CFR 136.3.

The chronic tests to use are:

Chronic 3-Brood Static Renewal Survival and Reproduction Test using *Ceriodaphnia dubia*

Chronic 7-Day Static Renewal Survival and Growth Test using *Pimephales promelas*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. The test endpoint (limit) must be represented by a dilution, and should be bracketed by at least one dilution above and one dilution below it. Results which cannot be determined (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. A retest of a non-acceptable test must be performed during the same compliance period as the test it is replacing. Express the test NOEC as TU_c (Chronic Toxic Units), by dividing 100/NOEC for DMR reporting. The 48 hour LC_{50} and IC_{25} should be included on the submitted test reports.

(4) One copy of each toxicity test report shall be submitted to the Piedmont Regional Office in accordance with the reporting schedule in Part I.C.17.g(4) below. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

(5) The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

(6) Frequency of Testing

Monthly testing is required as indicated in Part I.A.2 of this permit, beginning upon commencement of closure activities as defined in Part I.C.24.

c. Outfall 003 – Pre-Outfall 301 Discharge:

(1) In accordance with the schedule in Part I.C.17.g(1) below, the permittee shall perform annual acute and chronic toxicity tests of final effluent at Outfall 003 – Pre-Outfall 301 Discharge using 24 hour flow-proportioned composite samples for the duration of the permit.

The acute tests shall be:

48 Hour Static Acute test using *Ceriodaphnia dubia*

48 Hour Static Acute test using *Pimephales promelas*

These acute tests shall be conducted using 5 geometric dilutions of effluent with a minimum of 4 replicates, with 5 organisms in each. The NOAEC (No Observed Adverse Effect Concentration), as determined by hypothesis testing, shall be reported. The LC_{50} should also be determined and noted on the submitted report. Tests in which the control survival is less than 90% are not acceptable.

The chronic tests shall be:

Chronic 3-Brood Survival and Reproduction Static Renewal Test using *Ceriodaphnia dubia*

Chronic 7-day Survival and Growth Static Renewal test using *Pimephales promelas*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction. Results which cannot be quantified (i.e., a “less than” NOEC value) are not acceptable, and a retest will have to be performed. A retest of a non-acceptable test must be performed during the same compliance period as the test it is replacing. Express the test NOEC as TU_c (Chronic Toxicity Units), by dividing 100/NOEC. The LC_{50} at 48 hours and the IC_{25} shall also be reported.

(2) The test dilutions shall be able to determine compliance with the following endpoints:

(a) Acute tests: NOAEC = 100% effluent

(b) Chronic tests: NOEC $\geq$ 69% effluent equivalent to a TU_c of $\leq$1.44

(3) The permittee may provide additional samples to address data variability. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40CFR 136.3.

(4) The test data for each outfall will be evaluated statistically by DEQ for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should DEQ evaluation of the data indicate that a limit is needed, the permit may be modified or, alternatively, revoked and reissued to include a WET limit and compliance schedule for that outfall. Following written notification from DEQ of the need for including a WET limitation, the toxicity tests of Part I.C.17.c(1) for that outfall may be discontinued.

(5) The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

If evaluation of the data indicates that a limitation is not needed, annual acute and chronic testing shall commence in accordance with the remaining schedule in I.C.17.g(1) below.

d. Outfall 003 – Outfall 301 Discharge:
Final WET testing requirements for Outfall 003 (Outfall 301 Discharge) shall become effective upon commencement of discharge from Outfall 301. The WET testing shall be conducted as described above in Part I.C.17.c except that the testing shall be conducted in accordance with the schedule in Part I.C.17.g(2) below.

e. Outfall 004 – Pre-Drawdown - Chronic WET Limit Testing:

(1) The quarterly chronic tests required in Part I.A.10 of this permit to meet the interim limit of a TU_c of $\leq$50 and final limit of an NOEC ≥ 73%, equivalent to TU_c of $\leq$1.36 shall be:

Chronic 3-Brood Static Renewal Survival and Reproduction Tests using *Ceriodaphnia dubia*

These tests shall be conducted, using 24 hour flow-proportioned composite samples, in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction. The test endpoint (limit) shall be represented by a dilution, and at least one dilution above and one dilution below it. Results which cannot be determined (i.e., a “less than” NOEC value) are not acceptable, and a retest shall be performed. A retest of a non-acceptable test must be performed during the same compliance period as the test it is replacing. For reporting on the DMR, the NOEC is to be expressed in Chronic Toxicity Units (TU_C), which is obtained by dividing 100 by the test NOEC. The LC_{50} at 48 hours and the IC_{25} shall also be reported.

(2) One copy of each toxicity test report shall be submitted to the Piedmont Regional Office in accordance with the reporting schedule in Part I.C.17.g(3) below. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

(3) The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

(4) Upon the commencement of discharge from the LAP to Outfall 101, WET testing at Outfall 004 may be discontinued.

f. Outfall 005 – Pre-Drawdown – Acute and Chronic WET Testing:

(1) In accordance with the schedule in Part I.C.17.g(1) below, the permittee shall perform annual acute and chronic toxicity tests of final effluent at Outfall 005 – Pre-Drawdown. Grab samples shall be taken for this discharge during Pre-Drawdown activities. Chronic tests are required only if discharge occurs over five consecutive days. The permittee shall maintain a record of the dates that a discharge occurs at Outfall 005 and provide it to the Department upon request.

The acute tests shall be:

48 Hour Static Acute test using *Ceriodaphnia dubia*

48 Hour Static Acute test using *Pimephales promelas*

These acute tests shall be conducted using 5 geometric dilutions of effluent with a minimum of 4 replicates, with 5 organisms in each. The NOAEC (No Observed Adverse Effect Concentration), as determined by hypothesis testing, shall be reported. The LC_{50} should also be determined and noted on the submitted report. Tests in which the control survival is less than 90% are not acceptable.

The chronic tests shall be:

Chronic 3-Brood Survival and Reproduction Static Renewal Test using *Ceriodaphnia dubia*

Chronic 7-day Survival and Growth Static Renewal test using *Pimephales promelas*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. The LC_{50} at 48 hours and the IC_{25} shall also be reported. Results which cannot be quantified (i.e., a “less than” NOEC value) are not acceptable, and a retest shall be performed. The retest of a nonacceptable test shall be performed during the same compliance period as the test it is replacing. Express the test LC_{50} as TU_a (Acute Toxicity Units), by dividing $100/LC_{50}$. Express the test NOEC as TU_c (Chronic Toxicity Units), by dividing 100/NOEC. The LC_{50} at 48 hours and the IC_{25} shall also be reported.

(2) The test dilutions shall be able to determine compliance with the following endpoints:

(a) Acute tests: NOAEC = 100%.

(b) Chronic tests: NOEC $\geq$ 35% effluent, equivalent to a TU_c of ≤2.85.

(3) The permittee may provide additional samples to address data variability. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40CFR 136.3

(4) The test data will be evaluated statistically by DEQ for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should DEQ evaluation of the data indicate that a limit is needed, the permit may be modified or, alternatively, revoked and reissued to include a WET limit and compliance schedule. Following written notification from DEQ of the need for including a WET limitation, the toxicity tests of Part I.C.17.f(1) may be discontinued.

(5) The permit may be modified or revoked and reissued to include pollutant specific limits should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

If evaluation of the data indicates that a limitation is not needed, annual acute and chronic testing shall commence in accordance with the remaining schedule in Part I.C.17.g(1) below.

g. Reporting Schedule:

(1) The permittee shall report the results of the toxicity testing on Outfalls 001, 002, 003 - Pre-LVWWTS Discharge, and 005 – Pre-Drawdown as appropriate, and supply to the Piedmont Regional Office one copy of each of the toxicity test reports specified in this WET Monitoring Program. The compliance period in which each test shall be performed is established as annual (consecutive 12 months) periods based on the effective date of the permit. Reports shall be submitted no later than the 10th of the month following the end of each compliance period.

