Enclosure 1
Attachment 10

LETTER FROM C. TAYLOR TO T. FAHA, DATED OCTOBER 30, 2014, RE: POST 316(A) MONITORING PLAN FOR LAKE ANNA, WASTE HEAT TREATMENT FACILITY, AND NORTH ANNA RIVER

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Dominion Resources Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
Web Address: www.dom.com

Dominion®

October 30, 2014

Thomas A. Faha
Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, VA 22193

Dear Mr. Faha,

Enclosed for your review and approval is the revised Post 316(a) Monitoring Plan for Lake Anna, Waste Heat Treatment Facility and the North Anna River. This plan satisfies the requirement for the reissued Virginia Pollutant Discharge Elimination System (VPDES) permit no. VA0052451, section E, 2.

Please contact me with any questions concerning this submittal as well as any other ongoing environmental monitoring for North Anna Power Station.

Sincerely,

Cathy C. Taylor

Cathy C. Taylor
Director, Electric Environmental Services

A Monitoring Plan for Lake Anna, Waste Heat Treatment Facility and the North Anna River

by

Environmental Biology
Electric Environmental Services
Dominion Resources

November 2014

Background

The purpose of this monitoring plan is to address the requirements of the recently re-issued NPDES permit for North Anna Power Station (NAPS), permit VA0052451, Section E, Post 316(a) Monitoring, which states:

1. "In accordance with the original 316(a) study submittal and the biological and temperature sampling conducted since then, and to support 316(a) variance approval, the permittee shall continue to conduct temperature and biological monitoring of Lake Anna, the Waste Heat Treatment Facility, and the North Anna River.

2. The permittee shall review the existing Post 316(a) Monitoring Plan and notify the DEQ – Northern Regional Office, in writing, whether it is still accurate and complete by November 8, 2014. If the Post 316(a) Monitoring Plan is no longer accurate and complete, a revised Post 316(a) Monitoring Plan shall be submitted for approval to the DEQ –Northern Regional Office by November 8, 2014. The approved plan is an enforceable part of the permit. Any future changes to the plan must be submitted for approval to the DEQ-Northern Regional Office at least 60 days prior to implementation.

3. Temperature monitoring shall occur at a minimum of eleven (11) stations; three in the WHTF, seven in Lake Anna, and one in the North Anna River. Fixed continuous temperature recorders shall be used at each location to record hourly temperature in degrees Celsius at a depth of one meter for all the stations except at the station in Lake Anna closest to Dike 3 which shall be placed at a depth of three meters. Temperature recorders shall be field verified and calibrated annually.

4. Biological monitoring shall include fish population surveys.

5. The permittee shall submit the results for the preceding year's monitoring by May 31st of each year. The permittee shall submit with the annual report an analysis of the data and recommendations for changes to the study design as appropriate."

1.0 Introduction

In 1972, the North Anna River was impounded to create Lake Anna, a 3885 hectare (9600 acres) reservoir (lake) for the purpose of providing condenser cooling water for the North Anna Power Station (NAPS). NAPS utilizes a once-through cooling water system with a shoreline intake structure and a discharge canal. Adjacent to Lake Anna is a 1376 hectare (3400 acre) Waste Heat Treatment Facility (WHTF) that receives the cooling water. The fishery in Lake Anna is stocked and managed by the Virginia Department of Game and Inland Fisheries (VDGIF).

Aquatic monitoring studies have been conducted on Lake Anna since its inception. In January, 1984, the Company initiated an extensive Section 316(a) demonstration study (P.L. 95-500) to determine if proposed effluent limitations on thermal discharges from the power station were more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish and wildlife in Lake Anna and the lower North Anna River. The final report (Virginia Power 316(a) Report 1986) successfully demonstrated that the operation of the power station had not resulted in appreciable harm to the biological community. The Virginia Water Control Board (VWCB) accepted the study as a successful demonstration in September, 1986. Subsequent to the 316(a) study, the Company committed to the VWCB to continue environmental monitoring on Lake Anna and the lower North Anna River as part of a post-316(a) agreement, using procedures developed and approved by VWCB, VDGIF and others.

Because of the long-term, repetitive and continuous nature of the existing studies, it is imperative for ongoing studies to be similar to historical studies. This will allow for comparisons between and among years. Therefore, this study plan is based on historical studies.

Aquatic monitoring studies on Lake Anna and the WHTF have consisted of fixed continuous temperature monitoring (10 sites), quarterly synoptic temperature surveys (14 sites), quarterly gill netting (6 sites) and quarterly shoreline boat electrofishing (9 sites). Aquatic monitoring studies on the lower North Anna River have consisted of fixed continuous temperature monitoring (1 site) and three electric seine and backpack electrofishing surveys, once per month each year typically in May, July and September (4 sites) and a annual smallmouth bass population survey.

2.0 Temperature Monitoring

Temperature monitoring shall consist of two methods; fixed continuous temperature monitoring and quarterly synoptic temperature surveys.

2.1 Fixed continuous temperature monitoring will occur at 11 stations; three in the Waste Heat Treatment Facility (WHTF), seven in Lake Anna and one in the North Anna River (Figure 2.1)

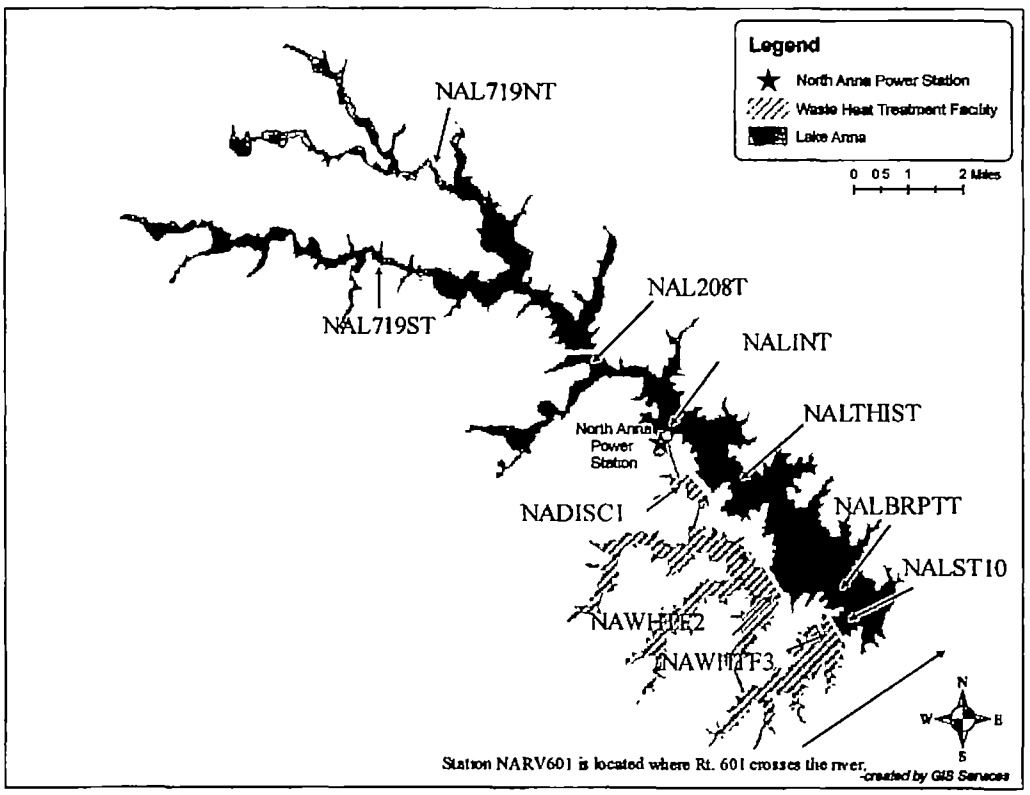


Figure 2.1 Lake Anna Fixed Continuous Temperature Monitoring Stations

Solinst Levelogger Junior Edge data loggers will be utilized for recording continuous water temperature data. The Levelogger is a stainless steel cylindrical logger power by a 5 year battery with an accuracy of ± 0.1°C. All data loggers will be encased in protective, vented PVC tubing during deployment.

Before deployment, each logger is connected to the host computer for launching and initializing. The real time temperature is observed for each logger and then compared with a traceable NST thermometer to verify accuracy. If the temperature as measured is suspect, that logger is placed in a temperature-controlled water bath along with a NST traceable thermometer to test for accuracy. Only loggers with verified accuracy will be deployed.

When deploying the loggers and again when retrieving the loggers, water temperatures will be measured at the one meter depth at each deployment station with a Hydrolab data sonde or comparable temperature instrument. The Hydrolab has an accuracy rating of ±0.1°C and its accuracy is checked against a NST traceable thermometer in a stabilized water bath on an annual basis as recommended by Hydrolab.

The fixed continuous temperature values will be recorded hourly (in degrees Celsius) at a depth of (1) meter at all stations except for Station 10 in the lake near Dike 3 which shall be at a depth of three (3) meters.

2.2 The quarterly synoptic temperature survey will be performed once during each calendar quarter, and will consist of measuring water temperature surface to bottom at one (1) meter intervals at fourteen (14) stations in Lake Anna (Figure 2.2). Water temperature will be measured and recorded utilizing a Hydrolab data sonde or comparable temperature instrument.

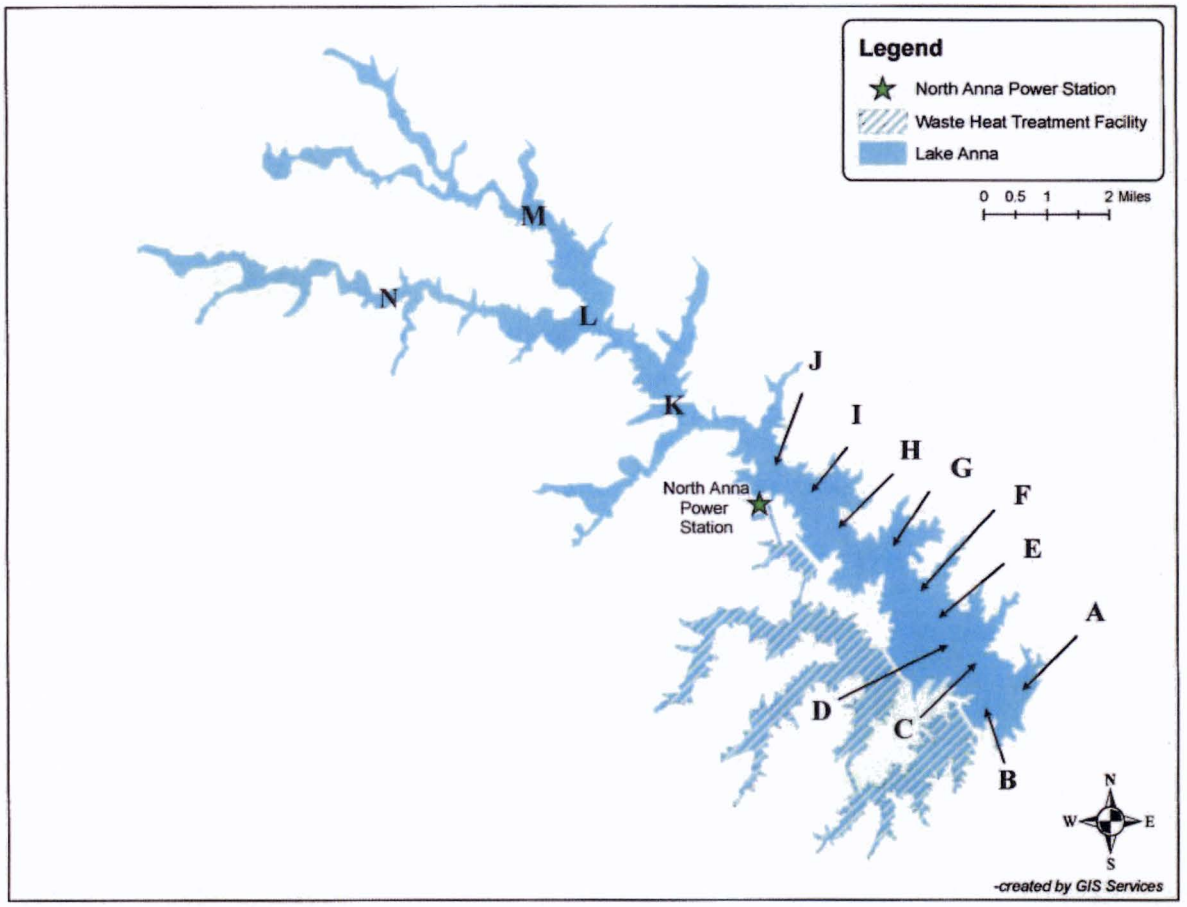


Figure 2.2 Lake Anna Quarterly Synoptic Plume Stations

3.0 Lake Anna Fisheries

Since the impoundment of the lake and the initiation of the lake fisheries studies, two methods have been used, gill netting and boat electrofishing. These methods are consistent with prior monitoring and therefore are recommended for this monitoring plan.

3.1 Gill netting will be used to capture fishes which normally inhabit the deeper strata of the lake, or exhibit a diel movement to and from the shoreline. Each gill net consists of six, fifty foot long by six foot deep panels beginning with ½ inch mesh in the first panel (set next to the shoreline) and increasing by ½ inch increments ending with 3 inch mesh in the final panel. The gill nets are set near littoral drop-off areas for approximately 20 hours including an overnight time period. Gill net surveys will be conducted quarterly at the historical stations depicted in Figure 3.1

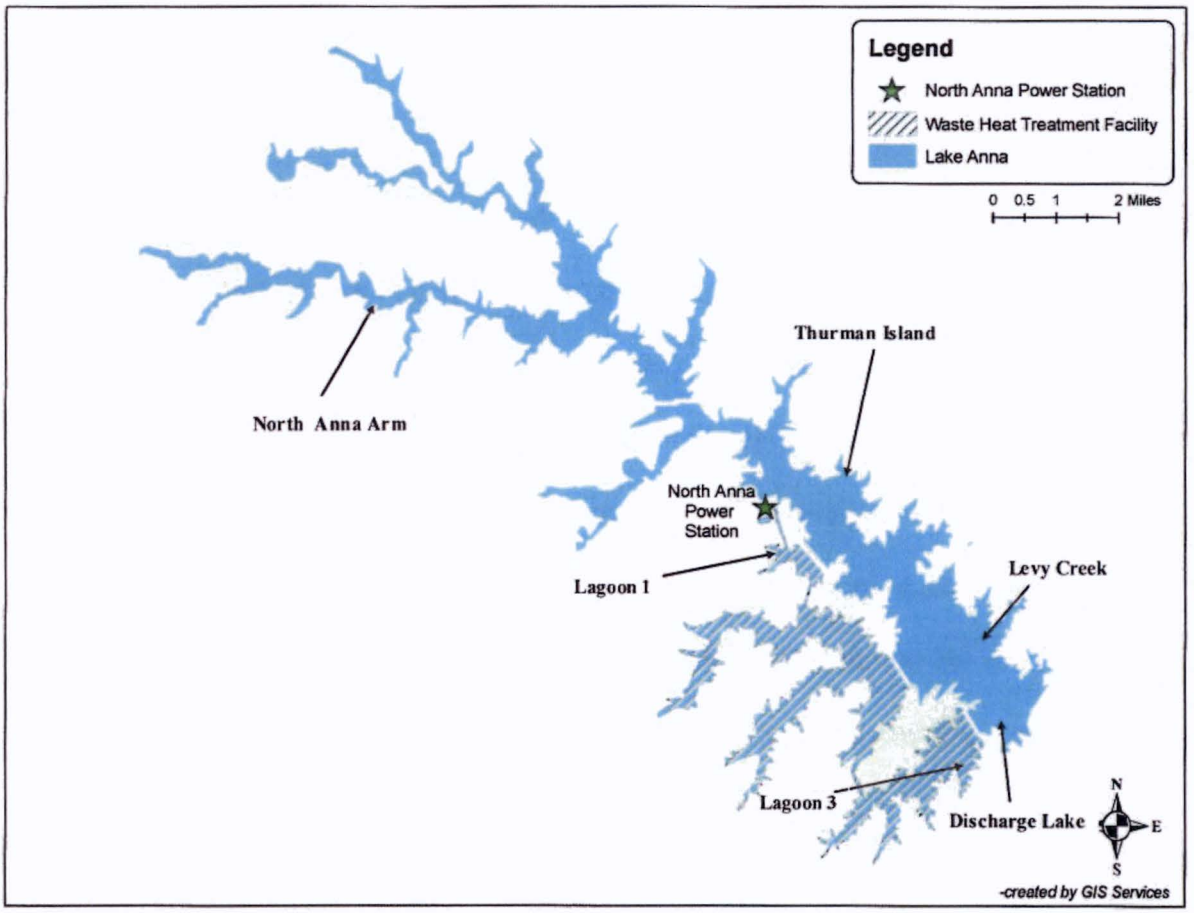


Figure 3.1 Lake Anna Gill Net Sampling Stations

Fish collected by gill netting will be returned to the laboratory and up to 25 individuals of each species will be measured for total length to the nearest millimeter and weight to the nearest gram. Any additional individuals per species will be counted and bulk-weighed to the nearest gram. Standard physicochemical measurements (surface water temperature (°C), dissolved oxygen (mg/L), pH and conductivity (μS/cm) will be recorded at the time of each sample collection.

3.2 Boat electrofishing will be used to evaluate the assemblage and abundance of fish populations which normally occupy the shoreline habitat. Sampling will be performed quarterly at the historical stations identified in Figure 3.2. Each station consists of 100 meters of shore line and normally includes a brush pile except for the dike stations which are comprised of uniform rip-rap.

Fish collected will either be returned to the laboratory for processing or released in the field, i.e., larger game fish will be measured, weighed, and released in the field. In the laboratory, 25 of the individuals per species of game fish will be measured to the nearest millimeter total length and weighed to the nearest gram. The remaining game fish will be enumerated and bulk weighted for each species. Non-game fish will only be enumerated for each species in an effort to increase the number of fish returned to the lake. Standard physiochemical measurements of surface water temperature (°C), dissolved oxygen (mg/l), pH and conductivity (μS/cm) will be recorded at the time of each sample collection.