Compliance Period	Monitoring Period	Report Due
1st Annual	October 1, 2016 - September 30, 2017	October 10, 2017
2nd Annual	October 1, 2017- September 30, 2018	October 10, 2018
3rd Annual	October 1, 2018- September 30, 2019	October 10, 2019
4th Annual	October 1, 2019- September 30, 2020	October 10, 2020

(2) WET testing for Outfall 003 - LVWWTS Discharge shall begin upon the commencement of discharge from the LVWWTS in accordance with the schedule below. The permittee shall report the results of the toxicity testing on Outfalls 003 - LVWWTS Discharge, and supply to the Piedmont Regional Office one copy of each of the toxicity test reports specified in this WET Monitoring Program. The compliance period in which each test shall be performed is established as calendar quarters for the first 10 quarters. Reports shall be submitted no later than the 10th of the month following the end of each compliance period.

Compliance Period	Monitoring Period	Report Due
1st Quarterly	October 1 – December 31, 2016	January 10, 2017
2nd Quarterly	January 1 – March 31, 2017	April 10, 2017
3rd Quarterly	April 1 – June 30, 2017	July 10, 2017
4th Quarterly	July 1 – September 30, 2017	October 10, 2017
5th Quarterly	October 1 – December 31, 2017	January 10, 2018
6th Quarterly	January 1 – March 31, 2018	April 10, 2018
7th Quarterly	April 1 – June 30, 2018	July 10, 2018
8th Quarterly	July 1 – September 30, 2018	October 10, 2018
9th Quarterly	October 1 – December 31, 2018	January 10, 2019
10th Quarterly	January 1 – March 31, 2019	April 10, 2019
1st Annual	April 1, 2019 – March 31, 2020	April 10, 2020
2nd Annual	April 1, 2020 – March 31, 2021	April 10, 2021

(3) Reporting for the Outfall 004 – Pre-Drawdown WET limitations shall be conducted quarterly and reported on the DMR as required in Part I.A.10 of this permit. One copy of the toxicity test report associated with each test, shall be submitted in hard copy or by email concurrent with the DMR on which the test result is reported.

(4) Reporting for the Outfall 101 WET limitations shall be conducted monthly and reported on the DMR as required in Part I.A.2 of this permit. Monthly monitoring will continue until dewatering activities associated with closure activities are completed. One copy of the

toxicity test report associated with each test, shall be submitted in hard copy or by email concurrent with the DMR on which the test result is reported.

18. Oil Storage Groundwater Monitoring Reopener
As this facility currently manages ground water in the bulk fuel oil storage area in accordance with 9 VAC 25-91-10 et seq., Facility and Aboveground Storage Tank (AST) Regulation, this permit does not presently impose ground water monitoring requirements in that storage area. However, this permit may be modified, or alternatively, revoked and reissued to include ground water monitoring not required by the AST regulation.

19. Water Quality Criteria Reopener
Should effluent monitoring indicate the need for any water quality-based limitations, this permit may be modified or alternatively revoked and reissued to incorporate appropriate limitations. In addition, this permit may be modified, or alternatively, revoked and reissued to incorporate appropriate temperature limitations if the Virginia Water Quality Standards are revised to include numeric standards addressing human health.

20. CER
Prior to constructing any wastewater treatment works, the permittee shall submit a Concept Engineering Report (CER) to the DEQ Piedmont Regional Office. DEQ written approval shall be secured prior to constructing any wastewater treatment works. The permittee shall construct the wastewater treatment works in accordance with the approved CER. No later than 14 days following completion of construction of any project for which a CER has been approved, written notification shall be submitted to the DEQ Piedmont Regional Office certifying that, based on an inspection of the project, construction was completed in accordance with the approved CER. The written notification shall be certified by a professional engineer licensed in the Commonwealth of Virginia or signed in accordance with Part II.K of this permit. The installed wastewater treatment works shall be operated to achieve design treatment and effluent concentrations. Approval by the Department of Environmental Quality does not relieve the owner of the responsibility for the correction of design and/or operational deficiencies. Noncompliance with the CER shall be deemed a violation of this permit.

Upon approval of a CER for the installation of nutrient removal technology, DEQ staff shall initiate modification, or alternatively, revocation and reissuance, of this permit to include annual concentration limits based on the technology proposed in the CER. Upon completion of construction in accordance with a CER that has been approved by the DEQ Piedmont Regional Office, any nutrient removal facilities installed shall be operated to achieve design effluent Total Nitrogen and Total Phosphorus concentrations.

21. Treatment Requirements for the Lower and Upper Ash Pond Closure Discharge
Commencing with the use of mechanical methods to drawdown surface water from the Lower Ash Pond and the Upper Ash Pond sediment basin for the purposes of closure, all water from the decanting/dewatering process shall be treated prior to discharge. Treated wastewater that exceeds one or more of the following trigger concentrations, as determined by inline process sampling, shall be routed through enhanced treatment prior to discharge:

Parameter:	Enhanced Treatment Trigger (ug/L):
Arsenic	100
Selenium	5.0
Lead	7.4
Copper	6.0
Antimony	640
Thallium	0.47

Enhanced treatment of the wastewater shall be maintained until inline process sampling indicates that all pollutant concentrations are below the enhanced treatment triggers.

Inline process sampling shall be collected at a minimum every 4 hours at an in-process point immediately prior to the enhanced treatment module(s), and analytical results shall be returned within approximately one hour after collection. This sampling is in addition to the effluent compliance monitoring required by this permit. The permittee shall maintain a log with the inline process sampling results and the times that enhanced treatment begins and ends. The log shall be available to DEQ upon request.

In addition to the DMR, the permittee shall submit a monthly summary report of the treated decanting/dewatering discharge no later than the 10th day of the month after monitoring takes place. The summary report shall contain the dates and times that enhanced treatment was turned on and off.

22. <u>Outfall 301 - Water Quality Criteria Monitoring</u>
The permittee shall monitor the effluent at internal Outfall 301 for the substances noted in Attachment A, "Water Quality Criteria Monitoring" according to the indicated analysis number, quantification level, sample type and frequency. Using Attachment A as the reporting form, the data shall be submitted no later than 90 days following the commencement of discharge from Outfall 301. Monitoring and analysis shall be conducted in accordance with 40 CFR Part 136 or alternative EPA approved methods. It is the responsibility of the permittee to ensure that proper QA/QC protocols are followed during the sample gathering and analytical procedures. The DEQ will use these data for making specific permit decisions in the future. This permit may be modified or, alternatively, revoked and reissued to incorporate limits for any of the substances listed in Attachment A.

23. <u>Ash Pond Closure Stormwater Management</u>
Best management practices (BMPs), structural and/or non-structural, shall be utilized by the permittee to minimize the impact of ash pond closure activities on industrial stormwater quality. Ash pond closure activities may include, but are not limited to the process of ash movement for off-site disposal, ash loading and unloading areas, any area(s) associated with the storage of ash prior to transport off-site, and vehicle tracking associated with the movement of ash.

The facility shall maintain a Stormwater Pollution Prevention Plan (SWPPP), required as part of Industrial Stormwater Permit General Permit No. VAR051023, that includes a description of the BMPs being implemented and a regular schedule for preventive maintenance of all BMPs where appropriate. All structural BMPs identified in the SWPPP shall be maintained in effective operating condition and shall be inspected for structural integrity and operational efficiency once per week during ash pond closure activities. Results of the weekly inspections and actions needed and performed in response to the weekly inspections shall be maintained with the SWPPP.

Nothing in this condition shall relieve the permittee from the responsibility for obtaining applicable permits for land disturbing activities, or permit coverage under the General VPDES Permit for Discharges of Stormwater from Construction Activities.

24. <u>Ash Pond Closure Discharge</u>
The permittee shall notify the DEQ Piedmont Regional Office at least 72 hours prior to the planned commencement of the discharge of drawdown water in the Upper or Lower Ash Ponds in preparation for pond closure. A second notification to the DEQ Piedmont Regional Office shall be provided within 24 hours after initiating the discharge of drawdown water from the Upper or Lower Ash Ponds. Closure activities as addressed in this permit shall begin with the commencement of drawdown of the Lower or Upper Ash Ponds, whichever occurs first and conclude with the completion of dewatering. Drawdown shall be defined as the intentional lowering of the pond elevation below 2 feet 2 inches from the top of the concrete outfall structure for Outfall 004 and 15 feet 6 inches from the top of the concrete outfall structure for Outfall 005.

25. <u>Notification of Commencement of Discharge</u>
No later than 10 days prior to the commencement of discharge from Outfall 301, the permittee shall submit written notification to DEQ which provides the first day of discharge. This first day of discharge will be used as the trigger date for all other permit conditions which drive off the commencement of discharge.

26. Cease Discharge Requirements for Outfall 101 – UAP and LAP Effluent - Closure
The permittee shall maintain agreement(s) with its contracted lab(s) requiring that results be reported no later than 48 hours following the result determination and/or 48 hours following a Whole Effluent Toxicity test termination. The permittee shall immediately cease the discharge of the outfall upon receipt of results in exceedance of permit limitations and shall promptly notify DEQ, in no case later than 24 hours, after being informed of the exceedance. The DEQ notification shall include the laboratory notification to the permittee indicating the parameter exceedance, and date and time of notification to the permittee. Should an exceedance occur, the permittee shall initiate a review of the treatment operations and data to identify the cause(s) of the exceedance and initiate appropriate corrective action(s). Resumption of the discharge shall not occur until such time as an evaluation report is provided to DEQ and written authorization to resume the discharge is granted by DEQ.

27. Pond Closure Drawdown Rate
The drawdown rate of any pond or basin shall not exceed 2 foot per day to maintain the integrity of the dams, unless approved by the Department of Conservation and Recreation Dam Safety Program.

28. Process Wastewater Conveyance Investigation
No later than 180 days following the effective date of this permit, the permittee shall submit to the DEQ Piedmont Regional Office an approvable plan for a comprehensive facility-wide process wastewater conveyance investigation. The investigation shall address all process wastewater conveyances to identify potential and actual cross connections, unknown infrastructure, bypasses, and inflow or exfiltration that could result in an illicit or unauthorized discharge. Such investigation requirements may be satisfied by video camera, visual inspection, dye testing or other methods as reasonable and appropriate. The plan shall prioritize the projects according to risk potential and present a schedule, not to exceed 2 years from DEQ written approval of the plan, to complete the investigation and submit a final report summarizing the findings. The permittee shall notify the DEQ no later than 24 hours following discovery of any potential or actual illicit or unauthorized discharge and submit a written plan and schedule to the DEQ Piedmont Regional Office for necessary repair, replacement or corrective action activities no later than 30 days following discovery.

29. §316(a) Alternate Effluent Limitations
The permittee shall no later than 90 days following this permit reissuance submit a general description of the type of data, studies, experiments, and other information which the permittee intends to submit for the update of the §316(a) demonstration.

The permittee shall, by no later than 180 days following this permit reissuance, submit for approval to DEQ a detailed plan for the permittee to update the studies to support renewal of its §316(a) demonstration.

The detailed plan shall specify the nature and extent of the following information to be updated: biological, hydrographical and meteorological data; physical monitoring data; engineering or diffusion models; laboratory studies; representative important species; and other relevant information. In selecting representative important species, special consideration shall be given to state- and federally-listed threatened or endangered species found in the immediate vicinity of the discharge outfalls.

Alternatively, the permittee may base renewal of their demonstration upon the absence of prior appreciable harm in lieu of predictive studies. Any such demonstrations shall show:

a. That no appreciable harm has resulted from the normal component of the discharge (taking into accouint the interaction of such thermal component with other pollutants and the additive effect of other thermal sources to a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge has been made, or
b. That despite the occurrence of such previous harm, the alternative effluent limitations will nevertheless assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in and on the body of water into which the discharge is made.

In determining whether or not prior appreciable harm has occurred, the Director shall consider the length of time in which the applicant has been discharging and the nature of the discharge.

The permittee may provide any additional information or studies which the permittee feels are appropriate to support renewal of their demonstration. Once approved by the DEQ, the plan shall become an enforceable provision of this permit. Results of the updated studies or demonstration shall be submitted to the DEQ Piedmont Regional Office by no later than 270 days prior to expiration of this permit.

D. §316(b) PHASE II CONDITIONS

1. Interim §316(b) Best Technology Available (BTA)
The permittee shall implement interim Best Technology Available (BTA) measures to minimize impingement and entrainment (I&E) mortality and adverse impacts. Each operating cooling water intake structure (CWIS) shall utilize a curtain wall, traveling screens, spray wash systems and debris return.

2. Impingement and Entrainment Control Technology Preventative Maintenance

The Operations and Maintenance (O&M) Manual for the permitted facility shall include a description of procedures and a regular schedule for preventative maintenance of all I&E control technologies and measures. In addition, the O&M Manual shall include a description of mitigation protocols and practices to implement should a water withdrawal event occur while an I&E technology or measure is off-line. The O&M Manual shall be updated to incorporate the information required by this condition by no later than 90 days following the effective date of this permit. All I&E control technologies and measures shall be maintained in effective operating condition. The permittee shall maintain documentation of maintenance and repairs of I&E control technologies and measures, including, but not limited to: the date(s) of regular maintenance, date(s) of discovery of areas in need of repair or replacement, date(s) for repairs, and date(s) the control technologies returned to full function.

3. Alternate Schedule for Submittal of 40 CFR §122.21(r) Information
The permittee shall, by no later than 270 days prior to the expiration date of this permit, submit to the DEQ Regional Office all applicable information described in 40CFR §122.21(r).

4. Monitoring Requirements
The permittee shall conduct visual inspections or employ remote monitoring devices during the period any cooling water intake structure is in operation. Inspections shall be conducted no less frequently than weekly to ensure that any technologies operated to comply with impingement mortality and entrainment requirements, any additional measures necessary to protect listed threatened and endangered species and designated critical habitat, and other standards for minimizing adverse environmental impact as established in this permit, are maintained and operated to function as designed.

Inspection documentation shall include at a minimum:

a. Date, time, and location of the inspection or remote monitoring period;

b. The name(s) and signature(s) of the inspector(s);

c. A description of water withdrawal volumes or rates occurring at the time of the inspection;

d. Where available, head loss across the intake screen(s);

e. If adverse weather conditions exist, a description of the adverse weather conditions;

f. Any technologies needing maintenance, repair, or replacement.

The requirement to conduct visual or remote inspections is waived when no water is withdrawn through all cooling water intake structures during an entire inspection period. For each cooling water intake structure, the permittee shall document the date(s) when no water is withdrawn through the respective intake structure.

When adverse weather conditions prevent visual inspections or remote monitoring from being safely conducted during a given inspection period, the visual inspection or remote monitoring requirements may be waived provided the permittee prepares documentation explaining the reasons why a visual inspection or remote monitoring could not be safely conducted. Adverse weather conditions are those that are dangerous or create inaccessibility for personnel, and may include such events as local flooding, high winds, electrical storms, or situations that otherwise make an inspection impracticable, such as drought or extended frozen conditions.