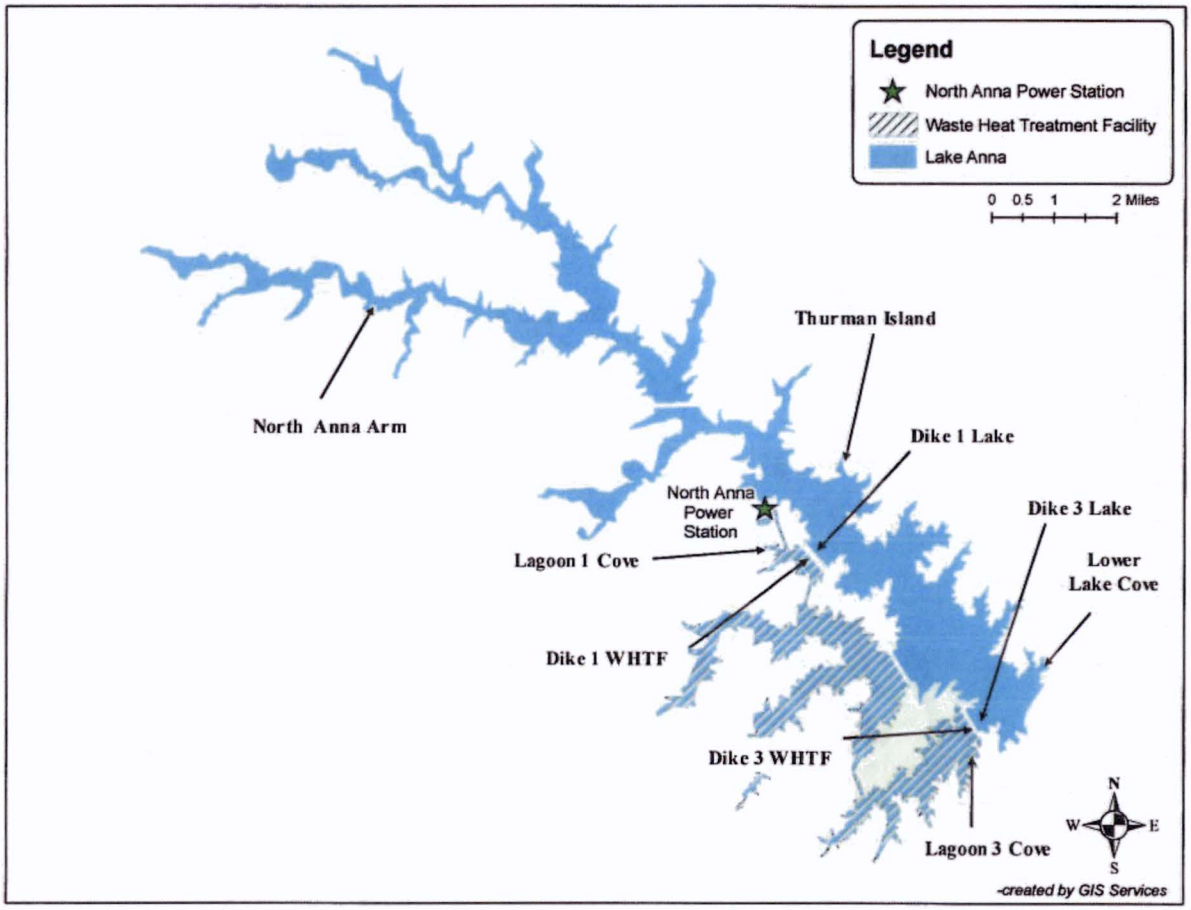


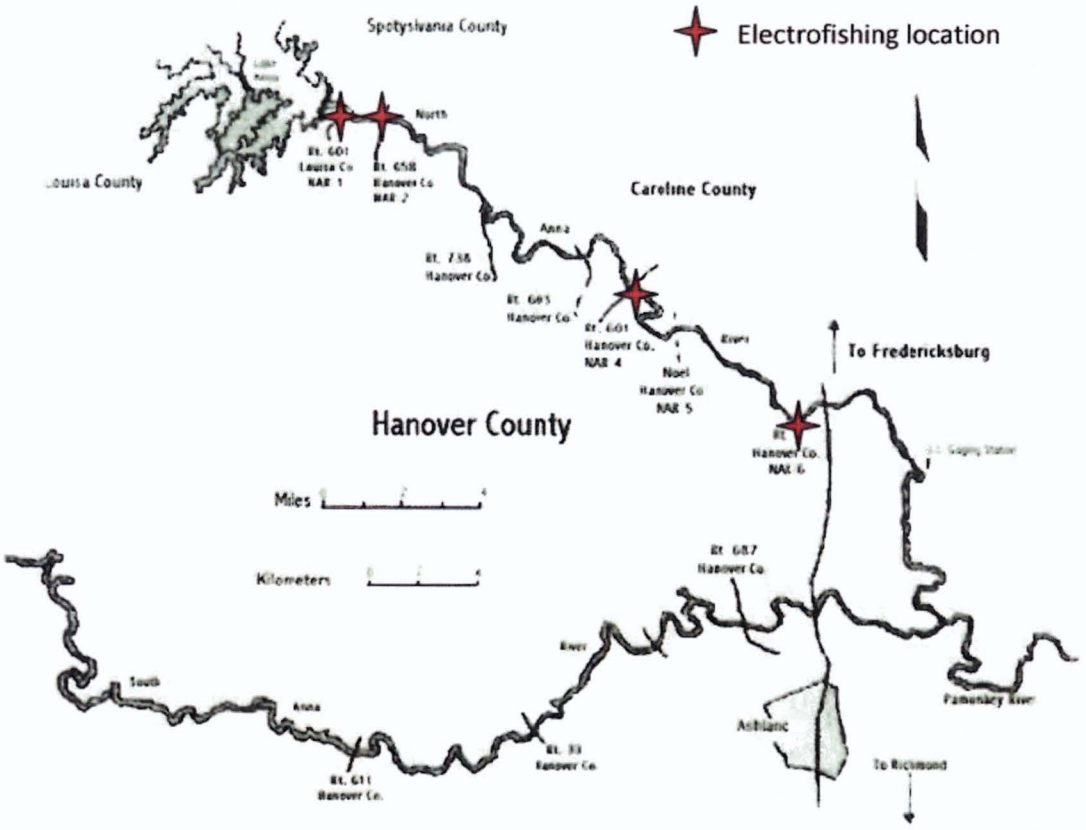
Figure 3.2 Lake Anna Boat Electrofishing Stations

4.0 Lower North Anna River Fishes

Fishes in the North Anna River have been assessed and/or monitored beginning prior to impoundment and continuing to the present. Fish population sampling station locations and fishery collection techniques have remained virtually the same and are proposed to continue going forward. The recently added Smallmouth Bass studies on the North Anna are still evolving and may change throughout the study period.

4.1 Fish Population Studies

Abundance and species composition data for North Anna River fish assemblages will be collected using electrofishing. Consistent sampling techniques have been used in historical North Anna River surveys including electric seine and backpack electrofishing. These techniques have typically been performed at 4 historical stations, approximately three (3) times per year (i.e. May, July, September) (Figure 5.1). Individual samples and sampling events have occasionally been missed due to high, unsafe flow conditions and weather events.



The electric seine is designed to collect fish in riffle and run habitats. Sampling is conducted by working the seine from bank to bank in a zigzag pattern in a reach of riffle/run

habitat approximately 70 meters long. Prior to sampling, each reach is blocked at the downstream end with a 6.5-mm mesh net. Fish are stunned and collected by netters using 6.5 mm mesh dip nets. One set of standard physiochemical measurements of surface water temperature (°C), dissolved oxygen (mg/l), pH and conductivity (µS/cm) will be recorded at each sampling station for each survey conducted.

Backpack electrofishing is also conducted at each station to sample pool type habitats adjacent to electric seine sampling areas. Backpack surveys are typically conducted at the conclusion of the electric seine runs. Sampling is conducted for approximately 600 seconds (10 minutes) of effort at each station.

Fish collected will either be preserved using 10% formalin and returned to the laboratory for processing or released in the field, i.e., larger game fish will be measured, weighed, and released in the field. In the laboratory, 15 of the individuals per species of game fish will be measured to the nearest millimeter total length and weighed to the nearest gram. The remaining game fish will be enumerated and bulk weighted for each species. Non-game fish will only be enumerated for each species in an effort to increase the number of fish returned to the river.

Due to the inherent danger of electrofishing and wading in high water, sampling will not be conducted in river flows greater than 80 cfs as measured at the Partlow gage (USGS 01670400). Sampling will also not be conducted during any weather events that would cause increased risk to personnel such as rain and high winds.

4.2 Smallmouth Bass

The lower North Anna River has been reported by fisherman to have an outstanding smallmouth bass fishery. Past studies by Oak Ridge and Virginia Tech biologists as well as Dominion biologists have also indicated that the smallmouth bass fishery is healthy and thriving.

In order to obtain a better understanding of this species in the river, efforts will be expended to collect young-of-the-year (YOY) Smallmouth Bass for otolith removal and determination of daily ages and an annual survey to monitor size class distribution and relative abundance of Smallmouth Bass. Smallmouth Bass daily ages will be back calculated to estimate spawn dates. Spawn dates will be compared to river conditions, i.e. temperature and flow, with the goal of identifying relationships between those conditions and spawning success. YOY Smallmouth Bass will be collected by the use of a Zodiac electrofisher used as a tote barge (shallow riffles and runs) or a boat electrofisher (deep runs and pools), but other sampling methods may also be explored.

YOY sampling will be primary conducted between NAR-3 (Rt. 603) and NAR-4 (Rt. 601H) beginning in July. Assuming most Smallmouth Bass in the North Anna River spawn in April and May (Lucas 1993), and based off of previous sampling efforts, sampling in July will likely strike a balance between obtaining otoliths that can be confidently aged, and allowing YOY to disperse from nesting sites and grow to a length they can be effectively sampled. An attempt to collect 50 YOY for otolith examination will be made annually. Additionally, any YOY

Smallmouth Bass collected during the fish population sampling will also be retained for age determination.

Size class and relative abundance sampling for Smallmouth Bass will be conducted at NAR-5 in the vicinity of Noel, VA. Sampling consists of electrofishing a sequence of five (5) pools from the upstream to downstream direction using pulsed DC during October when the YOY will most likely have moved from the riffles into the pools (Figure 4.2). Smallmouth Bass collected in each pool will be measured to the nearest millimeter total length and released except for YOY bass which will be retained for age determination. Sampling effort will be measured by the amount of time that the electrofishing unit was energized and delivering current to the water .



Figure 4.2 North Anna River, NAR-5 Zodiac Boat Electrofishing Stations

LITERATURE CITED

Lukas, J.A. 1993. Factors affecting reproductive success of smallmouth bass and redbreast sunfish in the North Anna River, Virginia. Master of Science thesis, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Virginia Power. 1986. Section 316(a) demonstration for North Anna Power Station. Virginia Power, Richmond, Virginia.

Enclosure 1
Attachment 11

LETTER FROM R. BRONSON TO J. WILLIAMS, DATED AUGUST 1, 2018,
RE: WAIVER FOR FEDERALLY LISTED AND ENDANGERED SPECIES SURVEYS

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

August 1, 2018

Northern Virginia Regulatory Section
NAO 2008-2534/ 10-V1256 (Lake Anna)

Dominion Virginia Power
Attn: Mr Jason Williams
Director Environmental
5000 Dominion Boulevard
Glenn Allen, VA 23060

Dear Mr. Williams:

This is in regard to the letter dated June 18, 2018 request for surveys associated with the following federally listed and endangered species: Northern Long-eared bat, Small-whorled pogonia, Sensitive joint- vetch and Atlantic sturgeon. Due to the deferred construction and operation of Unit 3 for Lake Anna Power Station in Louisa County, VA and Walkerton roll-off facility in King William County, VA; the surveys may be waived for 2018 for the above-mentioned species. However, if the construction timeline changes, surveys will be required as stated in the Department of the Army permit.

If you have any questions, please call (757) 201-7828 or email at regena.d.bronson@usace.army.mil .

Sincerely,

BRONSON.REGENA.D.1094003608

Digitally signed by BRONSON.REGENA.D.1094003608
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=BRONSON.REGENA.D.1094003608
Date: 2018.08.01 15:19:14-04'00'

Regena Bronson
Project Manager, Northern Virginia
Regulatory Section

Enclosure 1
Attachment 12

LETTER FROM R. BRONSON TO T. EFFINGER, DATED AUGUST 14, 2020,
RE: WAIVER FOR FEDERALLY LISTED AND ENDANGERED SPECIES SURVEYS

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

August 14, 2020

Northern Virginia Regulatory Section
NAO 2008-2534/ 10-V1256 (Lake Anna)

Dominion Virginia Power
Attn: Mr. Thomas Effinger
Director Environmental
5000 Dominion Boulevard
Glenn Allen, VA 23060

Dear Mr. Effinger:

This is in regard to the letter dated July 20, 2020 request for surveys associated with the following federally listed and endangered species: Northern Long-eared bat, Small-whorled pogonia, Sensitive joint- vetch and Atlantic sturgeon. Due to the deferred construction and operation of Unit 3 for Lake Anna Power Station in Louisa County, VA and Walkerton roll-off facility in King William County, VA; the surveys may be waived for 2020 for the above-mentioned species. However, if the construction timeline changes, surveys will be required as stated in the Department of the Army permit.

If you have any questions, please call (757) 201-7828 or email at regena.d.bronson@usace.army.mil .

Sincerely,

Regena Bronson

Digitally signed by Regena Bronson
Date: 2020.08.14 15:16:23 -04'00'

Regena Bronson
Project Manager, Northern Virginia
Regulatory Section

Enclosure 2

GROUNDWATER TOPICAL AREA DOCUMENT

Attachment 1 - Correspondence from Nadia Glucksberg to Erin Salling, dated June 4, 2020, re: Groundwater Protection Program 5-Year Hydrogeological Review, Haley & Aldrich, Inc.

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Enclosure 2
Attachment 1

CORRESPONDENCE FROM NADIA GLUCKSBERG TO ERIN SALLING, DATED JUNE 4, 2020, RE: GROUNDWATER PROTECTION PROGRAM 5-YEAR HYDROGEOLOGICAL REVIEW, HALEY & ALDRICH, INC.

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

HALEY & ALDRICH, INC
1 Park West Circle
Suite 208
Midlothian, VA 23114
804 419 0199

4 Junw 2020
File No. 130623-003

TO: North Anna Power Station
Erin Salling

FROM: Haley & Aldrich, Inc.
Nadia Glucksberg, Hydrogeologist

SUBJECT: Groundwater Protection Program, Five-Year Hydrogeological Review
North Anna Power Station, Mineral, Virginia

The Nuclear Energy Institute's Industry Groundwater Water Protection Initiative (NEI 0707) recommends revisiting the site's conceptual site model (CSM) every five years to evaluate if the groundwater monitoring program developed for each plant is still relevant and that the current monitoring well network and associated sampling frequency provides adequate assurance that any radiological contamination of groundwater will be detected in a timely manner, prior to off-site migration. This evaluation provides the background setting, additional groundwater data collected since the 18 February 2016 update (Dominion, 2016) and potential data gaps that should be considered to ensure that groundwater impacts are well understood and defined.

1.0 BACKGROUND

The North Anna Power Station (NAPS) is located in Louisa County in central Virginia, northwest of Richmond on Lake Anna. The Site is operated by Dominion Energy, Inc. and is jointly owned by the Dominion Virginia Power Corporation and by the Old Dominion Electric Cooperative.

Geology

Soils and bedrock surface below the plant have been modified during plant construction. Bedrock mapped in the vicinity of the NAPS includes: the Falmouth Intrusive Suite, consisting of granite, quartz monzonite, granodiorite and tonalite; and the Ta River Metamorphic Suite, consisting of amphibolite gneiss (VE&P, 2010). The overlying soils include saprolite (highly weathered bedrock-derived native soils) and represent both Suites mapped on site, likely due to the presence of a dormant fault line. Although highly weathered materials or saprolite are present at the bedrock/soil interface, the bedrock becomes more competent with depth.

Geologic data collected during test boring explorations indicated a generalized profile in the area of the Refueling Water Storage Tank (RWST) 1 pad and adjacent alleyway consisting of fill material placed on top of residual soil overlaying the bedrock material as part of site development.

The following soil units were observed in order of increasing depth below ground surface:

- Processed Fill: A layer of gray sand and gravel fill material (Processed Fill) encountered to approximately 10 to 17 feet below ground surface (bgs). This material appeared to be a granular fill used to backfill the alleyway to current grades. No visible staining or olfactory observations were noted. Note that surficial soil conditions could not be observed in detail, as each borehole location was pre-excavated to approximately 10 feet depths prior to the boring explorations.

- Residual Soil: Residual Soil material was present below the fill material, extending down to the underlying competent bedrock material to approximately 30 to 33-foot depths (GWP-23 location had a thin layer from 10.5 to 11.5 feet bgs). The Residual Soil consisted of a layer of highly weathered bedrock, in the form of a bonded (i.e. dense), tan to yellow/olive brown sand or silty sand material. These silty sands could likely trap water in the vadose zone. Furthermore, there are some horizontal structures within these soils that can further trap perched water and retard vertical migration. The material was consistent in appearance with the underlying parent bedrock material, and although dense, was considerably softer and more friable than the underlying formation. These materials would also be expected to have a higher natural gamma activity than the overlying fill materials and a lower conductivity.

- Bedrock: Competent Bedrock material was encountered in the GWP-19 through GWP-22 locations at depths ranging from of 30 to 33 feet below ground surface. The Bedrock consisted of a tan gray to yellow brown, slightly weathered Granitic Gneiss. At GWP-23, located at the eastern limit of the recent explorations, a tan to red gray, medium-grained Amphibole Gneiss bedrock material was encountered at 11.5 feet bgs.

Hydrogeology

Groundwater at the site, and specifically within the Protected Area, is controlled by the geology as well as Site structures, active sumps, seasonal recharge and Lake Anna. At the Unit 1 RWST, groundwater has been encountered at approximately 20 feet bgs or at approximately 250 feet mean sea level, with seasonal variations of up to 2 feet.

Although existing wells located outside the Protected Area show flow directions toward Lake Anna, within the Protected Area, groundwater is controlled by mat sumps that are designed to control water around the reactor buildings of both units and the auxiliary building. Groundwater is maintained by the Unit 1 and Unit 2 containment mat sumps to an elevation of approximately 240 feet mean sea level, creating a cone of depression in the water table that extends out beyond the RWSTs (Haley & Aldrich, 2012 and 2013).

This is evidenced by the inferred flow direction to the west in wells along the Unit 1 Alleyway, and demonstrates that any tritium releases that would occur up gradient (including the Unit 1 RWST) could be captured and would only be discharged via a monitored pathway. Although these sumps capture

groundwater, a smaller flow component of groundwater migrates via preferred pathways, bypassing the sump and flowing to the north of the Turbine Building. However, at these locations, tritium was not detected, and therefore, is not leaving the site via this pathway.

2.0 RELEVANT CONSTRUCTION PROJECTS

Since the last 5-Year Review, one groundwater monitoring well had to be moved due to the replacement of some piping in the Unit 2 Alleyway. Groundwater monitoring well GWP-15 was properly abandoned and replaced with GWP-15R. The work was completed in winter 2017.

In addition to modifications to the monitoring well network the following relevant conditions reports were filed. Please note that for the purpose of this 5-Year Review, only Condition Reports (CRs) associated with leaks to groundwater or soils have been listed.