Any deficiencies found during a visual inspection or remote monitoring event shall be corrected as soon as possible, but no later than 30 days following discovery, unless permission for a later date is granted by DEQ in writing.

All documentation relating to visual inspections or remote monitoring, or the inability to safely conduct such monitoring due to adverse weather conditions, shall be signed and certified in accordance with Part II.K of this permit and shall be made available to DEQ personnel for review during facility inspections or no later than 30 days following receipt of a request by DEQ.

5. Annual Certification Statement Requirements
The permittee shall annually prepare a written statement certifying either: a) operations of any unit at the permitted facility that impacts cooling water withdrawals or operation of any cooling water intake structure have been substantially modified, or b) no substantial changes have occurred in the operations of any unit at the permitted facility that impacts cooling water withdrawals or operation of any cooling water intake structure.

If substantially modified operations have occurred, the permittee must provide with the annual certification statement a summary of those changes. In addition, the permittee must submit revisions to the information required at 40 CFR §122.21(r) with the next application for reissuance of this permit.

Certification statements shall be signed in accordance with Part II.K of this permit and submitted to the DEQ Piedmont Regional Office by no later than each February 10 for the period covering the preceding calendar year.

6. Measures to protect Federally-listed Threatened or Endangered (T&E) species, designated critical habitat, and fragile species or shellfish

The permittee shall operate each cooling water intake structure and cooling system in a manner designed to minimize incidental take, reduce or remove more than minor detrimental effects to Federally-listed threatened, endangered, or fragile species and designated critical habitat, including prey base.

The permittee shall prepare, on a calendar year basis, a report providing an assessment of the efficiency/effectiveness of the facility's control measures. The report shall include a compilation of all federally-listed threatened or endangered species found to have been taken by a cooling water intake structure during the reporting year. For each federally-listed species taken, the report shall include the following data at a minimum:

- Species name (to include both the Latin and common name);
- Federal listed status (e.g., threatened, endangered, or other);
- Total number of organisms taken by life stage cycle (egg, larva, juvenile, adult);
- Method of take (impingement, entrainment, or other);
- Results of the take (death, injury, or other); and
- The take estimated by the federal Fishery Services when a federal incidental take authorization was granted.

The assessments and compiled data shall be submitted to the DEQ-Regional Office by no later than each February 10 for the preceding calendar year.

7. Federal Endangered Species Act Compliance
Nothing in this permit authorizes take for the purposes of a facility's compliance with the Endangered Species Act.

Part II. CONDITIONS APPLICABLE TO ALL VPDES PERMITS

A. Monitoring

1. Samples and measurements required by this permit shall be taken at the permit designated or approved location and be representative of the monitored activity.

   a. Monitoring shall be conducted according to procedures approved under Title 40 Code of Federal Regulations Part 136 or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this permit.

   b. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will insure accuracy of measurements.

   c. Samples taken shall be analyzed by a laboratory certified under 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

2. Any pollutant specifically addressed by this permit that is sampled or measured at the permit designated or approved location more frequently than required by this permit shall meet the requirements in A 1 a through c above and the results of this monitoring shall be included in the calculations and reporting required by this permit.

3. Operational or process control samples or measurements shall not be taken at the designated permit sampling or measurement locations. Operational or process control samples or measurements do not need to follow procedures approved under Title 40 Code of Federal Regulations Part 136 or be analyzed in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

B. Records

1. Records of monitoring information shall include:

   a. The date, exact place, and time of sampling or measurements;

   b. The individual(s) who performed the sampling or measurements;

   c. The date(s) and time(s) analyses were performed;

   d. The individual(s) who performed the analyses;

   e. The analytical techniques or methods used; and

   f. The results of such analyses.

2. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years, the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report, or application. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee, or as requested by the Board.

C. Reporting Monitoring Results

1. The permittee shall submit the results of the monitoring required by this permit not later than the 10th day of the month after monitoring takes place, unless another reporting schedule is specified elsewhere in this permit. Monitoring results shall be submitted to:

Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060-6296

2. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) or on forms provided, approved, or specified by the Department.

3. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

D. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Board may require the permittee to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the State Water Control Law. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

E. Compliance Schedule Reports

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized Discharges

Except in compliance with this permit, or another permit issued by the Board, it shall be unlawful for any person to:

1. Discharge into state waters sewage, industrial wastes, other wastes, or any noxious or deleterious substances; or

2. Otherwise alter the physical, chemical, or biological properties of such state waters and make them detrimental to the public health, or to animal or aquatic life, or to the use of such waters for domestic or industrial consumption, or for recreation, or for other uses.

G. Reports of Unauthorized Discharges

Any permittee who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance into or upon state waters in violation of Part II F; or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters in violation of Part II.F, shall notify the Department of the discharge immediately upon discovery of the discharge, but in no case later than 24 hours after said discovery. A written report of the unauthorized discharge shall be submitted to the Department within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;
2. The cause of the discharge;
3. The date on which the discharge occurred;
4. The length of time that the discharge continued;
5. The volume of the discharge;
6. If the discharge is continuing, how long it is expected to continue;
7. If the discharge is continuing, what the expected total volume of the discharge will be; and
8. Any steps planned or taken to reduce, eliminate, and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the Department under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of Unusual or Extraordinary Discharges

If any unusual or extraordinary discharge including a bypass or upset should occur from a treatment works and the discharge enters or could be expected to enter state waters, the permittee shall promptly notify, in no case later than 24 hours, the Department by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse affects on aquatic life and the known number of fish killed.

The permittee shall reduce the report to writing and shall submit it to the Department within five days of discovery of the discharge in accordance with Part II.I.2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;
2. Breakdown of processing or accessory equipment;
3. Failure or taking out of service some or all of the treatment works; and
4. Flooding or other acts of nature.

I. Reports of Noncompliance

The permittee shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report shall be provided within 24 hours from the time the permittee becomes aware of the circumstances. The following shall be included as information which shall be reported within 24 hours under this paragraph:
   a. Any unanticipated bypass; and
   b. Any upset which causes a discharge to surface waters.
2. A written report shall be submitted within 5 days and shall contain:
   a. A description of the noncompliance and its cause;
   b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
   c. Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

   The Board may waive the written report on a case-by-case basis for reports of noncompliance under Part II.I if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.
3. The permittee shall report all instances of noncompliance not reported under Parts II.I.1 or 2, in writing, at the time the next monitoring reports are submitted. The reports shall contain the information listed in Part II.I.2.

NOTE: The immediate (within 24 hours) reports required in Parts II.G, H, and I may be made to the Department's Regional Office at (804) 527-5020 (voice), (804) 527-5106 (fax) or online (http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness/MakingaReport.aspx). For reports outside normal working hours (before 8:30 am and after 5:00 pm Monday through Friday and anytime Saturday through Sunday), leave a message and this shall fulfill the immediate reporting requirement.

For emergencies, the Virginia Department of Emergency Services maintains a 24 hour telephone service at 1-800-468-8892.

J. Notice of Planned Changes

1. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

   a. The permittee plans alteration or addition to any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

      (1) After promulgation of standards of performance under Section 306 of the Clean Water Act which are applicable to such source; or

      (2) After proposal of standards of performance in accordance with Section 306 of the Clean Water Act which are applicable to such source, but only if the standards are promulgated in accordance with Section 306 within 120 days of their proposal;

   b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations nor to notification requirements specified elsewhere in this permit; or

   c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

2. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

K. Signatory Requirements

1. Applications. All permit applications shall be signed as follows:

   a. For a corporation: By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

   b. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

   c. For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a public agency includes: (i) The chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports, etc. All reports required by permits and other information requested by the Board shall be signed by a person described in Part II.K.1, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described in Part II.K.1;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

c. The written authorization is submitted to the Department.

3. Changes to authorization. If an authorization under Part II.K.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part II.K.2 shall be submitted to the Department prior to or together with any reports, or information to be signed by an authorized representative.

4. Certification. Any person signing a document under Parts II.K.1 or 2 shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

L. Duty to Comply

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the State Water Control Law and the Clean Water Act, except that noncompliance with certain provisions of this permit may constitute a violation of the State Water Control Law but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this permit has not yet been modified to incorporate the requirement.

M. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee shall apply for and obtain a new permit. All permittees with a currently effective permit shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Board. The Board shall not grant permission for applications to be submitted later than the expiration date of the existing permit.

N. Effect of a Permit

This permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. State Law

Nothing in this permit shall be construed to preclude the institution of any legal action under, or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by Section 510 of the Clean Water Act. Except as provided in permit conditions on "bypassing" (Part II.U), and "upset" (Part II.V) nothing in this permit shall be construed to relieve the permittee from civil and criminal penalties for noncompliance.

P. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Sections 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law.

Q. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by the permittee only when the operation is necessary to achieve compliance with the conditions of this permit.

R. Disposal of Solids or Sludges

Solids, sludges, or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering state waters.

S. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to Halt or Reduce Activity not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

U. Bypass

1. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Parts II.U.2 and U.3.

2. Notice

   a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, prior notice shall be submitted, if possible at least ten days before the date of the bypass.

   b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II.I.

3. Prohibition of bypass

   a. Bypass is prohibited, and the Board may take enforcement action against a permittee for bypass, unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The permittee submitted notices as required under Part II.U.2.

b. The Board may approve an anticipated bypass, after considering its adverse effects, if the Board determines that it will meet the three conditions listed above in Part II.U.3.a.

V. Upset

1. An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of Part II.V.2 are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.

2. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

a. An upset occurred and that the permittee can identify the cause(s) of the upset;

b. The permitted facility was at the time being properly operated;

c. The permittee submitted notice of the upset as required in Part II.I; and

d. The permittee complied with any remedial measures required under Part II.S.

3. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act and the State Water Control Law, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection unreasonable during an emergency.

X. Permit Actions

Permits may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. Transfer of permits

1. Permits are not transferable to any person except after notice to the Department. Except as provided in Part II.Y.2, a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new permittee and incorporate such other requirements as may be necessary under the State Water Control Law and the Clean Water Act.

2. As an alternative to transfers under Part II.Y.1, this permit may be automatically transferred to a new permittee if:

   a. The current permittee notifies the Department at least 30 days in advance of the proposed transfer of the title to the facility or property;

   b. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

   c. The Board does not notify the existing permittee and the proposed new permittee of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Part II.Y.2.b.

Z. Severability

The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

ATTACHMENT A for Outfall 301
DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY CRITERIA MONITORING

Effective January 1, 2012, all analyses shall be in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

A listing of Virginia Environmental Laboratory Accreditation Program (VELAP) certified and/or accredited laboratories can be found at the following website:
http://www.dgs.state.va.us/DivisionofConsolidatedLaboratoryServices/Services/EnvironmentalLaboratoryCertification/tabid/1059/Default.aspx

Please be advised that additional water quality analyses may be necessary and/or required for permitting purposes.

CASRN	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL(1)	REPORTING RESULTS(2)	SAMPLE TYPE(3)	SAMPLE FREQUENCY
METALS						
7440-36-0	Antimony, dissolved	(4)	1.4		G or C	1/5 YR
7440-38-2	Arsenic, dissolved	(4)	1.0		G or C	1/5 YR
7440-43-9	Cadmium, dissolved	(4)	0.3		G or C	1/5 YR
16065-83-1	Chromium III, dissolved (7)	(4)	3.6		G or C	1/5 YR
18540-29-9	Chromium VI, dissolved (7)	(4)	1.6		G or C	1/5 YR
7440-50-8	Copper, dissolved	(4)	0.50		G or C	1/5 YR
7439-92-1	Lead, dissolved	(4)	0.50		G or C	1/5 YR
7439-97-6	Mercury, dissolved	(4)	1.0		G or C	1/5 YR
7440-02-0	Nickel, dissolved	(4)	0.94		G or C	1/5 YR
7782-49-2	Selenium, Total Recoverable	(4)	2.0		G or C	1/5 YR (FW)
7440-22-4	Silver, dissolved	(4)	0.20		G or C	1/5 YR
7440-28-0	Thallium, dissolved	(4)	(5)		G or C	1/5 YR
7440-66-6	Zinc, dissolved	(4)	3.6		G or C	1/5 YR
PESTICIDES/PCBs						
309-00-2	Aldrin	608/625	0.05		G or C	1/5 YR
57-74-9	Chlordane	608/625	0.2		G or C	1/5 YR
2921-88-2	Chlorpyrifos (synonym = Dursban)	622	(5)		G or C	1/5 YR
72-54-8	DDD	608/625	0.1		G or C	1/5 YR
72-55-9	DDE	608/625	0.1		G or C	1/5 YR
50-29-3	DDT	608/625	0.1		G or C	1/5 YR
8065-48-3	Demeton (synonym = Dementon-O,S)	622	(5)		G or C	1/5 YR
333-41-5	Diazinon	622	(5)		G or C	1/5 YR
60-57-1	Dieldrin	608/625	0.1		G or C	1/5 YR

CASRN	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL(1)	REPORTING RESULTS(2)	SAMPLE TYPE(3)	SAMPLE FREQUENCY
959-98-8	Alpha-Endosulfan (synonym = Endosulfan I)	608/625	0.1		G or C	1/5 YR
33213-65-9	Beta-Endosulfan (synonym = Endosulfan II)	608/625	0.1		G or C	1/5 YR
1031-07-8	Endosulfan Sulfate	608/625	0.1		G or C	1/5 YR
72-20-8	Endrin	608/625	0.1		G or C	1/5 YR
7421-93-4	Endrin Aldehyde	608/625	(5)		G or C	1/5 YR
86-50-0	Guthion (synonym = Azinphos Methyl)	622	(5)		G or C	1/5 YR
76-44-8	Heptachlor	608/625	0.05		G or C	1/5 YR
1024-57-3	Heptachlor Epoxide	608/625	(5)		G or C	1/5 YR
319-84-6	Hexachlorocyclohexane Alpha-BHC	608/625	(5)		G or C	1/5 YR
319-85-7	Hexachlorocyclohexane Beta-BHC	608/625	(5)		G or C	1/5 YR
58-89-9	Hexachlorocyclohexane Gamma-BHC (syn. = Lindane)	608/625	(5)		G or C	1/5 YR
143-50-0	Kepone	8081 Extended/ 8270C/8270D	(5)		G or C	1/5 YR
121-75-5	Malathion	614	(5)		G or C	1/5 YR
72-43-5	Methoxychlor	608.2	(5)		G or C	1/5 YR
2385-85-5	Mirex	8081 Extended/ 8270C/8270D	(5)		G or C	1/5 YR
56-38-2	Parathion (synonym = Parathion Ethyl)	614	(5)		G or C	1/5 YR
1336-36-3	PCB, total	608/625	7.0		G or C	1/5 YR
8001-35-2	Toxaphene	608/625	5.0		G or C	1/5 YR
BASE NEUTRAL EXTRACTABLES						
83-32-9	Acenaphthene	610/625	10.0		G or C	1/5 YR
120-12-7	Anthracene	610/625	10.0		G or C	1/5 YR
92-87-5	Benzidine	625	(5)		G or C	1/5 YR
56-55-3	Benzo (a) anthracene	610/625	10.0		G or C	1/5 YR
205-99-2	Benzo (b) fluoranthene	610/625	10.0		G or C	1/5 YR
207-08-9	Benzo (k) fluoranthene	610/625	10.0		G or C	1/5 YR
50-32-8	Benzo (a) pyrene	610/625	10.0		G or C	1/5 YR
111-44-4	Bis 2-Chloroethyl Ether	625	(5)		G or C	1/5 YR
108-60-1	Bis 2-Chloroisopropyl Ether	625	(5)		G or C	1/5 YR
117-81-7	Bis 2-Ethylhexyl Phthalate (syn. = Di-2-Ethylhexyl Phthalate)	625	10.0		G or C	1/5 YR
85-68-7	Butyl benzyl phthalate	625	10.0		G or C	1/5 YR
91-58-7	2-Chloronaphthalene	625	(5)		G or C	1/5 YR
218-01-9	Chrysene	610/625	10.0		G or C	1/5 YR