Event	CR Number	Date	Description	Impact to Groundwater
Small leak to soils.	CR1030475	02/18/2017	Small leak (1000 ml) from 1-QS-24	No. Area sampled, no impacts.
Leak under insulation to soil.	CR1060475	02/20/2017	Unit 1 RWST yard from 1-QS-24 to soil	No. Area sampled, no impacts.
Sodium Hydroxide leak to soil.	CR030721	03/162016	5-gallon carboy of sodium hydroxide leaked to soil.	No. Soils removed; area sampled.
Quench Spray Leak	CR1032085	03/29/2016	Small release to soil.	No. Soils removed; area sampled.
Spill, U2 RWST valve	CR1011040	9/25/2015	Release from 2-QS-41. (Unit 2 RWST)	No. Valve cleaned; gravel sampled.
Leak, clarifier	Cr1127596	07/24/2019	Leak between liquid waste effluent to the clarifier.	No. Discharge to clarifier tunnel.
Leak quench spray system	CR1111062	11/24/2018	Leak identified next to Unit 1 Chem Addition Tank.	Moderate. NaOH under 1-QS-310. Gravel and soil remediated. Leak repaired.

Based on a review of these CRs, as well as other decommissioning files, the leaks or measured radioactivity has been associated with either Unit 1 and 2 Sodium Hydroxide chemical addition tanks (CAT) or the RWSTs. These are also areas that have wells downgradient to monitor potential groundwater impacts.

3.0 HISTORIC DOCUMENTATION OF TRITIUM IN GROUNDWATER

There are 27 wells and/or piezometers that are monitored as part of the Groundwater Protection Program (GWPP) on-site (Figure 1). Of those locations, NAPS collects groundwater samples from four wells on a monthly basis, five wells on a quarterly basis, and 16 wells on annual basis (Figure 1). The

groundwater results are reported in the Annual Radiological Environmental Monitoring Report and Annual Radioactive Effluents Release Report as well as reviewed internally.

The GWPP program was designed to collect samples from locations that are potentially downgradient from systems, tanks, or practices that have the potential to release tritium to groundwater. Data from the past 15 years was provided by NAPS. There are three wells that that have reported tritium in groundwater at levels that are consistently measured above 5,000 picoCuries per liter (pCi/L); PZ-3, GWP-6 and GWP-18. The occurrence and evaluation of each well is described below. Tritium data reported from these locations is shown on graphs in Attachment 1.

Please note that in the past five years there has only been one other location were tritium was detected above a threshold of 5,000 pCi/L. This threshold was selected as it is one quarter of the drinking water standard and is conservative when the reporting levels are typically at 20,000 pCi/L. Well GWP 3 reported tritium above that threshold once in 2018 (6.087 pCi/L in July of 2018) but has then decreased and has been below 5,000 pCi/L since that event. These data are also shown in a graph in Attachment 1.

Piezometer PZ-3

Tritium detected in PZ-3 as ranged from 900 to 15,373 pCi/L. Groundwater monitoring wells and piezometers are commonly used interchangeably to evaluate groundwater quality. However, because there are no installation records for PZ-3, data collected from this location may only be evaluated as "screening level data" as the tritium results may be representative of the aquifer, ***or*** they may be influenced by perched zones in the vadose zone (above the water table). It is also possible that PZ-3 is screened across several zones and therefore could be influenced by both.

Therefore, analytical results from well GWP-4, located immediately adjacent to PZ-3, are likely representative of the aquifer zone that PZ-3 was intended to monitor. Well GWP-4, in conjunction with the other groundwater monitoring wells, comprises a comprehensive network in the Unit 1 Alleyway to evaluate tritium in the overburden soils. Together with the qualitative or "screening level data" from PZ-3, this network confirms that there is some residual tritium in groundwater, and that the overall extent of tritium impacted groundwater is generally understood. There are no unmonitored discharges migrating off-site.

Monitoring Well GWP-6 and Replacement Well GWP-6R

Historic tritium data collected from the original well GWP-6 demonstrated a correlation with groundwater elevations; with elevated tritium results when there was a higher groundwater elevation. This pattern suggested a source within the vadose zone (or the zone between the ground surface and the water table) that leaches out at different rates.

Tritium concentrations remained generally constant over several years' time showing seasonal fluctuations that suggested a historic or constant source. This also correlated with historic accounts of past surface releases of boron and tritium in the area of the Unit 1 RWST.

GWP-6 was initially constructed with a one-inch inside diameter (ID) well, installed using a GeoProbe. In 2015, the well was abandoned and replaced with a four-inch well, GWP-6R (Haley & Aldrich, 2015). The larger size was to better evaluate well conditions and prepare for the potential of having to pump or dewater the area to extract impacted groundwater. No tritium was detected from GWP-6R. The increased flow rate into the well suggests that the samples are a better representation of groundwater quality across the well screen. Well GWP-20 was also installed within a five feet radius of GWP-6R, but screened in the bedrock/soil interface, i.e. below the screen set in GWP-6R. No tritium was detected at this location, further supporting a shallow source (soil).

In 2015, Haley & Aldrich also conducted a dye tracer study to better evaluate groundwater flow both below the Unit 1 RWST as well as how precipitation infiltrates the vadose zone to reach the underlying aquifer. As part of this investigation, a green dye (Fluorescein) was introduced at depth near and upgradient of the the Unit 1 RWST. The green dye was at the mat sump within days following the dye introduction. The red dye (Rhodamine WT [RWT]) was introduced to shallow surface soils on the downgradient side of the RWST, where historic accounts reported release of tritium and boron. This red dye was detected two years after introduction at well GWP-19, confirming that it is very likely that historic releases to the ground surface near the piping near the Unit 1 RWST release low concentrations of tritium to the environment. However, it should also be noted, as confirmed by the green fluorescein dye, once the tritium reaches the water table in the Protected Area, groundwater in this area is captured by the mat sumps and therefore any tritium that reaches the aquifer is also captured and discharged via a monitored pathway.

This data also suggests that the tritium detected at PZ-3 and the original GWP-6 was from historic releases trapped or perched in the vadose soils and based on the current monitoring program, do not warrant additional investigations.

Monitoring Well GWP-18

Tritium has historically been reported at well GPW-18 at concentrations close to those reported in Lake Anna. Given this observation, coupled with its proximity downgradient from the fire suppression system, it was hypothesized to create a localized groundwater mound and suggesting a potential leak in that line. However, in 2019, levels reached as high as 12,930 pCi/L suggesting other potential source(s), possibly from water in the Boron Recovery Tank (BRT) Tunnel. This water was then removed from the BRT Tunnel and the area inspected. No leaks were identified. It is believed the tritium in the tunnel is leaching from the concrete structure or washout/rainout from the station releases or impacts from a past release. However, it should be noted that levels have declined to below 5,000 pCi/L, which is similar to the Lake Anna levels.

4.0 SUMMARY

The current groundwater monitoring network provides adequate assurance that radiological contamination of groundwater will be detected in a timely manner (i.e., prior to migration off-site). Both the historic tritium levels and current data do not pose a risk to human health and the environment; the current tritium levels are well below the drinking water standard of 20,000 pCi/L. Furthermore, the impacted groundwater is controlled and discharged via a monitored discharge.

Based on the review of the hydrogeological data presented in the Hydrogeologic Assessment and Final Safety Analysis Report (FSAR) Review for NAPS, no changes are needed to the Groundwater Section of the Updated FSAR.

However, as a good practice, the following are limited recommendations based on the condition of the current network:

- Abandon the damaged wells or wells no longer required by the monitoring well network or are dry.
- Discontinue sampling wells on a monthly basis, but rather include them in the quarterly program, as there is sufficient data to confirm and monitoring the CSM.

REFERENCES

1. VE&P, 2010. Virginia Electric & Power Company. North Anna Power Station, Units 1 and 2, Application for Renewed Operating Licenses, Appendix E "Applicant's Environmental report – Operating License Renewal Stage, North Anna Power Station Units 1 and 2, Virginia Electric & Power Company, License Nos. NPF-4 and NPF-7."

2. Haley & Aldrich, 2012, Independent Review of the Groundwater Conceptual Site Model North Anna Power Station, Mineral, Virginia, August 29, 2012.

3. Haley & Aldrich, 2013. Draft Groundwater Investigation Report, North Anna Power Station, Mineral, Virginia. October 25, 2013.

4. Haley & Aldrich, 2015. Groundwater Investigation Report, North Anna Power Station, June 2015.

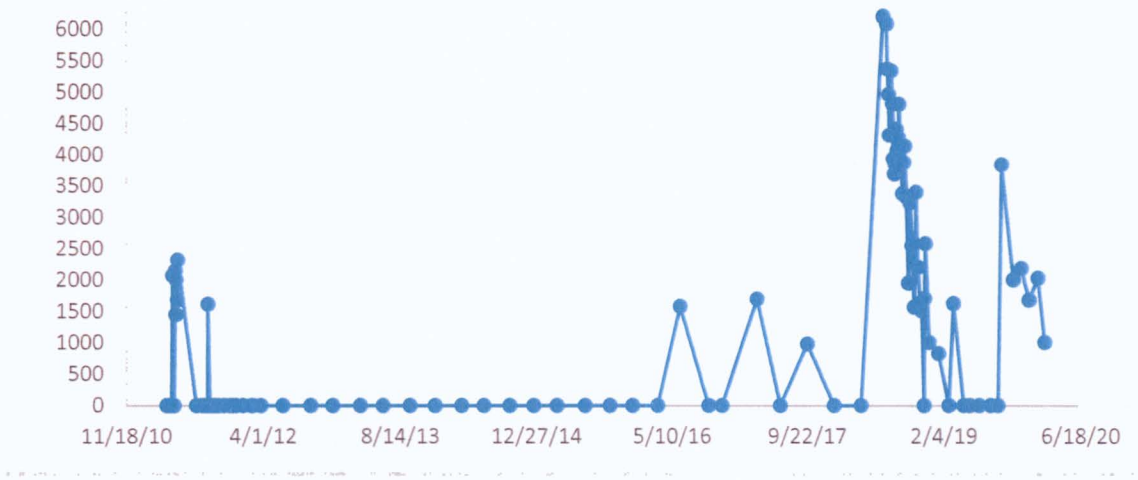
5. Dominion, 2016. Memorandum on *Hydrogeologic Assessment and FSAR Review, North Anna Power Station*, Updated February 18, 2016. From Donald Hintz, Electric Environmental Services (EES) to Nora Nicholson, Health Physics, NAPS.


BTW-2
BTW
TTW-1
TTW-2
TTW-3
TTW-4
TTW-5
VIRGINIA POWER
TURBINE BUILDING
GWP-4
PZ-3
GWP-5A
GWP-21
GWP-7
GWP-3
GWP-9
GWP-15
GWP-8
GWP-19
GWP-20
GWP-22
GWP-6R
GWP-13
GWP-23
GWP-16
GWP-14
REACTOR CONTAINMENT UNIT 2
REACTOR CONTAINMENT UNIT 1
GWP-17
GWP-18
LEGEND
GWP-13
DESIGN
OBSERV
DRILLIN
HALEY &
GWP-19
DESIGN
GROUN
DRILLIN
MONITO
GWP-9
DESIGN
WELL IN
NOTE
1. BASEMAP SOUR
0
HALEY ALDRICH
NO
MI

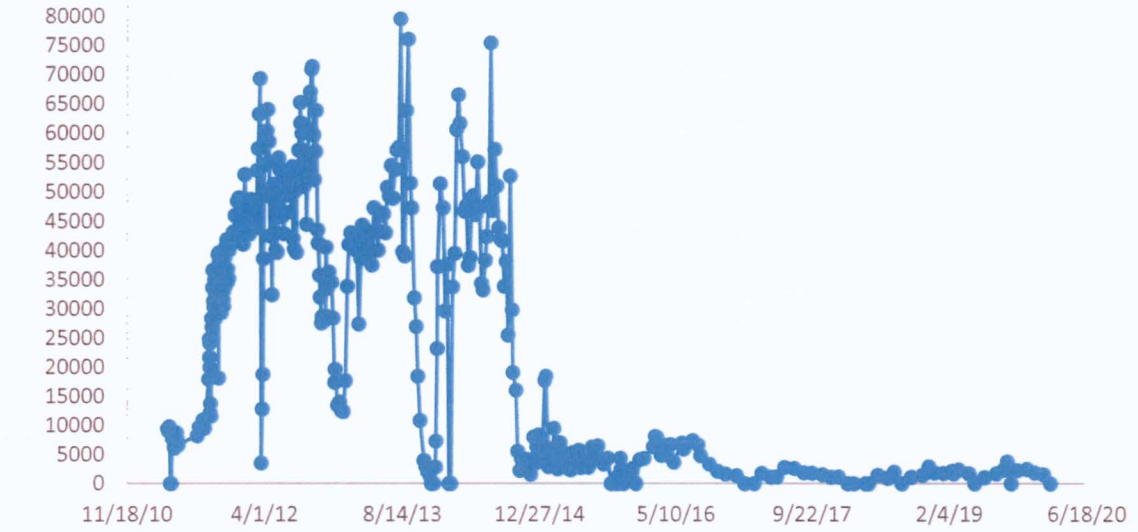
ATTACHEMENT 1

Tritium Results above 5,000 pCi/L
2016 through 2020

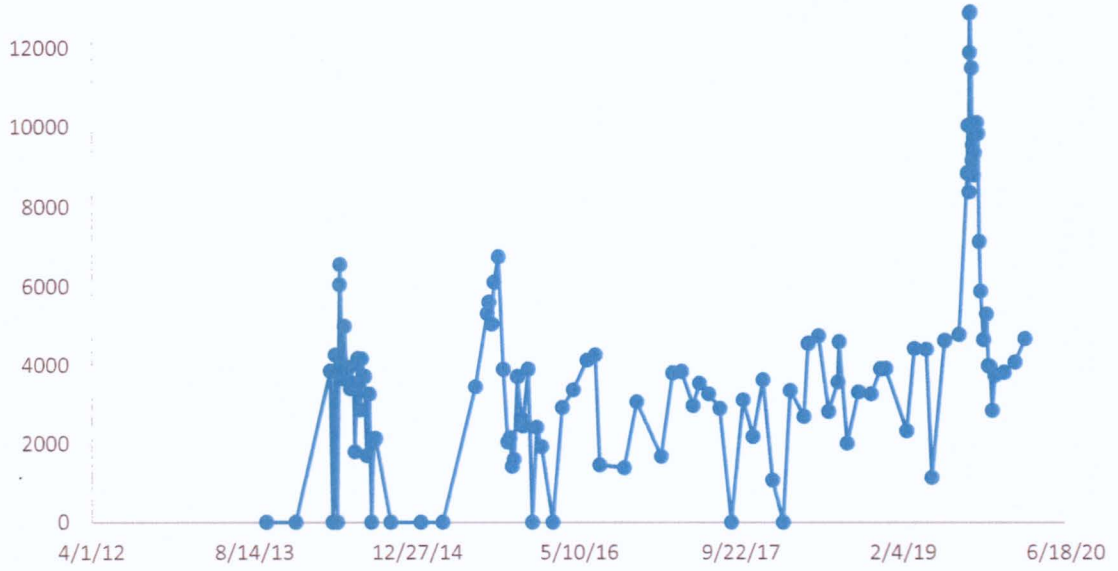
GWP-3
Tritium Conc (pCi/L)



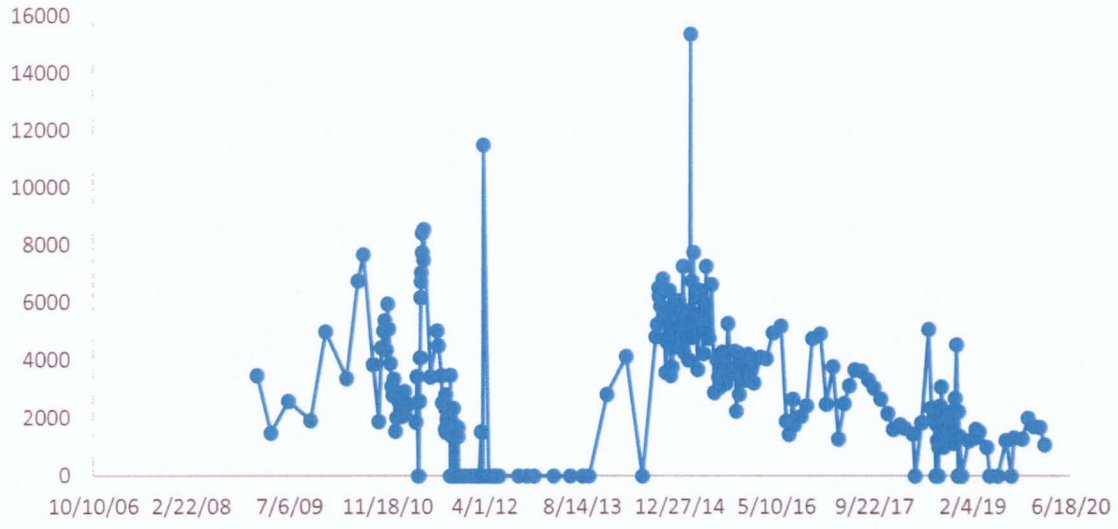
GWP-6
Tritium Conc (pCi/L)



GWP-18
Tritium Conc (pCi/L)



PZ-3
Tritium Conc (pCi/L)



Enclosure 3

TERRESTRIAL TOPICAL AREA DOCUMENTS

Attachment 1 - Flora and Fauna Habitat Management on Transmission and Distribution Rights-of-Way in Virginia, Guidance Document, August 26, 2013, Dominion Environmental Services

Attachment 2 - Invasive Species Management, Guidance Document, October 3, 2016, Dominion

Enclosure 3
Attachment 1

FLORA AND FAUNA HABITAT MANAGEMENT ON TRANSMISSION AND DISTRIBUTION RIGHTS-OF-WAY IN VIRGINIA, GUIDANCE DOCUMENT, AUGUST 26, 2013 DOMINION ENVIRONMENTAL SERVICES

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Dominion Environmental Services

Guidance Document

Flora and Fauna Habitat Management on Transmission and Distribution Rights-of-Way in Virginia

Written Date: August 26, 2013

Revision Date:

Document Owner: Matt Overton

Table of Contents

1.0	**Scope**	**3**
2.0	**Dominion Business Units Potentially Impacted**	**4**
3.0	**Background**	**4**
4.0	**Vegetation Maintenance: Best Management Practices (BMP)**	**5**
5.0	**BMP Selection**	**8**
6.0	**Contacts**	**9**
7.0	**Distribution List**	**9**
Site Location Map		**12**
Appendix A: Site List		**13**
Appendix B: Plant List		**25**
Appendix C: Memorandums-of-Agreement		**102**

Dominion Environmental Services

Guidance Document

Flora and Fauna Habitat Management on Electric Transmission and Distribution Rights-of-Way in Virginia

1.0 Scope:

This guidance addresses Dominion's process for selecting appropriate vegetation management practices on sites known be inhabited by rare, threatened, and/or endangered plant species along electric transmission and distribution utility lines. Because these designated plant species are not tolerant to herbicide treatment and any form of habitat destruction, special considerations are needed to ensure that these plants continue to propagate on Dominion's electric transmission and distribution rights-of-way (ROW).