CASRN	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL[(1)]	REPORTING RESULTS[(2)]	SAMPLE TYPE[(3)]	SAMPLE FREQUENCY
53-70-3	Dibenzo (a,h) anthracene	610/625	20.0		G or C	1/5 YR
95-50-1	1,2-Dichlorobenzene	602/624	10.0		G or C	1/5 YR
541-73-1	1,3-Dichlorobenzene	602/624	10.0		G or C	1/5 YR
106-46-7	1,4-Dichlorobenzene	602/624	10.0		G or C	1/5 YR
91-94-1	3,3-Dichlorobenzidine	625	(5)		G or C	1/5 YR
84-66-2	Diethyl phthalate	625	10.0		G or C	1/5 YR
131-11-3	Dimethyl phthalate	625	(5)		G or C	1/5 YR
84-74-2	Di-n-butyl Phthalate (synonym = Dibutyl Phthalate)	625	10.0		G or C	1/5 YR
121-14-2	2,4-Dinitrotoluene	625	10.0		G or C	1/5 YR
122-66-7	1,2-Diphenylhydrazine	625/ 8270C/8270D	(5)		G or C	1/5 YR
206-44-0	Fluoranthene	610/625	10.0		G or C	1/5 YR
86-73-7	Fluorene	610/625	10.0		G or C	1/5 YR
118-74-1	Hexachlorobenzene	625	(5)		G or C	1/5 YR
87-68-3	Hexachlorobutadiene	625	(5)		G or C	1/5 YR
77-47-4	Hexachlorocyclopentadiene	625	(5)		G or C	1/5 YR
67-72-1	Hexachloroethane	625	(5)		G or C	1/5 YR
193-39-5	Indeno(1,2,3-cd)pyrene	610/625	20.0		G or C	1/5 YR
78-59-1	Isophorone	625	10.0		G or C	1/5 YR
98-95-3	Nitrobenzene	625	10.0		G or C	1/5 YR
62-75-9	N-Nitrosodimethylamine	625	(5)		G or C	1/5 YR
621-64-7	N-Nitrosodi-n-propylamine	625	(5)		G or C	1/5 YR
86-30-6	N-Nitrosodiphenylamine	625	(5)		G or C	1/5 YR
129-00-0	Pyrene	610/625	10.0		G or C	1/5 YR
120-82-1	1,2,4-Trichlorobenzene	625	10.0		G or C	1/5 YR
VOLATILES						
107-02-8	Acrolein	624	(5)		G	1/5 YR
107-13-1	Acrylonitrile	624	(5)		G	1/5 YR
71-43-2	Benzene	602/624	10.0		G	1/5 YR
75-25-2	Bromoform	624	10.0		G	1/5 YR
56-23-5	Carbon Tetrachloride	624	10.0		G	1/5 YR
108-90-7	Chlorobenzene (synonym = Monochlorobenzene)	602/624	50.0		G	1/5 YR
124-48-1	Chlorodibromomethane	624	10.0		G	1/5 YR

CASRN	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL(1)	REPORTING RESULTS(2)	SAMPLE TYPE(3)	SAMPLE FREQUENCY
67-66-3	Chloroform	624	10.0		G	1/5 YR
75-27-4	Dichlorobromomethane	624	10.0		G	1/5 YR
107-06-2	1,2-Dichloroethane	624	10.0		G	1/5 YR
75-35-4	1,1-Dichloroethylene	624	10.0		G	1/5 YR
156-60-5	1,2-trans-dichloroethylene	624	(5)		G	1/5 YR
78-87-5	1,2-Dichloropropane	624	(5)		G	1/5 YR
542-75-6	1,3-Dichloropropene	624	(5)		G	1/5 YR
100-41-4	Ethylbenzene	602/624	10.0		G	1/5 YR
74-83-9	Methyl Bromide (synonym = Bromomethane)	624	(5)		G	1/5 YR
75-09-2	Methylene Chloride (synonym = Dichloromethane)	624	20.0		G	1/5 YR
79-34-5	1,1,2,2-Tetrachloroethane	624	(5)		G	1/5 YR
127-18-4	Tetrachloroethylene (synonym = Tetrachloroethene)	624	10.0		G	1/5 YR
10-88-3	Toluene	602/624	10.0		G	1/5 YR
79-00-5	1,1,2-Trichloroethane	624	(5)		G	1/5 YR
79-01-6	Trichloroethylene (synonym = Trichloroethene)	624	10.0		G	1/5 YR
75-01-4	Vinyl Chloride	624	10.0		G	1/5 YR
ACID EXTRACTABLES						
95-57-8	2-Chlorophenol	625	10.0		G or C	1/5 YR
120-83-2	2,4 Dichlorophenol	625	10.0		G or C	1/5 YR
105-67-9	2,4 Dimethylphenol	625	10.0		G or C	1/5 YR
51-28-5	2,4-Dinitrophenol	625	(5)		G or C	1/5 YR
534-52-1	2-Methyl-4,6-Dinitrophenol	625	(5)		G or C	1/5 YR
25154-52-3	Nonylphenol	ASTM D 7065-06	(5)		G or C	1/5 YR
87-86-5	Pentachlorophenol	625	50.0		G or C	1/5 YR
108-95-2	Phenol	625	10.0		G or C	1/5 YR
88-06-2	2,4,6-Trichlorophenol	625	10.0		G or C	1/5 YR
MISCELLANEOUS						
776-41-7	Ammonia as NH3-N	350.1	200		C	1/5 YR
16887-00-6	Chloride	(4)	(5)		C	1/5 YR (FW and PWS)
7782-50-5	Chlorine, Total Residual	(4)	100		G	1/5 YR
57-12-5	Cyanide, Free (9)	ASTM 4282-02	10.0		G	1/5 YR
N/A	*E. coli* / *Enterococcus* (N/CML)	(4)	(5)		G	1/5 YR

CASRN	CHEMICAL	EPA ANALYSIS NO.	QUANTIFICATION LEVEL (1)	REPORTING RESULTS (2)	SAMPLE TYPE (3)	SAMPLE FREQUENCY
18496-25-8	Sulfide, dissolved (8)	SM 4500 S^2 B	100		G or C	1/5 YR
60-10-5	Tributyltin	(6)	(5)		G or C	1/5 YR
471-34-1	Hardness (mg/L as $CaCO_3$)	(4)	(5)		G or C	1/5 YR (FW & TZs)

____
Name of Principal Executive Officer or Authorized Agent & Title

____
Signature of Principal Executive Officer or Authorized Agent & Date

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations. See 18 U.S.C. Sec. 1001 and 33 U.S.C. Sec. 1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

FOOTNOTES:

(1) Quantification level (QL) means the minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence in accordance with 1VAC30-45, Certification for Noncommercial Environmental Laboratories, or 1VAC30-46, Accreditation for Commercial Environmental Laboratories.

Units for the quantification level are micrograms/liter unless otherwise specified.

Quality control and quality assurance information (i.e. laboratory certificates of analysis) shall be submitted to document that the required quantification level has been attained.

(2) If the reporting result is greater than or equal to the QL, then include the reporting result. If the reporting result is less than the QL, then report "< [lab QL]". For example, if the reporting result is below the QL with a QL of 25 micrograms/liter, then report "<25".

(3) Sample Type

G = Grab = An individual sample collected in less than 15 minutes. Substances specified with "grab" sample type shall only be collected as grabs. The permittee may analyze multiple grabs and report the average results provided that the individual grab results are also reported. For grab metals samples, the individual samples shall be filtered and preserved immediately upon collection.

C = Composite = A 24-hour **(PW - Revise as required to require same composite duration as BOD_5)** composite unless otherwise specified. The composite shall be a combination of individual samples, taken proportional to flow, obtained at hourly or smaller time intervals. The individual samples may be of equal volume for flows that do not vary by +/- 10 percent over a 24-hour period.

(4) A specific analytical method is not specified; however, an appropriate method to meet the QL shall be selected from any approved method presented in 40 CFR Part 136.

(5) The QL is at the discretion of the permittee. If the test result is less than the method QL, a "<[QL]" shall be reported where the actual analytical test QL is substituted for [QL].

(6) Analytical Methods: Analysis of Butyltins in Environmental Systems by the Virginia Institute of Marine Science, dated November 1996 (currently the only Virginia Environmental Laboratory Accreditation Program (VELAP) accredited method).

(7) Both Chromium III and Chromium VI may be measured by the total chromium analysis. The total chromium analytical test QL shall be less than or equal to the lesser of the Chromium III or Chromium VI method QL

listed above. If the result of the total chromium analysis is less than the analytical test QL, both Chromium III and Chromium VI can be reported as "<[QL]", where the actual analytical test QL is substituted for [QL].

(8) Dissolved sulfide may be measured by the total sulfide analysis. The total sulfide analytical test QL shall be less than or equal to the dissolved sulfide method QL listed above. If the result of the total sulfide analysis is less than the analytical test QL, dissolved sulfide can be reported as "<[QL]", where the actual analytical test QL is substituted for [QL].

(9) Free cyanide may be measured by the total cyanide analysis. The total cyanide analytical test QL shall be less than or equal to the free cyanide method QL listed above. If the result of the total cyanide analysis is less than the analytical test QL, free cyanide can be reported as "<[QL]", where the actual analytical test QL is substituted for [QL].

Appendix E: Vessel Movement Summary -

Virginia Power Services Energy Corporation, Inc.
P.O. Box 25593
Richmond,VA,23260

Attn: Mike Philips

For Services Rendered: To survey the discharge at CHESTERFIELD POWER STATION on 9/19/15

Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur
Vessel	JNB-16
Your Reference	VPSE Ref # 2R091509
Our Reference	US330-0012553

Dear MR.Philips

Please find enclosed one original of our report No. US330-0012553 and invoice No. 1003750861 for service rendered corresponding to the Discharge Supervision of #2HSDO meeting CPL 88 grade - 2000 ppm Sulfur, on board the JNB-16, at CHESTERFIELD POWER STATION-CHESTER,Virginia,United States, on 9/19/15. Should you have any questions regarding this Invoice, please do not hesitate to contact us at your convenience. Once again, thank you very much for requesting our services, we remain.

Print Allison Moffatt

Intertek

Office Address 109-B FREEDOM BLVD , YORKTOWN , VA 23692

Office Telephone (757)8745840 Office Facsimile (757)8745843

All Intertek measurement devices and methods used for quantity and quality determination meet the pertinent requirements of 40 CFR 98.3 et. seq. (Greenhouse Gas Mandatory Reporting Rule). Intertek is dedicated to Customer Service and welcomes your feedback. Please click on the link below to send us your suggestions or comments. We thank you for your time. http://www.intertek-cb.com/generalsurvey.htm

Movement Summary Report

Our Reference	US330-0012553
Your Reference	VPSE Ref # 2R091509
Date	09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

To:	Virginia Power Services Energy Corporation, Inc.	Attn:	Michael Philips
Type Of Movement		Discharge	

Delays	

Month	Day	Year	Hour	Event
09	19	2015	0005	Barge(s) Arrived
09	19	2015	0010	Barge(s) All Fast
09	19	2015	0015	Commenced Barge(s) Pre-Inspection
09	19	2015	0025	Cargo Hose Connected
09	19	2015	0045	Completed Barge(s) Pre-Inspection
09	19	2015	0105	Commenced Discharge
09	19	2015	0405	Completed Discharge
09	19	2015	0410	Commenced Barge(s) Final Inspection
09	19	2015	0415	Completed Barge(s) Final Inspection
09	19	2015	0425	Cargo Hose Disconnected
09	19	2015	0430	Released

Shore Quantities

Shore Tank #	Delivered/ Received Quantity	Units	Open Product Density	Closing Product Density	Density For Weight Determination	Method of Water/ S&W Calculation	S&W Values
F.O. TK 1	260291.00	Gallons	38.7	38.7	40.4	None	

Total Of All Tanks - Shore

	T.C.V.	G.S.V.	N.S.V.
Gallons	260291.00	260291.00	260291.00
Cubic Meters	985.308	985.308	985.308
Barrels	6197.40	6197.40	6197.40
Pounds	1783999	1783999	1783999
Long Tons	796.428	796.428	796.428
Metric Tons	809.195	809.195	809.195
Short Tons	891.999	891.999	891.999
Kilograms	809195.0	809195.0	809195.0
Litres	985308	985308	985308

Vessel(s) Quantities

		Product					Free Water		
Vessel Name	Units	Arrival Volume	Departure Volume	Delivered/ Received Volume	Vessel Experience Factor	Volume With VEF Applied	Arrival Volume	Departure Volume	Delivered/ Received Volume
JNB-16	Gallons	257262.37	0.00	257262.37	1.0000	257262.37	0.00	0.00	0.00
TOTALS (Barrels)		6125.29	0.00	6125.29		6125.29	0.00	0.00	0.00

Form : 044 . 2015

Intertek	# Movement Summary Report	Our Reference: US330-0012553 Your Reference: VPSE Ref # 2R091509 Date: 09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

Shore/Vessel Comparison					
	Shore	Vessel	Difference	Vessel With VEF Applied	Difference With VEF Applied
T.C.V.					
Barrels	6197.40	6125.29	72.11	6125.29	72.11
Gallons	260291.00	257262.37	3028.63	257262.37	3028.63
Cubic Meters	985.308	973.844	11.464	973.844	11.464
Difference %			1.16		1.16
G.S.V.					
Barrels	6197.40	6125.29	72.11	6125.29	72.11
Gallons	260291.00	257262.37	3028.63	257262.37	3028.63
Cubic Meters	985.308	973.844	11.464	973.844	11.464
Difference %			1.16		1.16
N.S.V.					
Barrels	6197.40				
Gallons	260291.00				
Cubic Meters	985.308				

Analysis Performed	
Comments	

Sincerely Walter Rowe On Behalf Of Intertek

Office Address 109-B FREEDOM BLVD , YORKTOWN , VA 23692

Office Telephone (757)8745840 Office Facsimile (757)8745843

All Intertek measurement devices and methods used for quantity and quality determination meet the pertinent requirements of 40 CFR 98.3 et. seq. (Greenhouse Gas Mandatory Reporting Rule). Intertek wishes to remind all clients that it's formal report, and associated documents, contain warnings, exceptions, caveats and terms and conditions which are pertinent to the data supplied therein, and also to the data summarized in summary reports. While data is supplied in summary formats for the convenience of the client, it is the position of Intertek that the formal report is the prevailing document, and that the use of summary documents by the client is at their own risk.