In addition, seven Memorandums-of-Agreement (MOAs) exist that require special ROW management in the event of maintenance or enhancement. The seven MOAs are discussed further in Section 4.2 and are presented in Appendix C. They are entitled:

1. Corolla to Carova Distribution Line
2. Currituck Sound Transmission Line
3. Scuppernong Transmission Line
4. Virginia Quail Council
5. Roanoke River Transmission Line
6. Nags Head Woods Transmission Line
7. The W&OD Trail Transmission Line

Currently, this document only applies to gas line rights-of-way where a right-of-way is shared with a Dominion electric transmission and/or distribution line. Gas line rights-of-way have not been part of the rare plant surveys to date.

Threatened and/or endangered (T&E) species may be listed either by the United States Fish and Wildlife Service (USFWS – Federal) or the Virginia Department of Agriculture and Consumer Services (VDACS – State). In addition, the Virginia Department of Conservation and Recreation (VDCR) – Natural Heritage Division ranks each native species found in Virginia based on its degree of rareness from S1 (very rare) to S5 (very common), which includes FEDLE/LT (Federally Listed Endangered or Threatened) and SOC (Species of Concern). For the purposes of defining a "rare" plant, those ranked as either S1, S2, FEDLE/LT, and SOC are considered "rare" and are determined to be worthy of special management considerations.

In order to comply with applicable state regulatory requirements and permits, any applicable SCC requirements, and to minimize the potential environmental and financial risks associated with impacts to designated T&E species (a potential civil offense) and potential public relation and sustainability considerations associated with impacts to designated rare plants, it is important

for Dominion to develop and follow guidance for the selection and best management practices for vegetation management on selected transmission and distribution rights-of-way.

2.0 Dominion Business Units Potentially Impacted:

This guidance is applicable to all Dominion electric transmission and distribution rights-of-way and operations that maintain vegetation through some form of treatment, either chemically, mechanically, etc and/or are required by one of the MOAs to specifically manage floral and faunal habitat within the ROW.

This document could also guide Transmission and Distribution construction services when accessing infrastructure for repair or replacement.

3.0 Background:

One well known modern refuge for rare plants species is powerline rights-of-way. Transmission and distribution lines are maintained as open-canopy habitats to prevent woody growth from damaging the powerlines and interfering with line maintenance. These areas are dominated by native grasses, forbs, and the rare plants that have historically thrived in similar open-canopy habitats.

In 1973, the United States enacted the *Endangered Species Act*, which provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. The Act provides for:

- determination of species as endangered and threatened;
- prohibits unauthorized taking, possession, sale, and transport;
- provides authority to acquire land for the conservation of listed species,
- authorizes establishment of similar State programs;
- assesses civil and criminal penalties for violating the Act; and
- authorizes the payment of rewards.

Species are designated as either threatened or endangered by the U.S. Fish and Wildlife Service. In Virginia, additional species may be designated as threatened, endangered or degrees of rareness by the Virginia Department of Conservation and Recreation – Division of Natural Heritage (VA DCR-DNH). In Virginia, species are protected by either the Virginia Department of Game and Inland Fisheries (all species except plants and insects) or the Virginia Department of Agriculture and Consumer Services (plants and insects).

In 1979, the *Endangered Plant and Insect Species Act*, (Chapter 10 §3.2-1000 through 1011 of the Code of Virginia) provided further protection of T&E species above and beyond the federal listed species.

The *Virginia Natural Area Preserves Act* (DCR-DNH - Chapter 10 §10.1-209 through 217 of the Code of Virginia) mandates VDCR to rank each species on its relative abundance (i.e., degree of rareness).

Any person violating the Endangered Species Act is guilty of a Class 1 misdemeanor unless another penalty is specified. Federal listed species may be taken (killed or otherwise impacted beyond the plant's ability to thrive) with "Take" permits. These permits can take months or even years to obtain. While State listed species may be taken without permit with landowner permission, Dominion has agreed with VDCR to protect these species identified in our ROWs.

Links:

Endangered Species Act
http://epw.senate.gov/esa73.pdf

Virginia Endangered Plant and Insect Species Act
http://www.vdacs.virginia.gov/plant&pest/endangered.shtml

Virginia Natural Area Preserves Act
http://www.dcr.virginia.gov/natural_heritage/natural_area_preserves/index.shtml

In 1995, the first of several surveys for T&E and rare plants were initiated between Dominion personnel and VDCR – Natural Heritage Division. VDCR is the Virginia agency responsible by statutory authority under the Virginia Natural Area Preserves Act (Section 10.1-209 through 217, Code of Virginia) for inventory, database maintenance, protection, and management of Virginia's natural heritage resources. Specific sites were chosen, based on desktop reviews, identifying sites within rights-of-way that had the highest likelihood for rare plant communities and then visited during annual field events in 1995 through 1998. The results of these field surveys are documented in a series of reports.

Fifty-seven (57) sites on Dominion ROWs were identified as being inhabited by T&E and/or rare plants (a list is presented in APPENDIX A). These sites support seventy-six (76) T&E and rare plant species (presented in APPENDIX B).

All of the identified sites were revisited in 2005 and 2012 to document the presence/absence and overall health of the T&E and rare plants.

4.0 Best Management Practices (BMP)

4.1 Vegetation Maintenance

Historically, most ROWs were maintained via mowing using tractors and bushhogs on a three year schedule. Recently, the use of selective herbicides has been utilized for Dominion's ROWs, except in special areas where herbicide treatment is precluded, such as sites near sensitive

resources and waterbodies. The use of selective herbicides allows the user to "select" only those species that are undesirable. Specifically, along Dominion's ROWs, only woody species that may grow tall enough to interfere with powerline operation would be selected for treatment. This allows for other plants, such as the T&E and rare plants, to continue to thrive without being affected by other management means. Most sites are maintained on a 3-5 year rotating cycle.

The selective herbicide management is only as "selective" as the user. There may be collateral damage to adjacent plant species if the herbicide is applied "nonselectively." A plant affected by herbicide is killed to the root with little chance of survival. Consequently, in the selected sites with known T&E and rare plants, herbicide management may not be the best management practice. Impacts to these plants should be avoided, which may dictate another form of vegetation management such as mowing – which allows the plant to re-germinate from the unaffected root system. Mowing vegetation mimics the results of fire in nature where the plant is damaged above the ground surface but remains intact beneath the ground surface and is able to re-germinate when suitable conditions return. However, mowing may not be the only alternative based on site restrictions for access or maneuverability. Another form of selective herbicide treatment may be used on these sites is called basal/stem injection (commonly called hack and squirt). This form of treatment is very selective in its treatment and causes little to no collateral damage with its application. A site specific determination should be made for each site.

4.2 Memorandums-of-Agreement

Seven Memorandums-of-Agreement (MOAs) exist that require special ROW management in the event of maintenance or enhancement. These MOAs remain enforceable in perpetuity unless otherwise indicated in each section.

4.2.1 Corolla to Carova Distribution Line

This agreement is for the cooperative maintenance by Dominion and the North Carolina Department of Environment and Natural Resources – Division of Coastal Management for an electric distribution line right-of-way for installation and maintenance of an underground electrical cable to meet additional power capacity demands and reliability to the Currituck Outer Banks.

4.2.2 Currituck Sound Transmission Line

The increased utilization of electric power poles along the Outer Banks as nesting sites by osprey presented a danger to the birds. In cooperation with the Town of Kitty Hawk, Dominion (formerly North Carolina Power) established additional nesting sites for the osprey by leaving intact twelve concrete transmission structures crossing Currituck Sound with osprey nesting platforms.

This agreement was through December 31, 1990; however, the nesting platforms still remain.

4.2.3 Nags Head Woods Transmission Line

An agreement between Dominion and The Nature Conservancy (TNC) calls for cooperative maintenance along a transmission right-of-way (50-feet wide) through parcels owned by TNC in the Atlantic Township of Dare County, North Carolina. The purpose of the agreement is to minimize any interference with or harm to the ecological integrity of the Nags Head Woods Ecological Preserve.

4.2.4 Roanoke River Transmission Line

A Memorandum of Understanding (MOU) between Dominion and the U.S. Fish and Wildlife Service for maintenance of a transmission line right-of-way through the USFWS' property designated as the Company Swamp and Hampton Swamp tracts. The MOU describes Dominion's options for tree removal within the right-of-way and just outside the boundary.

4.2.5 Scuppernong Transmission Line

A Department of the Army Corps of Engineers wetland permit (Permit no. SAWC088-N-089-0221; State permit no. 161-88) allows for construction of a transmission line across the Scuppernong River in Tyrrell County, North Carolina. Among other requirements, one of the mitigation tasks is the placement of twelve wood duck boxes in the vicinity of the Scuppernong River.

4.2.6 Virginia Quail Council

Dominion is a signature of the Virginia Quail Council Memorandum of Agreement (MOA). As a signature, Dominion agrees to actively support the Virginia Quail Action Plan through internal and external outreach, applicable research, and the promotion and application of land management practices and programs, subject to the availability of funds, to establish and maintain habitat for bobwhite quail and other early succession wildlife species in Virginia.

4.2.7 The W&OD Trail Transmission Line

This MOU between Dominion and the Northern Virginia Regional Park Authority is to establish vegetation management guidelines where the W&OD Trail and Dominion transmission lines co-exist. Specific guidelines on right-of-way vegetation management are documented.

5.0 BMP Selection

All identified sites were surveyed using a GPS unit in 2012. These areas have been posted on either the electric Transmission or Distribution GIS layers. The transmission layers are posted on the current Google Earth layers used by the foresters. Distribution layers are posted on the distribution-only GIS system.

If vegetation management, or any maintenance/construction work that may impact vegetation through construction activity or access to or through these areas, is proposed for one of the 57 selected sites within the boundaries displayed on the GIS layers, the Supervisor of Forestry, Supervisor of Construction, and/or Environmental Biology should be consulted on the best BMP to employ. The decision on which management technique to use is strictly site specific and must be made through coordination with all parties.

There are several alternatives.

1. Proceed with selective herbicide treatment with specific areas demarcated as "No Treatment Areas",
2. Choose an alternate vegetation management tool such as mowing, or
3. Avoid vegetation management on the selected site all together.

6.0 Contacts

Regarding This Guidance Document:

1. Karen Canody 804-271-5304 or karen.k.canody@dom.com
2. Matt Overton 804-271-5373 or matt.overton@dom.com

7.0 Distribution List

7.1 Electric Environmental Services

Pam Faggert

Karen Canody

Alan Ball

Anikka Moore

Ken Roller

Liz Willoughby

Jason Ericson

Alice Prior

Cathy Taylor

Glenn Johnson

Rick Woolard

Don Hintz

Andy Gates

Oula Shehab-Dandan

Steve Horn

Manna Chan

7.2 Environmental Policy

Paula Hamel

Roberta Gellner

Lenny Cupuis

Dennis Slade

7.3 Environmental Biology

Chris Taylor

Bob S. Andrews

Paul Vidonic

Casey Seelig

Glenn Bishop

Robert Graham

Taylor Allen

7.4 Environmental Business Support

Bob Bisha

Becky Remick

Corey Chamberlain

Kim Lanterman

Larry Labrie

7.5 Gas Environmental Services – Virginia

Lisa Moerner

Paul Dickens

Chuck Valentino

Tim Carter

Brad Will

Sharon Burke

Roland Pratt

Jasmine Scheuring

Meghann Quinn

Bill Scarpinato

Greg Eastridge

Casey Talento

Gina Kelly

Jennifer Broush

Eric Corder

Mike Leger

BillWilkinson

Bill Morrison

Jim Puckett

Christopher Todd

Troy Hawkins

Alex Daquila

Paul Dickson

Jeff Zehner

Danielle Axson

Scott Kingston

Richard Gangle

Tara Miletti

Robert Prescott

Jeffrey Prawdzik

Kendra Cumpston

Thomas Samarco

7.6 Dominion ECCs – Virginia

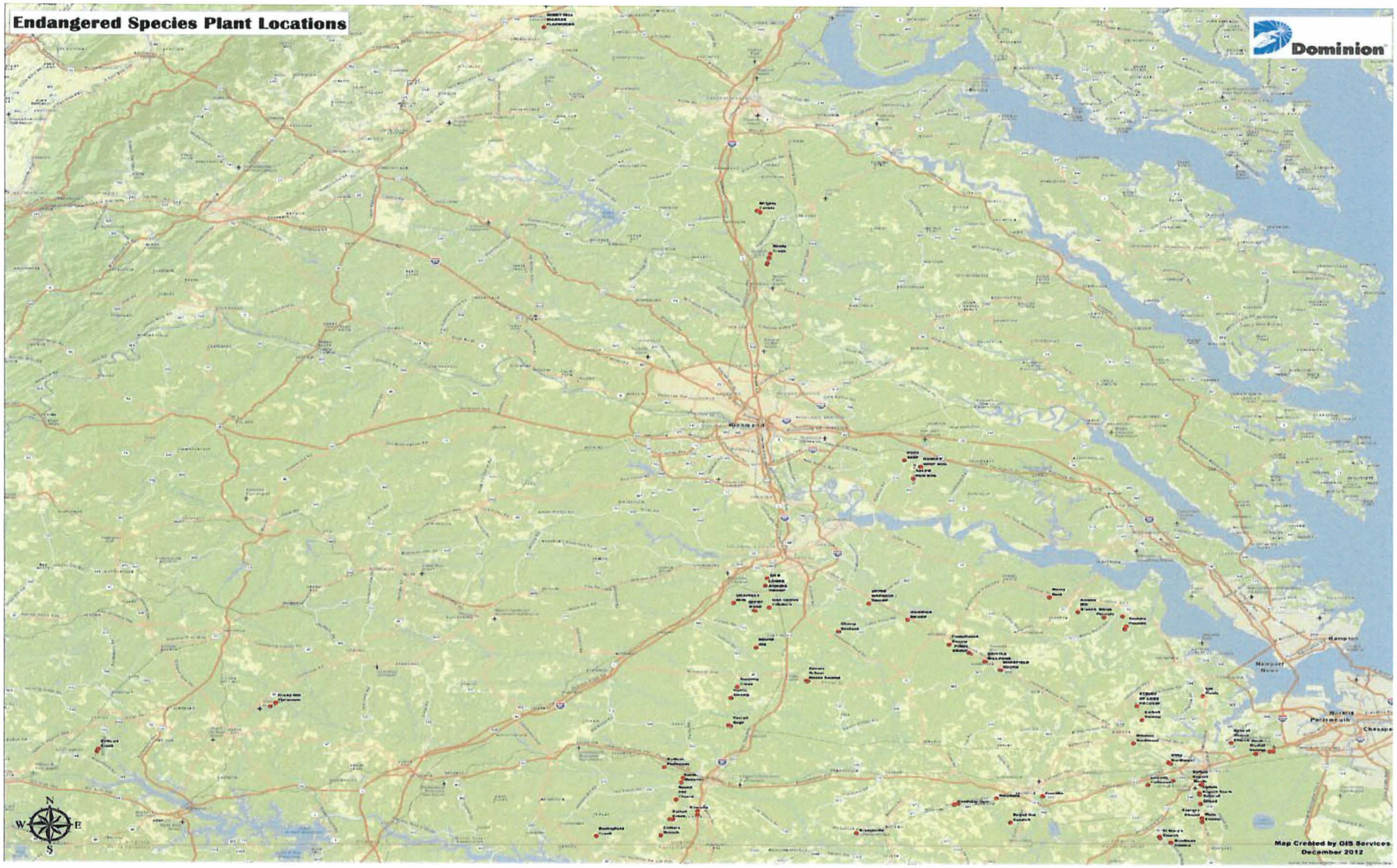
Randy Markey
Sara Bell
Adam Cooper
Bruce Sanders
Tim Hamlet
Jeff Marcell
Laura Shumaker
Scott Morelen
Phyllis Wells
Beverly Wood
Jean Tribull
Dawn Garber
Geoffrey Hensley
Charles K. Allen
Christy Armitage
Erik Reyes

7.7 Dominion Transmission (Bulk Power) – Virginia

Mike Brucato
Jeff Back
Jon Tanner
Kalena Comer
Michael Kirk
Tom Darling
Allen Baxter
Jennifer M. Felix
Joshua Whirley
Kathy McDaniel
Peter Donovan

7.8 Dominion Distribution (Delivery) - Virginia

Jay Griles
Jeff Geis
Sam Vaughan
Dale Crutchfield
Randy Clarke


Endangered Species Plant Locations
Dominion
Map Created by GIS Services
December 2012

APPENDIX A. SITE LIST

Site	County	Plant common name	Plant scientific name	Rank
Balm of Gilead	Suffolk City	Spreading pogonia	*Cleistes divaricata*	S1
		Pine barren gentian	*Gentiana autumnalis*	S1
		Bay-gail holly	*Ilex coriacea*	S2
		Ciliate meadow-beauty	*Rhexia petiolata*	S1
		Short-beard plumegrass	*Saccharum brevibarbe*	S1
		Slender nutrush	*Scleria minor*	S2
Bedingfield Creek Swale	Brunswick	Golden colicroot	*Aletris aurea*	S1
Berry Hill Diabase Flatwoods	Culpeper	Susquehanna cherry	*Prunus pumila v. susquehanae*	S1
Branchville	Southampton	Southern bog goldenrod	*Solidago gracillima*	S2
Brittles Millpond	Sussex	Red milkweed	*Asclepias rubra*	S2S3
		Toothache grass	*Ctenium aromaticum*	S1
		Slender marsh rose-pink	*Sabatia campanulata*	S2
		Slender nutrush	*Scleria minor*	S2
Carbell Swamp	Isle of Wight	Many headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
Cat Ponds East	Isle of Wight	Maidencane	*Panicum hemitomon*	S2

Site	County	Plant common name	Plant scientific name	Rank
		Two-formed rose-pink	*Sabatia difformis*	S1
Cattail Creek	Greensville	Short-leaved beardgrass	*Gymnopogon brevifolius*	S2S3
		A St. John's wort	*Hypericum setosum*	S1
		Small capitates beakrush	*Rhynchospora cephalantha v. attenuata*	S1
		A beakrush	*Rhynchospora perplexa v. virginiana*	S1S2
Cherry Orchard	Sussex	Cuthbert turtlehead	*Chelone cuthbertii*	S2
		Bog-buttons	*Lachnocaulon anceps*	S2
		Slender marsh rose-pink	*Sabatia campanulata*	S2
		Slender nutrush	*Scleria minor*	S2
Collier Branch	Greensville	Atlantic tickseed	*Coreopsis oniscicarpa*	S1
		Savanna eryngo	*Eryngium integrifolium*	S1
		Creeping St. John's wort	*Hypericum adpressum*	S1
		Rafinesque's seedbox	*Ludwigia hirtella*	S1
		Sessile-leaved hornpod	*Mitreola sessilifolia*	S1
		Slender marsh rose-pink	*Sabatia campanulata*	S2
		Blue maidencane	*Amphicarpum purshii*	S1
		Long-leaf milkweed	*Asclepias longifolia*	S1

Site	County	Plant common name	Plant scientific name	Rank
		White-top fleabane	*Erigeron vernus*	S2
		Bog rush	*Juncus elliottii*	S1S2
Coppahaunk Swamp	Sussex	Red milkweed	*Asclepias rubra*	S2S3
Cypress Chapel	Suffolk City	Short bearded plumegrass	*Saccharum brevibarbe*	S1
Delaware	Southampton	Rough hair panic grass	*Dichanthelium strigosum v. strigosum*	S1
Depot Road	Dinwiddie	Cuthbert turtlehead	*Chelone cuthbertii*	S2
		Southern purple pitcher plant	*Sarracenia purpurea ssp. venosa*	S2
		Slender marsh rose-pink	*Sabatia campanulata*	S2
		Slender nutrush	*Scleria minor*	S2
Difficult Creek	Halifax	Carolina thistle	*Cirsium carolinianum*	S1
		Smooth coneflower	*Echinacea laevigata*	FED LE
		Rattlesnake master	*Eryngium yuccifolium v. yuccifolium*	S2
		Obovate marshallia	*Marshallia obovata v. obovata*	S1
		Trailing phlox	*Phlox nivalis v. henizii*	S2S3
		American ipecac	*Porteranthus stipulates*	S1
Emporia	Greensville	Pine barrens reedgrass	*Calamovilfa brevipilis*	S1
		Slender rattlesnake root	*Prenanthes autumnalis*	S2

Site	County	Plant common name	Plant scientific name	Rank
		Ciliate meadow beauty	*Rhexia petiolata*	S1
		Small capitates beakrush	*Rhynchospora cephalantha v. attenuata*	S1
		Slender nutrush	*Scleria minor*	S2
		Dense-flowered camas	*Zigadenus densus*	S1
Foxtail Bogs	Greensville	Golden colicroot	*Aletris aurea*	S1
		Red milkweed	*Asclepias rubra*	S2S3
		Barratt's sedge	*Carex barrattii*	S2
		Bog-buttons	*Lachnocaulon anceps*	S2
		Basil mountain mint	*Pycnanthemum clinopodioides*	S1
		Torrey's mountain mint	*Pycnanthemum torrei*	S2
		Small capitate beakrush	*Rhynchospora cephalantha v. attenuata*	S1
		Slender nutrush	*Scleria minor*	S2
		Elliott goldenrod	*Solidago latissimifolia*	S2
Franklin	Southampton	Sandy-woods chaffhead	*Carphephorus bellidifolius*	S1
		Short-leaved beardgrass	*Gymnopogon brevifolius*	S2S3
		Dwarf southern bayberry	*Myrica cerifera v. pumila*	S1
Golden Hill Branch	Surry	Many headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2

Site	County	Plant common name	Plant scientific name	Rank
		Tall yellow-eyed-grass	*Xyris platylepis*	S2
Goodman Swamp	Suffolk City	Southern red lily	*Lilium catesbaei v. longii*	S1
Gravelly Run	Dinwiddie	Maidencane	*Panicum hemitomon*	S2
Handsom-Gum	Southampton	Ten-angle pipewort	*Eriocaulon decangulare*	S2
		A St. John's wort	*Hypericum setosum*	S1S2
		Ciliate meadow-beauty	*Rhexia petiolata*	S1
		Small capitate beakrush	*Rhynchospora cephalantha v. attenuata*	S2
		Two-formed rose-pink	*Sabatia difformis*	S1
		Southern purple pitcher plant	*Sarracenia purpurea v.venosa*	S2
		Slender nutrush	*Scleria minor*	S2
		Red milkweed	*Asclepias rubra*	S2
		Dense-flowered camas	*Zigadenus densus*	S1
Harris Swamp	Sussex	Virginia thistle	*Cirsium virginianum*	S2
Kilby Northwest	Suffolk City	Red milkweed	*Asclepias rubra*	S2
		Pine barrens reedgrass	*Calamovilfa brevipilis*	S1
		Raven's seedbox	*Ludwigia ravenii*	S1
		Tall yellow-eyed-grass	*Xyris platylepis*	S2

Site	County	Plant common name	Plant scientific name	Rank
		Barratt's sedge	*Carex barrattii*	S2
		Spreading pogonia	*Cleistes divaricata*	S1
		Slender nutrush	*Scleria minor*	S2
Lower Arthur Swamp	Dinwiddie	Red milkweed	*Asclepias rubra*	S2
		Cuthbert turtlehead	*Chelone cuthbertii*	S2
		Rafinesque's seedbox	*Ludwigia hirtella*	S1
		Small capitates beakrush	*Rhynchospora cephalantha v. attenuata*	S1
		Curtiss' yellow-eyed-grass	*Xyris difformis v. curtissii*	S1
Lummis Flatwoods	Suffolk City	A sedge	*Carex striata v. brevis*	S2S3
		Pine barren gentian	*Gentiana autumnalis*	S1
		Savanna beakrush	*Rhynchospora debilis*	S1
		Yellow pitcher plant	*Sarracenia flava*	S1
		Slender nutrush	*Scleria minor*	S2
		Spreading pogonia	*Cleistes divaricata*	S1
Manning	Suffolk City	A sedge	*Carex striata v. brevis*	S2S3
		Slim-leaf tick-trefoil	*Desmodium tenuifolium*	S1
		Short-beard plumegrass	*Saccharum brevibarbe*	S1

Site	County	Plant common name	Plant scientific name	Rank
		Slender nutrush	*Scleria minor*	S2
Mercy Seat Church	Surry	Slender nutrush	*Scleria minor*	S2
Moss Swamp	Suffolk City	Tall yellow-eyed-grass	*Xyris platylepis*	S2
Nance's Shop Bog	Charles City	New Jersey Rush	*Juncus caesariensis*	SOC
North Dismal Swamp	Suffolk City	Hairy seedbox	*Ludwigia pilosa*	S1
	Chesapeake City	Water paspalum	*Paspalum dissectum*	S1
		Elliot goldenrod	*Solidago latissimifolia*	S2
		Fringed yellow-eyed-grass	*Xyris fimbriata*	S1
Oak Grove Church	Dinwiddie	Cuthbert turtlehead	*Chelone cuthbertii*	S2
Piney Grove	Sussex	Red milkweed	*Asclepias rubra*	S2S3
		Pine barrens reedgrass	*Calamovilfa brevipilis*	S1
		Small capitates beakrush	*Rhynchospora cephalantha v. attenuata*	S1
		Southern purple pitcher plant	*Sarracenia purpurea ssp. venosa*	S2
		Slender nutrush	*Scleria minor*	S2
		Large-flowered camas	*Zidadenus glaberrimus*	S1
Possum Run Seep	Charles City	New Jersey Rush	*Juncus caesariensis*	SOC
Radium Flatwoods	Greensville	A St. John's wort	*Hypericum setosum*	S1

Site	County	Plant common name	Plant scientific name	Rank
Reedy Creek Seeps	Caroline	New Jersey Rush	*Juncus caesariensis*	SOC
		Little-leaf sensitive briar	*Mimosa quadrivalvis v. angustata*	S2
		Large white fringed orchid	*Platanthera blephariglottis v. conspicua*	S1
		Purple pitcher plant	*Sarracenia purpurea*	S2
Rocky Mill Flatwoods	Lunenburg	Short-leaved beardgrass	*Gymnopogon brevifolius*	S2S3
		Obovate marshallia	*Marshallia obovata v. obovata*	S1
		Torrey's mountain mint	*Pycnanthemum torrei*	S2
		Purple dropseed	*Sporobolus junceus*	S1
Rose of Sharon Church	Suffolk City	Water paspalum	*Paspalum dissectum*	S2
Round Gut Sandhill	Southampton	Grass-like roselings	*Callisia graminea*	S1
		Plukenet's flatsedge	*Cyperus plukenetii*	S2
		Pineland tick-trefoil	*Desmodium strictum*	S2
Round Hill Church	Greensville	Water paspalum	*Paspalum dissectum*	S2
Saint Mary's Church	Suffolk City	Woolly chaffhead	*Carphephorus tomentosus*	S1
		Carolina sheep-laurel	*Kalmia carolina*	S2
		Southern red lily	*Lilium catesbaei v. longii*	S1
		Ciliate meadow-beauty	*Rhexia petiolata*	S1

Site	County	Plant common name	Plant scientific name	Rank
Salem Run Bog	Charles City	New Jersey Rush	*Juncus caesariensis*	SOC
Sappony Creek	Sussex	Golden colicroot	*Aletris aurea*	S1
		Virginia thistle	*Cirsium virginianum*	S2
		Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
		Yellow pitcher plant	*Sarracenia flava*	S1
		Curtiss' yellow-eyed-grass	*Xyris difformis v. curtissii*	S1
Shands Bog	Dinwiddie	Red milkweed	*Asclepias rubra*	S2S3
		Pine barrens reedgrass	*Calamovilfa brevipilis*	S1
		Toothache grass	*Ctenium aromaticum*	S1
		Ten-angle pipewort	*Eriocaulon decangulare*	S2
		Early paspalum	*Paspalum praecox*	S1
		Large white fringed orchid	*Platanthera blephariglottis v. conspicua*	S2
		Slender rattlesnake root	*Prenanthes autumnalis*	S2
		Slender marsh rose-pink	*Sabatia campanulata*	S2
		Yellow pitcher plant	*Sarccenia flava*	S1
		Large-flowered camas	*Zidadenus glaberrimus*	S1
Shrub Pocosin	Surry	False hop sedge	*Carex lupuliformis*	S1

Site	County	Plant common name	Plant scientific name	Rank
		Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
		A beakrush	*Rhynchospora perplexa v. virginiana*	S1S2
		Tall yellow-eyed-grass	*Xryis platylepis*	S2
South Meherrin	Greensville	Water paspalum	*Paspalum dissectum*	S2
		Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
State Route 666	Dinwiddie	Cuthbert turtlehead	*Chelone cuthbertii*	S2
String of Logs Pocosin	Isle of Wight	Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
Suffolk Airport North	Suffolk City	Toothache grass	*Ctenium aromaticum*	S1
		Pine barren gentian	*Gentiana autumnalis*	S1
		Slim-leaf tick-trefoil	*Desmodium tenuifolium*	S1
		Slender nutrush	*Scleria minor*	S2
Suffolk Airport South	Suffolk City	Red milkweed	*Asclepias rubra*	S2
		Pine barrens reedgrass	*Calamovilfa brevipilis*	S1
		Slim-leaf tick-trefoil	*Desmodium tenuifolium*	S1
		Elliott goldenrod	*Solidago latissimifolia*	S2
		Tall yellow-eyed-grass	*Xyris platylepis*	S2
		Pine barren gentian	*Gentiana autumnalis*	S1

Site	County	Plant common name	Plant scientific name	Rank
		Slender nutrush	*Scleria minor*	S2
Sussex Schoolhouse Swamp	Sussex	Carolina boltonia	*Boltonia caroliniana*	S2
		Virginia thistle	*Cirsium virginianum*	S2
		Wrinkled jointgrass	*Coelorachis rugosa*	S1
		Slim-leaf tick-trefoil	*Desmodium tenuifolium*	S1
		Blood panic grass	*Dichanthelium consanguineum*	S1
		A . St. John's wort	*Hypericum setosum*	S1
		Bog rush	*Juncus elliottii*	S1S2
		Rafinesquie's seedbox	*Ludwigia hirtella*	S1
		Slender rattlesnakeroot	*Prenanthes autumnalis*	S2
		A goldenrod	*Solidago gracillima*	S2
Tuckers Pocosin	Surry	Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
		A beakrush	*Rhynchospora perplexa v. virginiana*	S1S2
Upper Warwick Swamp	Prince George	Barratt's sedge	*Carex barrattii*	S2
Wakefield South	Sussex	Red milkweed	*Asclepias rubra*	S2
		Tall yellow-eyed-grass	*Xyris platylepis*	S2

Site	County	Plant common name	Plant scientific name	Rank
Warwick Swamp	Prince George	Red milkweed	*Asclepias rubra*	S2S3
		Spreading pogonia	*Cleistes divaricata*	S1
		Large-flowered camas	*Zidadenus glaberrimus*	S1
Windsor Southeast	Isle of Wight	Many-headed bunch beakrush	*Rhynchospora cephalantha v. pleiocephala*	S2
Wrights Corner	Caroline	New Jersey Rush	*Juncus caesariensis*	SOC

APPENDIX B. PLANT LIST

Golden colicroot – *Aletris aurea*

Plant Description: The colic root plant grows 1–3 feet high. The thin leaves, 4–8 inches long, form a rosette at the base of the stem. The flowers are tubular, yellow to orange and about 1/4 inch long, 6-lobed at the tip. They form spikelike clusters on the upper third of the stem.

State Ranking: S1

Dominion Locations Found:

County	Site
Brunswick	Bedingfield Creek Swale
Greensville	Foxtail Bogs
Sussex	Sappony Creek



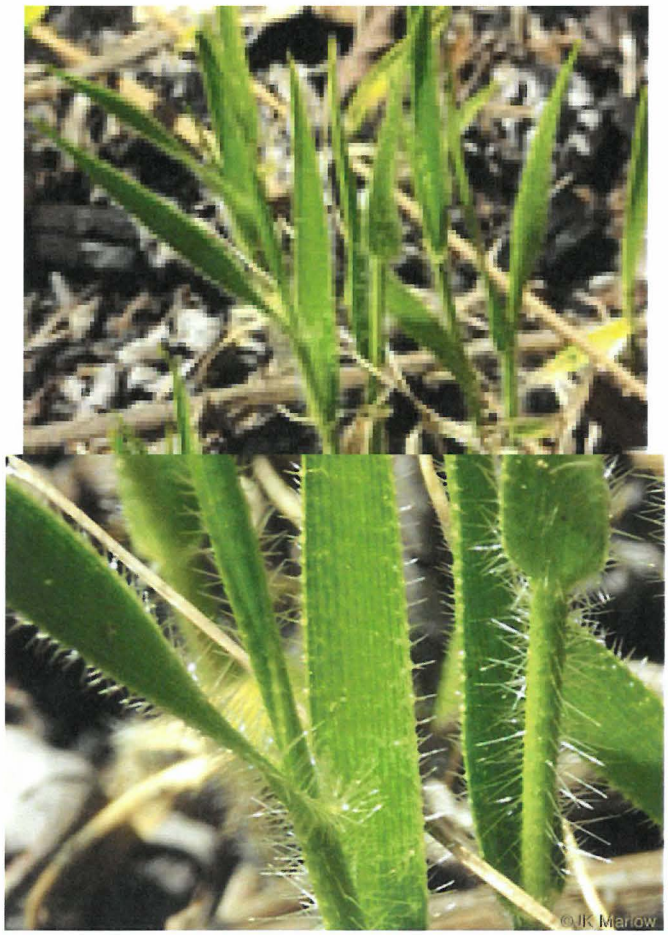
Blue maidencane – *Amphicarpum purshii*

Plant Description: *Amphicarpum purshii* is an annual grass with erect stems 30 to 80 centimeters tall. The leaves, sheaths, and blades both are hairy, the lower blades are up to 15 cm long and 1 to 1.5 cm wide while the upper leaves are reduced. The clusters are simple, 3 to 20cm long, are with a few main branches. As in all grasses, the small, inconspicuous flowers occur in scaly structures called spikelets. The spikelets are hairy and 4 millimeters long. *A. purshii* also has subterranean spikelets with solitary flowers borne on long stems. These underground spikelets are 7-8 mm long, long-pointed, and sparsely hairy. All or at least most of *A. purshii's* seeds are produced by these underground flowers

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Long leaf milkweed – *Asclepias longifolia*

Plant Description: During much of the year, this milkweed is rather inconspicuous. As a deciduous species, it spends its winter dormant and beneath the soil surface. In early spring, it emerges, but is never much more than a few thin basal leaves. By late spring, each plant stands about 2 feet tall with a rigid, but thin, main stem and numerous 3-6 inch linear leaves. The flowers occur in round umbels; several near the top of the main stem. They are small and whitish. The tips of the strongly recurved petals and the tips of the corollas are often a purplish pink. Blooming is most common in late spring, but may occur as late as early summer. Seed production follows about 6 weeks later.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Red milkweed – *Asclepias rubra*

Plant Description: Red Milkweed is a distinctive native perennial, forming a clump of flowers to 1 ft. wide. In mid spring 1 to 4 stems break through the soil, and quickly grow 2 to 3 ft. tall. Lavender-pink flowers bloom for several weeks in late spring.

State Ranking: S2S3

Dominion Locations Found:

County	Site
Dinwiddie	Lower Arthur Swamp
	Shands Bog
Greensville	Foxtail Bogs
Prince George	Warwick Swamp
Southampton	Handsom-Gum
Suffolk City	Kilby Northwest
	Suffolk Airport South
Sussex	Brittle Millpond
	Coppahaunk Swamp
	Piney Grove
	Wakefield South



Carolina boltonia – *Boltonia caroliniana*

Plant Description: They are characterized by broad, willow-like leaves beneath the branches of the arrays and lilac rays on the flowers.

State Ranking: S2

Dominion Locations Found:

County	Site
Sussex	Sussex schoolhouse swamp



Pine barrens reedgrass – *Calamovilfa brevipilis*

Plant Description: A grass standing between 1-3 feet tall. Very non-descript in nature. The major characteristic is the large "knuckle" on the top of the root system, usually just below the soil surface.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Greensville	Emporia
Suffolk City	Kilby Northwest
	Suffolk Airport South
Sussex	Piney Grove



Grasslike roselings – *Callisia graminea*

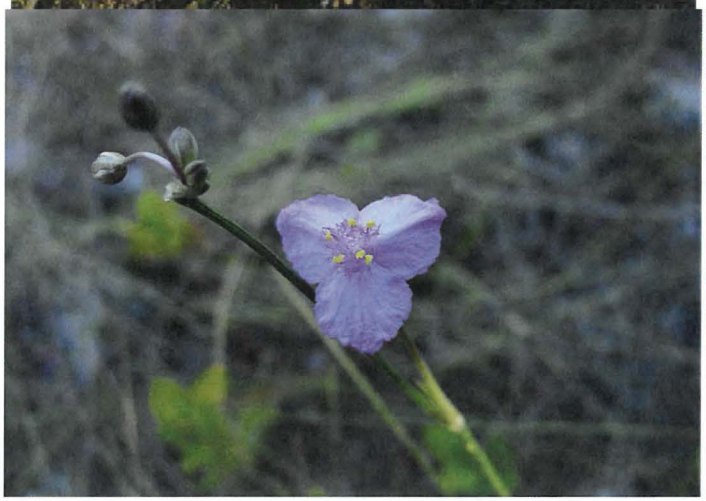
Plant Description: Most have grass-like leaves and all have small pink flowers - like a miniature spiderwort, but not nearly as aggressive in terms of its ability to spread in a landscape. All roselings are annuals. Grassleaf roseling, as its common and Latin names suggest, has grass-like leaves that form a clump about 8 inches across and 6-8 inches high. From this small mound, the flower stalks emerge in late spring to early summer; standing another inch or two above the foliage. Tiny pink blooms open in the morning and close by early afternoon; similar to those of its close relatives the spiderworts. Each flower lasts for only a short period, but new flowers are produced daily for many weeks.