Time Log

Our Reference	US330-0012553
Your Reference	VPSE Ref # 2R091509
Date	09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

Month	Day	Year	Hour	Event
09	19	2015	0005	Barge(s) Arrived
09	19	2015	0010	Barge(s) All Fast
09	19	2015	0015	Commenced Barge(s) Pre-Inspection
09	19	2015	0025	Cargo Hose Connected
09	19	2015	0045	Completed Barge(s) Pre-Inspection
09	19	2015	0105	Commenced Discharge
09	19	2015	0405	Completed Discharge
09	19	2015	0410	Commenced Barge(s) Final Inspection
09	19	2015	0415	Completed Barge(s) Final Inspection
09	19	2015	0425	Cargo Hose Disconnected
09	19	2015	0430	Released

Comments	

Vessel Representative ______________________ For Intertek ______________________

Print ______________________ Print Walter Rowe

Intertek

Certificate of Quantity

Our Reference	US330-0012553
Your Reference	VPSE Ref # 2R091509
Date	09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

Units of Measurement	Height/Length	Volume	Temperature	Open VCF Table	Close VCF Table	Product Density
	Feet Inches	Gallons	Degree Fahrenheit	2004-TABLE 6B	2004-TABLE 6B	API Gravity @ 60 F

	Tank No	T.O.V.			Water			Temperature				Shell Corr.	Prod. Density Value	Roof Corr.	G.O.V.	V.C.F/ WCF/ Litre Weight	G.S.V.	S&W %Vol.	N.S.V.
		Gauge	Method of Gauge	Vol.	Water Gauge	Method of Gauge	Vol.	Upp Temp	Mid Temp	Low Temp	Avg Temp								
Open	F.O. TK 1	42-10 3/16	Innage	1.0049645E7	0-0	Innage	0.0	77.7	77.7	77.6	77.7	1.00020	38.7	0.00	10051654.93	0.99150	9966215.86		
Close		43'-11 5/8"	Innage	1.0312635E7	0-0	Innage	0.0	77.7	77.8	77.9	77.8	1.00020	38.7	0.00	10314697.53	0.99145	10226506.86		
AMB. Temp(Open)			68	AMB. Temp(Close)			63												
Total This Tank				262990.0			0.0								263042.6		260291.0		

	T.C.V.	G.S.V.	N.S.V.		
Gallons	260291.00	260291.00	260291.00		
Cubic Meters	985.308	985.308	985.308	V.C.F/ WCF/ Litre Weight	V.C.F.
Barrels	6197.40	6197.40	6197.40	Method of Water/S&W Calculation	None
Pounds	1783999	1783999	1783999	Inline Sample S&W (Volume%)	
Long Tons	796.428	796.428	796.428		
Metric Tons	809.195	809.195	809.195	Vessels Free Water	
Short Tons	891.999	891.999	891.999		
Kilograms	809195.0	809195.0	809195.0	Vessels S&W (Volume%)	
Litres	985308	985308	985308		
Density/API		40.4		WCF Table	2012 - Table 11/13
Comments				WCF Value	0.12851 / 0.13057
				Shore Lines	Full And Full

Terminal Representative ______________________

Print ______________________

For Intertek ______________________

Print Walter Rowe

109-B FREEDOM BLVD , YORKTOWN, VA 23692, (PHONE)(757)8745840, (FAX)(757)8745843

Form : 009. 2015

Intertek

Barge Survey Report

Our Reference	US330-0012553
Your Reference	VPSE Ref # 2R091509
Date	09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

Method of Gauge	Ullage	Type Of Movement	Discharge	Location of Gauge	6 Inch Gauge Hatch	Product Density	API Gravity @ 60 F

Unit of Measurement	Height/Length	Volume	Temperature	V.C.F/ WCF/ Litre Weight	VCF Table	WCF Table
	Feet Inches	Gallons	Degree Fahrenheit	V.C.F.	2004-TABLE 6B	2012 - Table 11/13

Arrival

Draft	FWD PORT	5-0	FWD STARBOARD	5-0	AFT PORT	6-6	AFT STARBOARD	6-6	Prod. Density Value	40.4

Tank No.	Gauge	Total T.O.V.	T.O.V. Liquid	T.O.V. Non-Liquid	Temperature	Free Water (Gauge)	Free Water (Volume)	G.O.V.	V.C.F/ WCF/ Litre Weight	G.S.V.
1P	10-5 3/4	39834.00	39834.00		77.3	0-0	0.00	39834.00	0.99153	39496.61
2P	9-8 1/2	47581.00	47581.00		77.3	0-0	0.00	47581.00	0.99153	47177.99
3P	10-4 1/4	42584.00	42584.00		77.3	0-0	0.00	42584.00	0.99153	42223.31
1S	10-5 1/2	39982.00	39982.00		77.3	0-0	0.00	39982.00	0.99153	39643.35
2S	9-8 1/4	47713.00	47713.00		77.3	0-0	0.00	47713.00	0.99153	47308.87
3S	10-5 1/4	41766.00	41766.00		77.3	0-0	0.00	41766.00	0.99153	41412.24
	Total	259460.00	259460.00	0.00	Avg. Temp.	77.3				

Departure

Draft	FWD PORT	1-0	FWD STARBOARD	1-0	AFT PORT	1-6	AFT STARBOARD	1-6	Prod. Density Value	

Tank No.	Gauge	Total T.O.V.	T.O.V. Liquid	T.O.V. Non-Liquid	Temperature	Free Water (Gauge)	Free Water (Volume)	G.O.V.	V.C.F/ WCF/ Litre Weight	G.S.V.
1P	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
2P	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
3P	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
1S	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
2S	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
3S	0-0	0.00	0.00		60.0	0-0	0.00	0.00		0.00
	Total	0.00	0.00	0.00	Avg. Temp.	60.0				

Vessel Representative ______________________ For Intertek ______________________

Print ______________________ Print Walter Rowe

109-B FREEDOM BLVD , YORKTOWN, VA 23692, (PHONE)(757)8745840, (FAX)(757)8745843

Intertek

Barge Survey Report

Our Reference: US330-0012553
Your Reference: VPSE Ref # 2R091509
Date: 09/19/2015

Vessel	JNB-16	Customer Product Description	#2HSDO meeting CPL 88 grade - 2000 ppm Sulfur	Port	CHESTER,Virginia,United States	Terminal	CHESTERFIELD POWER STATION

Totals	Arrival	Departure	Delivered/Received	WCF Values	
GSV (Barrels)	6125.29	0.00	6125.29	WCF Arrival	0.12851 / 0.13057
GSV (Gallons)	257262.37	0.00	257262.37	WCF Departure	0.0
GSV (Cubic Meters)	973.844	0.000	973.844	API Gravity of Loaded Material	40.4
Free Water (Volume)	0.00	0.00	0.00	Comments	
Pounds	1763241	0	1763241		
Short Tons	881.620	0.000	881.620		
Long Tons	787.161	0.000	787.161		
Metric Tons	799.779	0.000	799.779		
Kilograms	799779	0	799779		
Litres	973844.0	0.0	973844.0		

Vessel Representative ______________________

Print ______________________

For Intertek ______________________

Print Walter Rowe

109-B FREEDOM BLVD , YORKTOWN, VA 23692, (PHONE)(757)8745840, (FAX)(757)8745843

Form : 003. 2015