State Ranking: S1

Dominion Locations Found:

County	Site
Southampton	Round Gut Sandhill





Barratt's sedge – *Carex barrattii*

Plant Description: Barratt's sedge is a loosely clumped grass-like perennial that occurs in patches. Its roots are fuzzy and yellow. Leaves are strap-like, 2-5 mm wide, and curled under on the edges. Stems are 20-90 cm tall and much exceed the leaves. At the apex of the stems are narrowly cylindrical clusters of male flowers. Also towards the apex of the stems are 2-4 secondary stems which branch off of the main stems. At the apex of these secondary stems are cylindrical flower/fruit clusters (spikes). Usually these spikes are mostly composed of densely arranged female flowers with a few male flowers towards the apex of the spikes. The female flowers develop into fruits, which are 2.5-3.5 mm long

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	Foxtail Bogs
Prince George	Upper Warwick Swamp
Suffolk City	Kilby Northwest



False Hop Sedge – *Carex lupuliformis*

Plant Description: This is a large stout sedge with one or a few erect stems up to 1.3 meters tall sticking out above the clump of wide green leaves. There are 1-5 large and fat cylinder-shaped female spikes toward the top of the stem with inflated flower bracts. The diamond-shaped fruits have small knobs on the angles that often break through and stick out of the flower bracts late in the season.

State Ranking: S1

Dominion Locations Found:

County	Site
Surry	Shrub Pocosin



Walter's Sedge – *Carex striata var. brevis*

Plant Description: These plants are grass-like. When growing these plants tend to go up, developing very little in width, and they tend to have a columnar development. It is an evergreen; during spring, summer, autumn, winter it assumes a green coloring; the adult specimens are medium in size and reach 4 m high.

State Ranking: S2S3

Dominion Locations Found:

County	Site
Suffolk City	Lummis Flatwoods
	Manning



Sandy Woods Chaffhead – *Carphephorus bellidifolius*

Plant Description: Plants are usually 20–60 cm tall (short). Stems have small hairs on them. Leaves, if present, are at the base of the plant near the ground surface.

State Ranking: S1

Dominion Locations Found:

County	Site
Southampton	Franklin





Wooly Chaffhead – *Carphephorus tomentosus*

Plant Description: Plant grows to 20-80 cm with a purple stem, reduced leaves, and many bunched pinkish flowers.

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Saint Mary's Church



Cuthbert turtlehead – Chelone cuthbertii

Plant Description: plant is usually 40-100 cm tall, leaves are willow-like with a toothed margin being paler beneath than above. Flowers are purple.

State Ranking: S2

Dominion Locations Found:

County	Site
Sussex	Cherry Orchard
Dinwiddie	Depot Road
	Lower Arthur Swamp
	Oak Grove Church
	State Route 666



Carolina Thistle – *Cirsium carolinianum*

Plant Description: Biennial herb to 1.5 m.; flowering May, June; fruiting June, July. When in bloom, the flowering heads are conspicuous with purplish color.

State Ranking: S1

Dominion Locations Found:

County	Site
Halifax	Difficult Creek



Virginia Thistle – *Cirsium virginianum*

Plant Description: It is a biennial growing to 1.2 m (4ft). The flowers are hermaphrodite (have both male and female organs). Flowers are purple to lavender, flowering in May – July.

State Ranking: S2

Dominion Locations Found:

County	Site
Sussex	Harris Swamp
	Sappony Creek
	Sussex Schoolhouse Swamp



Spreading Pogonia – Cleistes divaricata

Plant Description: medium size plant (1-2 feet tall) with a pink tubular flower with 3 long narrow spreading brownish or purplish-green sepals. Leaves are 8-inches long and are oblong and lanceolate inserted above the middle of the stem.

State Ranking: S1

Dominion Locations Found:

County	Site
Prince George	Warwick Swamp
Suffolk City	Balm of Gilead
	Kilby Northwest
	Lummis Flatwoods



Wrinkled Jointgrass – *Coelorachis rugosa*

Plant Description: The plants grow to a height of approximately 1.2 meters. It is a deciduous plant with simple leaves. The leaves are arranged opposite. The plants bloom from August to September. The brown fruits are caryopses. They develop in autumn.

State Ranking: S1

Dominion Locations Found:

County	Site
Sussex	Sussex Schoolhouse Swamp



Atlantic Tickseed – *Coreopsis oniscicarpa*

Plant Description: Plant grows to 50-100 cm tall with bright yellow flowers. Basal leaves are oval and become more willow-like towards the top of the plant. Produces fruit commonly known as "hitchhikers". There is a common species in this group found throughout Virginia.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Toothache Grass – *Ctenium aromaticum*

Plant Description: This is a perennial grass that forms clumps of stems reaching 1 to 1.5 meters in maximum height. The leaves are up to 46 centimeters long. The flower cluster is a spikelet with one branch that is up to 15 centimeters long and lined on one side with two rows of spikelets. Each spikelet is roughly a centimeter long.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Suffolk City	Suffolk Airport North
Sussex	Brittles Millpond



Plukenet's Flatsedge – *Cyperus plukenetii*

Plant Description: Herbaceous plant is usually 1 m tall and rough to the touch over the entire plant. Flowers July – September with small spikelets (6-8 mm) on the terminal flower cluster.

State Ranking: S2

Dominion Locations Found:

County	Site
Southampton	Round Gut Sandhill



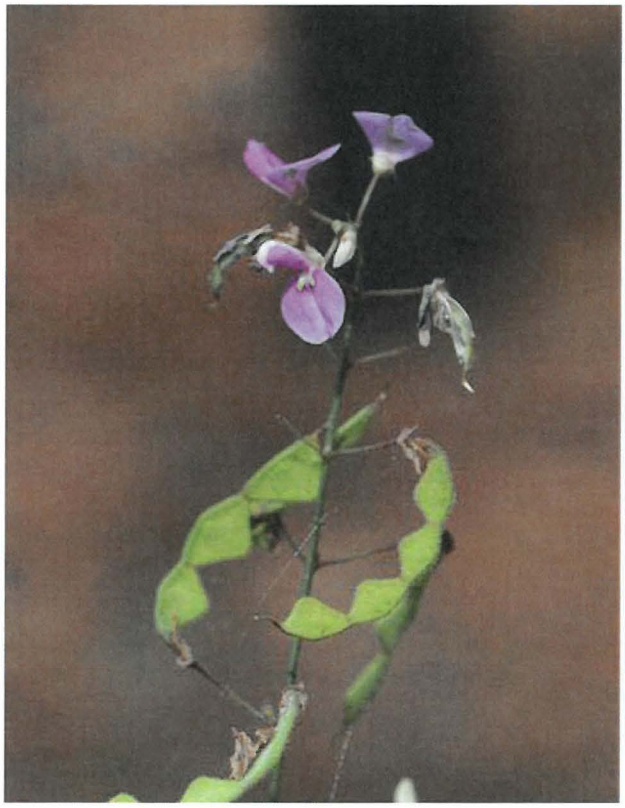
Pineland Tick-trefoil – *Desmodium strictum*

Plant Description: It grows to a height of approximately 1, 2 meters. It is a deciduous plant with three leaves. The leaves are arranged opposite one another. They are willow-like. The flowers are pea-shaped and pink. The plants bloom from July to August. The fruit becomes what is commonly known as "hitch hikers".

State Ranking: S2

Dominion Locations Found:

County	Site
Southampton	Round Gut Sandhill





Slim Leaf Tick-trefoil – *Desmodium tenuifolium*

Plant Description: It is a deciduous plant with three-palmate leaves. The leaves are arranged opposite one another. They are linear. The flowers are pea-shaped and pink. The plants bloom from August to September. The fruits become what is commonly known as "hitch hikers".

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Manning
	Suffolk Airport North
	Suffolk Airport South
Sussex	Sussex Schoolhouse Swamp



Blood Panic Grass – *Dichanthelium consanguineum*

Plant Description: Plants grayish-green. The leaf blades are 2-8 cm, oval to willow-like. Flower cluster is 20-55 cm, erect; nodes are hairy.

State Ranking: S1

Dominion Locations Found:

County	Site
Sussex	Sussex Schoolhouse Swamp



Rough Hair Panic Grass – *Dichanthelium strigosum var. strigosum*

Plant Description: Densely tufted perennial. Stems nodes swollen or brittle. Stems erect or laying flat to 10-40 cm tall. Stem internodes are hollow and with flower clusters less than 1 m tall. Leaves mostly near the bottom of the stem, below middle of stem.

State Ranking: S1

Dominion Locations Found:

County	Site
Southampton	Delaware



Smooth Coneflower – *Echinacea laevigata*

Plant Description: This is a perennial herb that grows up to about 1.5 meters in height with a mostly naked, smooth, leafless stem. Any leaves are roughly willow-shaped. On top of the stem is a flower head containing narrow pink or purplish ray petals up to 8 centimeters long. The petals droop away from the center of the head. The small, tubular disc florets in the center are dark purple in color. Blooming occurs in May through July.

State Ranking: FED ENDANGERED

Dominion Locations Found:

County	Site
Halifax	Difficult Creek



White Top Fleabane – *Erigeron vernus*

Plant Description: Flowering stem less than 1 m is mostly leafless. The flower (in Spring) is 20-30 white (rarely lavender) petals.

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	Collier Branch



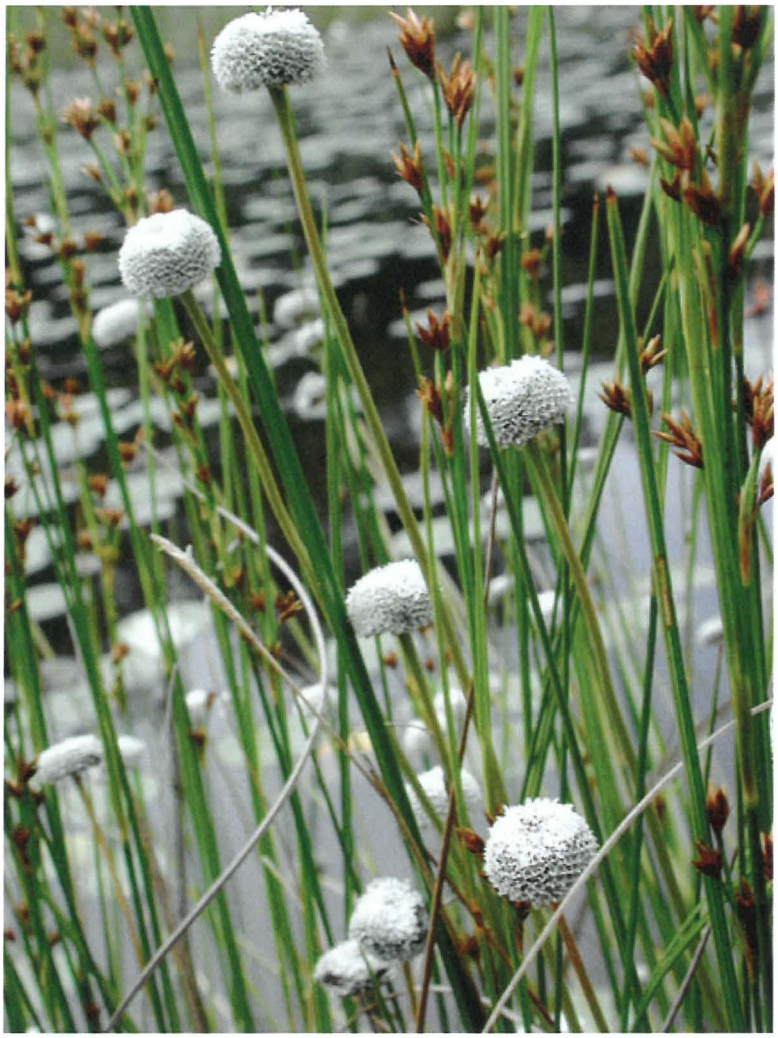
Ten-angle Pipewort – *Eriocaulon decangulare*

Plant Description: Herbs, perennial, 30--110 cm. Leaves are only observed at the base with a leafless stem ending in a round crowded head of tiny flowers. Commonly referred to as "hatpins" because of their resemblance.

State Ranking: S2

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Southampton	Handsom-Gum



Savanna Eryngo – *Eryngium integrifolium*

Plant Description: Plant is slender and erect to 30-80 cm. Leaves are larger near the bottom of the stem and are not present during flowering. Flowers are greenish at first, then turning blue.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Rattlesnake Master – *Eryngium yuccifolium var. yuccifolium*

Plant Description: Smooth rigid stem (2-6 m) bearing thistle-like flower heads made up of small greenish-white florets. Flowers from July – August. Leaves are long, linear, pointed and parallel veined.

State Ranking: S2

Dominion Locations Found:

County	Site
Halifax	Difficult Creek



Pine Barren Gentian – *Gentiana autumnalis*

Plant Description: Plant is 20-60 cm. Leaves are thin, linear, and elongated. Solitary flower, on occasion up to 2 or 3, at the tops of the stems, with five petals, fused for one-half of their length. The flowers grow upright, opening in the sun. Striking shade of deep indigo-blue petals; the throat has white-greenish stripes and spots.

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Balm of Gilead
	Lummis Flatwoods
	Suffolk Airport North
	Suffolk Airport South



Short Leaved Beardgrass – *Gymnopogon brevifolius*

Plant Description: Plant short (to 9 cm). Narrow leaves (2-8 cm X 2-8 mm vs. 2.5-12 cm X 5-10 mm), short fruit stalks (.8-1 mm vs. 4-12.2 mm), and usually having panicle branches that are naked of spikelets for the lower third.

State Ranking: S2S3

Dominion Locations Found:

County	Site
Greensville	Cattail Creek
Lunenburg	Rocky Mill Flatwoods
Southampton	Franklin



Creeping St. John's Wort – *Hypericum adpressum*

Plant Description: Creeping St. John's wort is a herbaceous plant that grows 3-8 decimeters tall. It usually occurs in large clumps with many stems. It has opposite, linear, to narrowly elliptic leaves that are 3-6 centimeters long and 5-10 millimeters wide, 4-6 times as long as wide. Each leaf has a tiny white point at the tip and is tapered at the sessile base. The margins are without teeth and turned under. There are usually many flowers in the inflorescence. The bright yellow petals are 6-8 millimeters long. The fruit is a one-chambered capsule that is 4-6 millimeters long and gradually narrowed to the beak.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Hairy St. John's Wort – *Hypericum setosum*

Plant Description: Plant stems are usually solitary or 2 to the base. Slender unbranched to the terminal flower cluster 30-80 cm tall. Leaves are hairy on both sides. Flowers are orange-yellow and 5-8 mm long.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Cattail Creek
	Radium Flatwoods
Southampton	Handsom-Gum
Sussex	Sussex Schoolhouse Swamp



Bay-gail holly – *Ilex coriacea*

Plant Description: Leaf: An evergreen shrub or small tree that reaches heights to 20 feet with a very open crown. The leaves are alternate, simple, irregularly serrated or spine-tipped, 1 1/2 to 3 inches long, oblong to oval, evergreen, leathery, shiny and dark green above, lighter and dull beneath. The flower is small, greenish white and inconspicuous, appearing in late spring. The fruit is small, nearly black, shiny berry-like drupes, 1/3 inch in diameter, ripening in fall, less persistent than other hollies.

State Ranking: S2

Dominion Locations Found:

County	Site
Suffolk City	Balm of Gilead



New Jersey Rush – *Juncus caesariensis*

Plant Description: New Jersey Rush is a tufted, perennial herb approximately 40 – 70 cm tall. The leaves are elongate and narrowly cylindrical. The open, branched flower cluster bears clusters of small, non-showy, green flowers or, when fruiting, sharp-pointed dark brown capsules. The capsules are longer than the surrounding floral parts. The stems and foliage are noticeably rough to the touch, feeling like sandpaper

State Ranking: SOC

Dominion Locations Found:

County	Site
Caroline	Reedy Creek Seeps
	Wrights Corner
Charles City	Nance's Shop Bog
	Possum Run Seep
	Salem Run Bog



Bog Rush – *Juncus elliottii*

Plant Description: It is a tufted, perennial herb approximately 50 cm tall. Root system has tubers thickened at the ends. The leaf blades are more slender than other Juncus sp.

State Ranking: S1S2

Dominion Locations Found:

County	Site
Greensville	Collier Branch
Sussex	Sussex Schoolhouse Swamp



Carolina Sheep Laurel – *Kalmia carolina*

Plant Description: Evergreen shrub 3 - 5 feet (1 - 1.5 meters) tall, with nearly hairless twigs, forming colonies. Leaves are ¾ - 3 inches (2 - 8 cm) long, usually in whorls of three, oval; upper surface blue-green, hairless, and shiny; lower surface covered with minute, fine hairs. Flower clusters in the angles between the stem and last year's leaves. Flowers are about ¼ inch (0.5 cm) wide; white, pink, or rose; bowl-shaped with 5 shallow lobes and a ring of dark pink dots near the throat; tips of the stamens tucked into 10 tiny pockets around the inside of the "bowl." Fruit a round, 5-lobed capsule.

State Ranking: S2

Dominion Locations Found:

County	Site
Suffolk City	Saint Mary's Church



Bog buttons – *Lachnocaulon anceps*

Plant Description: This plant is a clump former with the leaves forming a rosette. The leaves are linear and only 2-6 mm long, pale green or gray-green. The stem is 15-40 cm long with a bulbous head at the end whitish or pale gray. The stem has a twisted appearance.

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	Foxtail Bog
Sussex	Cherry Orchard



Southern Red Lily – *Lilium catesbaei var. longii*

Plant Description: It requires hot, wet, acidic soil, conditions that would normally exclude lily species. It stands approximately 3-4 feet tall producing a single flower, it generally blooms late in the year. The flower is upright with 6 petals which are curved backward and are orange toward the tip, yellow and purple-spotted toward the base.

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Goodman Swamp
	Saint Mary's Church



Rafinesque's seedbox – *Ludwigia hirtella*

Plant Description: Erect herb, stems (30-)50-120 cm tall, brown or golden, fairly well branched in mid to upper third of plant. Leaves alternate, held close to the stem, 1.4-5.5 cm long, 0.4-1.2 cm wide, willow-like, green on both surfaces. Flowers few to many. Fruit capsule 4.0-7.0 mm long, 4.0-5.0 mm in diameter, yellow-green to brown at maturity, open by a terminal pore. Seeds are light brown, oblong 0.6-0.72 mm long, 0.32-0.42 mm wide.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Lower Arthur Swamp
Greensville	Collier Branch
Sussex	Sussex Schoolhouse Swamp





Hairy seedbox – *Ludwigia pilosa*

Plant Description: Stems much branched, 40-120 cm tall. Leaves are alternate, with one inconspicuous vein on the underside, leaves 6.5-20 mm long, 5-11 mm wide, oval or elliptic. Flowers are usually congested in upper leaf axils, sepals very conspicuous, creamy white within, usually also tinged with pink along the main veins and edges, occasionally reddish when grown in exposed sites, ovate-triangular or triangular, with 3 parallel main veins. Fruit capsule 3-5 mm long and 3-4.5 mm in diameter, with rounded corners, and hard-walled

State Ranking: S1

Dominion Locations Found:

County	Site
Chesapeake City	North Dismal Swamp
Suffolk City	North Dismal Swamp



Ravens seedbox – *Ludwigia ravenii*

Plant Description: Stems erect, usually well branched and leafy, 35-90 cm tall. Leaves are alternate, with one inconspicuous vein on the underside, 0.15-0.25 mm wide, willow-like to oval and reddish purple. Flowers are reddish purple, willow-like to widely heart-shaped, succulent, 0.25-0.45 mm long, 0.15-0.25 mm wide, flowers many, in leaf axils. Fruit capsules are 4-5 mm long, oval when mature, and hard-walled

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Kilby Northwest



Obovate marshallia – *Marshallia obovata var. obovata*

Plant Description: Plants are erect and 10–60 cm tall. Leaves mostly at the bottom of the plant; blades 3-nerved, elliptic or oval, 5–10 cm × 5–15 mm. Flowers are white.

State Ranking: S1

Dominion Locations Found:

County	Site
Halifax	Difficult Creek
Lunenburg	Rocky Mill Flatwoods





Little leaf sensitive briar – *Mimosa quadrivalvis var. angustata*

Plant Description: A perennial vine and climber that is 30-45 cm tall. Stem has thorns. Leaves will curl upon touching. Leaves are green and small 5-10 mm wide. Flowers are purplish-pink and bloom in mid-summer.

State Ranking: S2

Dominion Locations Found:

County	Site
Caroline	Reedy Creek Seeps



Sessil leaved hornpod – *Mitreola sessilifolia*

Plant Description: Plant is 10-50 cm tall. Leaves are flat along the ground and oval, rounded at the base usually not over 2 cm long. Flowers are white and in-line on a clustered, branched top of the plant.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Collier Branch



Dwarf Southern Bayberry – *Myrica cerifera var. pumila*

Plant Description: It is a small tree or large shrub and is an evergreen. The glandular leaves are long, have a leathery texture and serrated edges, and contain aromatic compounds. The plant is dioecious, with male and female flowers on separate plants. Male flowers have three or four stamens, and are surrounded by short bracts. The female flowers develop into fruit, which are globular and surrounded by a natural wax-like coating. The species flowers from late winter to spring, and bear fruit in late summer or fall.

State Ranking: S1

Dominion Locations Found:

County	Site
Southampton	Franklin



Maidencane – *Panicum hemitomon*

Plant Description: This plant is a perennial grass with stems reaching up to 2 meters in height. It is aquatic or semi-aquatic, growing in water or wet soils. It spreads via its root system to form large colonies. The canelike roots are filled with air and form a mass up to 46 centimeters wide. The stems may be erect or spreading; if nodes on the stem contact moist substrate they will root. The leaves are up to 35 centimeters long by 1.5 wide and have tapering tips. The inflorescence is a panicle with upright branches.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Gravelly Run
Isle of Wight	Cat Ponds East



Water Paspalum – *Paspalum dissectum*

Plant Description: Grass species that is less than 1 m tall. The stem nodes are hairy and hollow. Leaves are two-ranked and sheathed at the base. The flowers and fruits are arranged in a linear cluster at the end of the plant, mostly arranged linearly on one side of the branch.

State Ranking: S1

Dominion Locations Found:

County	Site
Chesapeake City	North Dismal Swamp
Greensville	Round Hill Church
	South Meherrin
Suffolk City	North Dismal Swamp
	Rose of Sharon Church



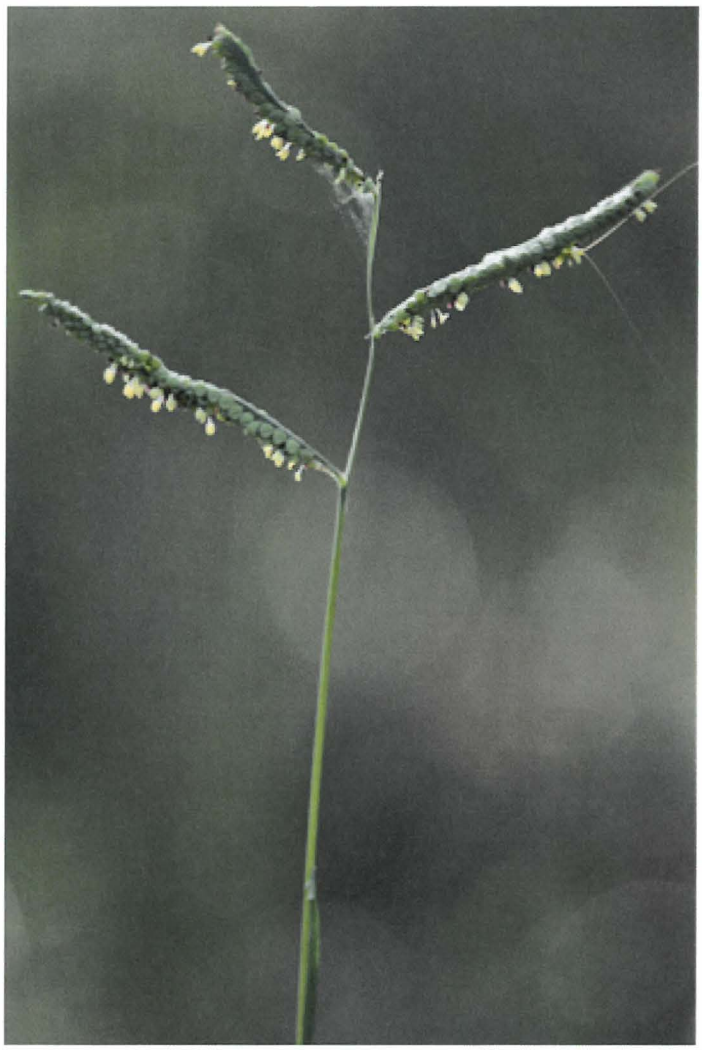
Early Paspalum – *Paspalum praecox*

Plant Description: May exceed 1 m tall. Foliage can be hairy. Leaves are folded. Spikelets mostly paired, 2.2-3.1 mm long. The flowers and fruits are arranged in a linear cluster at the end of the plant, mostly arranged linearly on one side of the branch.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog



Trailing Phlox – *Phlox nivalis var. henizii*

Plant Description: Low growing plants, rarely over 15 cm tall forms a dense mat with pink to lavender flowers. Flowers have 5 petals. Leaves are 1 cm long and opposite and are closely set, needle-like.

State Ranking: S2S3

Dominion Locations Found:

County	Site
Halifax	Difficult Creek



Large White-fringed Orchid – *Platanthera blephariglottis var. conspicua*

Plant Description: Flowering from late spring until summer, it is an 8 to 110 centimeters (3 to 43 inches) tall plant that can be found growing in bogs and on the moist banks of lakes and rivers on the eastern side of North America. The stems and leaves (at least 2) are often several spreading leaves scattered along the stem. Leaf shapes from linear to roundish willow-like. Flowers are dense spikes of showy white flowers. Petals are near entire fringed and the shape is linear and narrows toward the point of attachment.

State Ranking: S1

Dominion Locations Found:

County	Site
Caroline	Reedy Creek Seeps
Dinwiddie	Shands Bog



American Ipecac – *Porteranthus stipulates*

Plant Description: It modestly flowers on its sprawling stems and it will form well-branched 4 by 3 foot clumps. One inch, narrow, five-petaled, star-shaped flowers appear in late spring and early summer. Flowers, resembling very narrow-petaled apple blossoms, are white with red sepals and flutter in the slightest breeze. They are especially enhanced by the dark reddish, wiry, stems and dark green, 3-parted leaves.

State Ranking: S1

Dominion Locations Found:

County	Site
Halifax	Difficult Creek



Slender Rattlesnake Root – *Prenanthes autumnalis*

Plant Description: Plants are typically 40–140 cm tall with a thickened taproot. Stems are 1–5, erect, mostly green with mottled purple, slender, and hairy. Leaves are only present during flowering; blades oblong to linear, 7–18 × 0.5–6 cm.

State Ranking: S2

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Greensville	Emporia
Sussex	Sussex Schoolhouse Swamp



Susquehanna Cherry – *Prunus pumila var. susquehanae*

Plant Description: It is a deciduous small shrub that grows to 10–40 cm (rarely to 180 cm) tall, forming dense colonies by sprouts from the root system. The leaves are leathery, 4–7 cm long, with a serrated margin. The flowers are produced in small clusters of two to four together, 15–25 mm in diameter, with five white petals and 25–30 stamens. The fruit is a small cherry 13–15 mm diameter, ripening dark purple in early summer.

State Ranking: S1

Dominion Locations Found:

County	Site
Culpeper	Berry Hill Diabase Flatwoods





Basil Mountain Mint – *Pycnanthemum clinopodioides*

Plant Description: Basil mountain-mint is a perennial wildflower that grows up to a meter tall. It has square branching stems that are covered with short, curved hairs mixed with longer, straight hairs. The leaves are relatively narrow, mostly more than 3 times as long as wide, willow-shaped and with very short leaf stalks. The upper leaf surface has scattered hairs and the lower surface has longer hairs especially on the main veins. The branches are topped by loose clusters of small, light lavender, purple-spotted flowers. In fruit the flower clusters are loose enough to see the individual branchlets inside.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Foxtail Bogs



Torrey's Mountain Mint – *Pycnanthemum torrei*

Plant Description: Its leaves and bracts are rounded and hairless on the upper surface, and a long (1 to 1.5 mm) stem. The flowers are in a cluster at the top of the stem and the petals are typically white.

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	Foxtail Bogs
Lunenburg	Rocky Mill Flatwoods



Ciliate Meadow Beauty – *Rhexia petiolata*

Plant Description: Stem is 10-50 cm tall and rigid with few branches. Leaves are 1-1.5 cm long oval with 3 nerves. The leaf margins are serrated with bristle tips giving the leaf a "ciliated" appearance. Flowers are lavender to rose and asymmetrical.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Emporia
Southampton	Handsom-Gum
Suffolk City	Balm of Gilead
	Saint Mary's Church



Small Capitates Beakrush – *Rhynchospora cephalantha var. attenuata*

Plant Description: Plants tending to be tall (>1 m), the spikelets in a dense head. This species has fruits 3 mm long

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Lower Arthur Swamp
Greensville	Cattail Creek
	Emporia
	Foxtail Bogs
Southampton	Handsom-Gum
Sussex	Piney Grove



Many Headed Bunched Beakrush – *Rhynchospora cephalantha var. pleiocephala*

Plant Description: Plants tending to be tall (>1 m), the spikelets in a dense head. This species has fruits 3 mm long. Difference among the three subspecies is very small and can usually only be determined by a professional botanist in a lab setting.

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	South Meherrin
Isle of Wight	Carbell Swamp
	String of Logs Pocosin
	Windsor Southeast
Surry	Golden Hill Branch
	Shrub Pocosin
	Tuckers Pocosin
Sussex	Sappony Creek



A Beakrush – *Rhynchospora perplexa var. virginiana*

Plant Description: Plants tending to be shorter (50-110 cm), the spikelets in a dense head. Fruits are fairly flat.

State Ranking: S1S2

Dominion Locations Found:

County	Site
Greensville	Cattail Creek
Surry	Shrub Pocosin
	Tuckers Pocosin



Savanna Beakrush – *Rhynchospora debilis*

Plant Description: Plants perennial and relatively short at 20–45 cm. Leaves blades are linear, 1 mm, tapering at the end. Spikelet clusters 1–2, mostly compact at the end of the stem. Fruits are dark red brown, oval, 2–3 mm

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Lummis Flatwoods



Slender Marsh Rose Pink – *Sabatia campanulata*

Plant Description: It is a perennial, that is 1 to 4 cm long. Plants form a winter rosette with short oval leaves that do not persist into the growing season. Stems are 20 to 70 cm tall, two to many, erect or spreading, and alternately branched, giving plants an asymmetrical appearance. Leaves are opposite, linear to elliptic, broader toward the base and narrower toward the summit. Lowest leaves are 1 to 4 cm long and 1 to 12 mm wide. Upper leaves are very narrow, almost needlelike. The flower cluster is highly-branched with terminal, solitary flowers. Flowers are most often rose to pink.

State Ranking: S2

Dominion Locations Found:

County	Site
Dinwiddie	Depot Road
	Shands Bog
Greensville	Collier Branch
Sussex	Brittles Millpond
	Cherry Orchard



Two-formed Rose Pink – *Sabatia difformis*

Plant Description: Perennial herb to 45-80 cm tall. Stems are erect. Flowers are white with typically 5 petals.

State Ranking: S1

Dominion Locations Found:

County	Site
Isle of Wight	Cat Ponds East
Southampton	Handsom-Gum



Short Beard Plumegrass – *Saccharum brevibarbe*

Plant Description: Perennial, stem nodes swollen or brittle, and erect or ascending. Plant with inflorescence 1-2 m tall. Leaves are conspicuously 2-ranked, and 1-2 cm wide,

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk City	Balm of Gilead
	Cypress Chapel
	Manning



Yellow Pitcher Plant – *Sarracenia flava*

Plant Description: It is a carnivorous plant that traps insects using a rolled leaf, which in this species is a vibrant yellow in color, and 1 m tall (although 50 cm is more typical). The uppermost part of the leaf is flared into a lid (the operculum), which prevents excess rain from entering the pitcher and diluting the digestive secretions within. In spring, the plant produces large flowers with 5-fold symmetry. The yellow petals are long and strap-like, and dangle over the umbrella-like style of the flower, which is held upside down at the end of a 50 cm long stem.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Suffolk City	Lummis Flatwoods
Sussex	Sappony Creek





Purple Pitcher Plant – *Sarracenia purpurea*

Plant Description: It is a carnivorous plant that traps insects using a rolled leaf, stands approximately 40-80 cm tall and has a veined appearance with yellows and reds. The uppermost part of the leaf is flared into a lid (the operculum), which prevents excess rain from entering the pitcher and diluting the digestive secretions within. In spring, the plant produces large flowers with 5-fold symmetry. The purplish/reddish petals are broad and do not hang like that of the yellow pitcher plant.

State Ranking: S2

Dominion Locations Found:

County	Site
Caroline	Reedy Creek Seeps



Southern Purple Pitcher Plant – *Sarracenia purpurea ssp. venosa*

Plant Description: It is a carnivorous plant that traps insects using a rolled leaf, stands approximately 20-60 cm tall and has a veined appearance with yellows and reds. This is the only native pitcher plant to Virginia and is significantly smaller than the other pitcher plants. The uppermost part of the leaf is flared into a lid (the operculum), which prevents excess rain from entering the pitcher and diluting the digestive secretions within. In spring, the plant produces large flowers with 5-fold symmetry. The purplish/reddish petals are broad and do not hang like that of the yellow pitcher plant.

State Ranking: S2

Dominion Locations Found:

County	Site
Dinwiddie	Depot Road
Southampton	Handsom-Gum
Sussex	Piney Grove



Slender Nutrush – *Scleria minor*

Plant Description: Slender nutrush is a perennial species, with slender stems up to 80 cm tall, rising from long rhizomes. The leaves are 1 to 2.5 mm wide and hairless. The stems are taller and more slender than the leaves. The flower cluster is 3 to 10 cm long, and normally consists of 1 or 2 flower clusters each with 1 to 5 spikelets. The fruits are brownish gray, sometimes with longitudinal dark stripes, 1.5 to 2 mm long, and are covered with a whitish siliceous crust

State Ranking: S2

Dominion Locations Found:

County	Site
Dinwiddie	Depot Road
Greensville	Emporia
	Foxtail Bogs
Southampton	Handsom-Gum
Suffolk City	Balm of Gilead
	Kilby Northwest
	Lummis Flatwoods
	Manning
	Suffolk Airport North
	Suffolk Airport South
Surry	Mercy Seat Church
Sussex	Brittles Millpond
	Cherry Orchard
	Piney Grove



Southern Bog Goldenrod – *Solidago gracillima*

Plant Description: One of the smaller goldenrods (50-100 cm). Yellow leaves top an elongated flower cluster. Leaves at the bottom of the plant are sparsely to obviously serrate.

State Ranking: S2

Dominion Locations Found:

County	Site
Southampton	Branchville
Sussex	Sussex Schoolhouse Swamp



Elliott Goldenrod – *Solidago latissimifolia*

Plant Description: Coastal goldenrod is an erect wildflower that grows 1-3 meters tall from a long creeping rhizome. There may be 1-5 stems per plant. They are hairless or may contain hairs within the branches of the flower cluster. The lower stem leaves wither by flowering time. The leaves on the middle and upper part of the stem are willow-like, toothed, 60-150 mm long and only a little reduced in size toward the top of the stem. They are hairless, not 3-nerved, slightly roughened, and have a conspicuous net of veins visible. There are 35-800 flower heads in open clusters which sometimes have bracts within them. The branches are slightly to strongly curved down with flowers growing on one side of the branch. The yellow ray flowers are 2-3 mm long.

State Ranking: S2

Dominion Locations Found:

County	Site
Greensville	Foxtail Bogs
Suffolk/Ches. City	North Dismal Swamp
	Suffolk Airport South



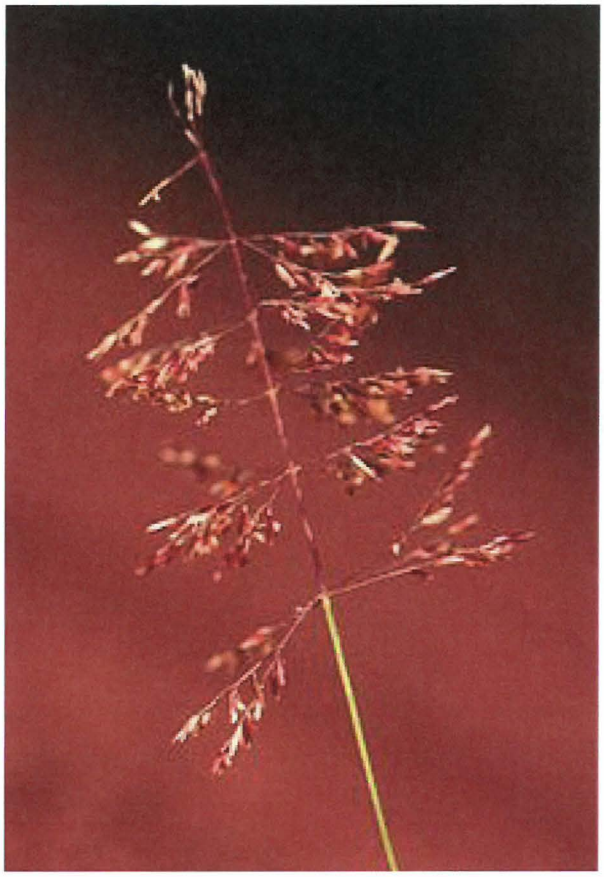
Purple Dropseed – *Sporobolus junceus*

Plant Description: This perennial bunchgrass has stems up to a meter tall. The leaves are up to 30 centimeters long and are flat or rolled. They are blue-green in color. The flower cluster is pyramidal in shape with spreading branches. They are lined with purplish or reddish spikelets.

State Ranking: S1

Dominion Locations Found:

County	Site
Lunenburg	Rocky Mill Flatwoods



Curtiss' Yellow-eyed Grass – *Xyris difformis var. curtissi*

Plant Description: Stems are 10-90 cm. Leaves in narrow to broad fans, 5--50 cm; linear---sword-shaped, flat, not twisted, under 7 mm wide. Flower clusters winged on the outside, 0.5--3 mm wide, variably ribbed, Flowers: slightly curved, 5-7 mm long, keel brown, yellow petals unfolding in morning.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Lower Arthur Swamp
Sussex	Sappony Creek



Fringed Yellow-eyed Grass – *Xyris fimbriata*

Plant Description: Stems are typically 60-150 cm, Leaves in fans, 40-70 cm; straw-colored, green, or pinkish; flat or slightly twisted, 5-25 mm, smooth. Flower clusters: spikes oval, 12-25 mm, yellow-brown, nearly straight, unfolding in late morning.

State Ranking: S1

Dominion Locations Found:

County	Site
Suffolk/Ches. City	North Dismal Swamp



Tall Yellow-eyed Grass – *Xyris platylepis*

Plant Description: Stems: perennial, occasionally solitary, 2-10) cm long. Leaves erect or ascending, 15--30(--50) cm; sheaths pinkish to red, soft; blade green, linear, flattened, twisted, 5-10 mm wide, smooth, margins smooth. Flower clusters: spikes oval to cylindric, 8-30 mm; Flowers: yellow petals unfolding at midday.

State Ranking: S2

Dominion Locations Found:

County	Site
Suffolk City	Kilby Northwest
	Moss Swamp
	Suffolk Airport South
Surry	Golden Hill Branch
	Shrub Pocosin
Sussex	Wakefield South



Dense Flowered Camus – *Zigadenus densus*

Plant Description: Plants 4–20 dm, from bulbs; bulbs not clumped. Leaves: blades 10–50 cm × 2–12 mm. Flower white clusters 40–100-flowered, cylindrical, 4–15 × 2.5–5 cm. Flowers: cream colored to greenish.

State Ranking: S1

Dominion Locations Found:

County	Site
Greensville	Emporia
Southampton	Handsom-Gum



Large Flowered Camus – *Zigadenus glaberrimus*

Plant Description: It generally grows to a height of 60–120 cm (2–4 ft). A total of 30–70 flowers are borne in clusters. Each white to cream colored flower is bell-shaped, 20–30 mm (0.8–1.2 in) across. The petals of the flower remain attached to the fruit capsule when it forms. The cone shaped seed capsules are 10–15 mm (0.4–0.6 in) long by 4–7 mm (0.2–0.3 in) across. It flowers from mid July to September.

State Ranking: S1

Dominion Locations Found:

County	Site
Dinwiddie	Shands Bog
Prince George	Warwick Swamp
Sussex	Piney Grove



APPENDIX C: MEMORANDUMS-OF-AGREEMENTS

COROLLA TO CAROVA DISTRIBUTION LINE

Attachment B

MEMORANDUM OF AGREEMENT

BETWEEN

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

AND

VIRGINIA ELECTRIC AND POWER COMPANY d/b/a DOMINION NORTH CAROLINA POWER

THIS MEMORANDUM OF AGREEMENT is made and entered into as of the ____ day of May 2007 (the "Effective Date") by and between the **NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES** (the "Department"), through its **DIVISION OF COASTAL MANAGEMENT** (the "Division"), party of the first part, and **VIRGINIA ELECTRIC AND POWER COMPANY**, a Virginia public service corporation doing business in the State of North Carolina as "Dominion North Carolina Power" ("Dominion"), party of the second part,

RECITALS

The Division is responsible for the management of the Currituck Banks component of the North Carolina National Estuarine Research Reserve, comprising nine hundred sixty (960) acres in Currituck County, North Carolina (the "Reserve").

Under the provisions of N.C.G.S § 113A-129.2, the Division is authorized to administer the North Carolina Coastal Reserve for research, education, and compatible and traditional public uses.

Under the provisions of N.C.G.S. § 113A-129.3, the North Carolina National Estuarine Research Reserve is administered as part of the North Carolina Coastal Reserve that is administered for the same purposes stated above.

NOW THEREFORE, this Agreement is for the cooperative maintenance by Dominion and the Division of the permanent easement granted to Dominion for an electric distribution line right-of-way for installation and maintenance of an underground electrical cable to meet additional power capacity demands and reliability to the Currituck Outer Banks as shown in Exhibit 1 (the "Right-of-Way").

I. DOMINION AGREES:

1. To minimize interference with or harm to the ecological integrity of the Currituck Banks component of the North Carolina National Estuarine Research Reserve, owned by the State of North Carolina, which might foreseeably result from Dominion's use and maintenance of the Right-of-Way, including, but not limited to, any future low canopy shrub community created within the Right-of-Way, and to eliminate any potential impact on existing freshwater ponds located within the Currituck Banks component.





Form No. 728711 (Dec 2006) ©2006 Dominion Resources Services, Inc.

2. To access and conduct all routine inspections of the Right-of-Way via a meandering pathway four (4) feet in width (the "pathway"). Entrance to the pathway is through the approximately one hundred five (105) foot long fence with gate located at the southern terminus of the Right-of-Way. See Exhibit 1). An all-terrain vehicle marked with Dominion's name may be used on the pathway for these purposes. Dominion shall use alternate temporary access routes pre-approved by the Division when wet weather prevents, or the location of existing permanent ponds blocks, access via the pathway.

3. To conduct all work performed on the Right-of-Way in conformity with the following specifications:

(a) To the extent possible, Dominion North Carolina Power shall comply with all reasonable requests by the Division to minimize interference with areas that the Division reasonably identifies to be of special ecological concern.

(b) To install and maintain a boundary fence at the southern terminus of the Right-of-Way to deter unwanted trespass and traffic onto the Reserve via the pathway while still allowing Dominion access to the Right-of-Way. Dominion is responsible for maintaining the fence and will address maintenance issues reported by Reserve staff.

(c) To conduct inspections of the pathway before initiating planned work to identify brush trimming necessary to clear the pathway four (4) feet in width of woody vegetation. Hand crews shall complete brush trimming. Bush hogs shall not be used to maintain the pathway.

(d) When, in its sole opinion, it is reasonable to do so, Dominion shall plan all non-emergency line work and routine inspections during the months of January, February and March.

(e) To notify the Division of its intent to perform distribution line maintenance and construction, routine inspections, and brush trimming. Such notification shall be made as far in advance as it is practical, but not less than forty-eight (48) hours before the commencement of work. The Company shall not, however, be required to notify the Division in advance of any work to be performed by Dominion under conditions that Dominion deems to constitute an emergency. Dominion shall notify the Division that work is in progress under emergency conditions no less than twenty-four (24) hours after an emergency has been declared. For purposes of the preceding sentences, an "emergency" shall include, but not be limited to, ice storms, hurricanes, tornadoes, wind storms, fires, vandalism to Dominion's facilities, and any other conditions that, in Dominion's judgment, cause or threaten to cause an interruption of service to Dominion's customers.

(f) That staff or agents of the Division may, at their option, accompany Dominion personnel during any routine work performed on the Right-of-Way.

Dominion Form No. [illegible] © 2009 Dominion Resources Services, Inc.

(g) Approved temporary access locations referred to in 1.2 may be impassable due to vegetation. In the event Dominion needs to access the Right-of-Way through an approved temporary access location, vegetation shall be cleared as stated in section 3(c). After work is complete, Dominion shall restore the location to an impassable condition within fourteen (14) days. The preferred method for this restoration is the transplantation of suitable native vegetation from other locations on the Right-of-Way. Division staff will provide guidance and oversight during the transplanting process. The installation of posts, cables, and/or gates also may be used, provided that they are sufficiently substantial to act as a significant deterrent to vehicular trespass at the approved temporary access location. These alternatives shall be removed by Dominion after vegetation has sufficiently established itself to deter unwanted vehicular trespass.

(h) To return surface elevations where electrical cable is to be installed to initial pre-construction contours after construction, maintenance, and repair.

(i) That it will not intentionally introduce any non-native plant species by seeding or planting in the Currituck Banks component of the Reserve.

(j) To minimize the introduction of seeds from non-native plant species by power washing all equipment used in inspection, maintenance, emergency situations, and construction activities before entering the Currituck Banks component of the Reserve

(k) To post and maintain signage along the Right-of-Way that states:
Conditioned Utility Right-of-Way
Environmentally Sensitive Area
Special Conditions Apply for all Entry
Contact Manager at 252.261.8491

4. To indemnify and save harmless the State of North Carolina, its directors, officers, employees, contractors, subcontractors and agents from and against any and all actions, suits, demands, claims, and judgments, and from and against all costs, expenses, pecuniary or other loss arising out of any damage, injury to or loss of person, life and/or property proximately caused by the negligent acts or omissions of Dominion, its employees, contractors, subcontractors and agents including, without limitation, improper installation or use of equipment or defective equipment by Dominion.

5. To have no liability for debts or other obligations incurred by the Division, its members, employees, contractors, subcontractors or agents during their performance of any act directly or indirectly related to the provisions of this Agreement.

6. That it shall be liable for property damage and bodily injury (including loss of life and worker's compensation claims) proximately caused by negligent actions or omissions of Dominion, its directors, officers, employees, contractors, subcontractors and agents during their performance of work on the Right-of-Way under the terms of this Agreement.

II. THE DIVISION AGREES:

1. If the Division discovers conditions it reasonably believes to be hazardous, it shall provide immediate oral notice to Dominion North Carolina Power, and promptly shall follow up such oral notice with notice in writing. Dominion North Carolina Power shall correct the condition if, in Dominion's sole judgment, such action is warranted.

2. To provide the following assistance to Dominion when it is appropriate:

(a) Identify temporary access locations in the event the pathway is not passable per stipulations in section I.2.

(b) Guidance and oversight of restoring temporary access locations.

3. To inform Dominion of any maintenance needed to the fence/gate.

4. That it will not disturb any equipment or maintenance and repair site without Dominion's prior approval

5. To accompany Dominion personnel on site upon request or at the Division's discretion.

6. To have no liability for debts or other obligations incurred by Dominion, its directors, officers, employees, contractors, subcontractors or agents during their performance of any act directly or indirectly related to the provisions of this Agreement.

III. DOMINION AND THE DIVISION MUTALLY AGREE:

1. To conduct all activities described in this Agreement in conformance with these purposes. All the terms and conditions provided for in this Agreement shall be interpreted to effectuate these goals and objectives.

2. To maintain and update the contact information included in Addendum A as necessary to ensure adequate communication for purposes of this Agreement.

3. That the terms and conditions of this Agreement shall extend to and be binding upon all, employees, agents, contractors, sub-contractors and assigns of either Party.

4. That nothing herein shall be construed to abrogate or diminish the rights held by Dominion under any existing easement agreement.

5. That nothing herein contained shall be construed as limiting or affecting in any way the authority of the Division in connection with the proper administration, management, and protection of the Currituck Banks component of the Reserve in accordance with the laws and documents referenced in this Agreement.

Dominion [illegible]

6. That amendments to this Agreement may be proposed by either party and shall become effective upon written approval of both parties.

7. That this Agreement shall become effective following signature by the parties and shall remain in force for five (5) years, at which time it may be reviewed and renewed for another five-year period. The Agreement may be terminated by written notice of one party to the other, but will remain in force until six months after the official termination date for removal of equipment, gates, signs, etc.

[THE REMAINDER OF THIS PAGE INTENTIONALLY HAS BEEN LEFT BLANK. SIGNATURE PAGE FOLLOWS.]

Dominion

IN WITNESS WHEREOF, Dominion North Carolina Power and the Division have caused this Memorandum of Agreement to be executed by their duly authorized officers and their corporate seals to be affixed and attested by their Assistant Secretaries or Assistant Corporate Secretaries as of the Effective Date.

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

BY: _____
Charles S. Jones
Director, Division of Coastal Management

BY: _____
William G. Ross, Jr.
Secretary

VIRGINIA ELECTRIC AND POWER COMPANY

BY: _____
P. Rodney Blevins
Vice President - Electric Delivery Operations

ATTEST:

BY: _____
Vice President and Corporate Secretary

Dominion

Form No. 727/11@49 2003 ©2003 Dominion Resources Services, Inc.

ADDENDUM A
CONTACT INFORMATION AND QUALIFIED OBSERVERS

Dominion North Carolina Power

Michael W. Conner
Manager - Electric Delivery Operations
5300 The Woods Road
Kitty Hawk, NC 27949
(252) 255-2141
Michael.Conner@dom.com

Joseph F. Murphy
Manager - Electric Delivery Construction
5300 The Woods Road
Kitty Hawk, NC 27949
(252) 255-2551
Joe.Murphy@dom.com

Division of Coastal Management &
North Carolina National Estuarine Research Reserve

Ann Wunderly
North Carolina National Estuarine Research Reserve
Northern Sites Office
983 West Kitty Hawk Road
Kitty Hawk, NC 27949
(252) 261-8891
ann.wunderly@ncmail.net

Rebecca Ellin
Reserve Manager
Division of Coastal Management
North Carolina Department of
Environment and Natural Resources
400 Commerce Avenue
Morehead City, NC 28557-3421
(252) 808-2808
rebecca.ellin@ncmail.net

Form No. 72871 (Rev. 2/08) ©2008 Dominion Resources, Inc.

CURRITUCK SOUND TRANSMISSION LINE

COUNTY OF DARE

MANTEO, NORTH CAROLINA 27954

November 24, 1986

OFFICE OF THE
BOARD OF COMMISSIONERS

ROBERT V. OWENS, JR., NAGS HEAD
CHAIRMAN

H. R. LANGLEY, MANNS HARBOR
VICE CHAIRMAN

T. B. GRAY, BUXTON
ORMAN L. MANN, WANCHESE
LOUISE DOLLARD, SOUTHERN SHORES

P. O. BOX 1000
PHONE (919) 473-2141

SANDRA W. GAMIEL
SECRETARY AND CLERK
TO THE BOARD

DWIGHT H. WHEELESS
COUNTY ATTORNEY

NOTED DEC 2 1986 J.F.H.

Mr. John F. Hughes, Jr.
District Manager
North Carolina Power
Post Office Box 279
Manteo, North Carolina 27954

Dear Mr. Hughes:

Upon a motion by Thomas B. Gray, seconded by H. Russell Langley, the enclosed resolution was unanimously adopted by the Dare County Board of Commissioners at its meeting held on November 21, 1986.

You will notice that the wording of the resolution is different than the suggested form you sent us. County Attorney Wheeless reworded in a way to prevent liability to the county.

If you have any questions, please contact us.

Sincerely,

Sandra W. Gamiel

Sandra W. Gamiel
Clerk to the Board

Enclosure

RESOLUTION TO SUPPORT THE EXPERIMENTAL USE OF ABANDONED ELECTRIC TRANSMISSION STRUCTURES AS OSPREY NESTING SITES

WHEREAS, the increased utilization of electric power poles along the Outer Banks as nesting sites by the Osprey presents a certain danger to the birds, to North Carolina Power distribution facilities and to the public.

AND, an opportunity exists to provide safe, alternate nesting habitat via the conversion of the twelve abandoned concrete transmission structures crossing Currituck Sound into Osprey nesting sites.

NOW, THEREFORE, BE IT RESOLVED that North Carolina Power and the County of Dare hereby agree to work cooperatively to establish additional nesting habitat for the Osprey.

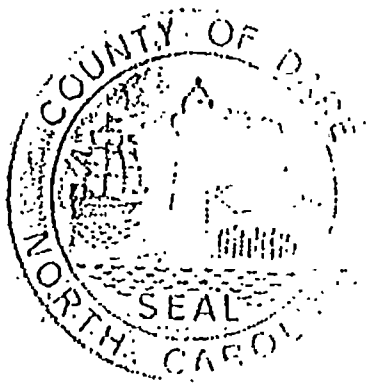
This is the 21st day of November, 1986.

Robert V. Owens, Jr.

Robert V. Owens, Jr., Chairman
Dare County Board of Commissioners

WITNESS:

Sandra W. Samuel
Clerk to the Board



ELIZABETH A.SMITH
Mayor

SAMUEL O. SMITH
GEORGE F. HOFFMAN
CARL L. PARROTT
ALVAH T. WILLIAMS
Town Council Members

1981
TOWN OF KITTY HAWK
P.O. Box 549
Kitty Hawk, NC 27949
(919) 261-3552

F. WEBB WILLIAMS, JR.
Town Manager

JOHN G. GAW, JR.
Town Attorney

PATRICIA KLUSMAN
Town Clerk

RESOLUTION TO SUPPORT THE EXPERIMENTAL USE OF ABANDONED ELECTRIC TRANSMISSION STRUCTURES AS OSPREY NESTING SITES

WHEREAS, the increased utilization of electric power poles along the Outer Banks as nesting sites by the Osprey presents a certain danger to the birds, to North Carolina distribution facilities and to the public.

AND, an opportunity exists to provide safe, alternate nesting habitat via the conversion of the twelve abandoned concrete transmission structures crossing Currituck Sound into Osprey nesting sites.

NOW, THEREFORE, BE IT RESOLVED THAT North Carolina Power and the Town of Kitty Hawk hereby agree to work cooperatively to establish additional nesting habitat for the osprey. In this regard, the undersigned agree to leave intact the standing, for a three year period beginning January 1, 1988 and ending December 31, 1990, twelve concrete transmission structures crossing Currituck Sound so that they may be converted into Osprey nesting platforms. North Carolina Power agrees to construct, install and monitor these platforms. At the end of the study period the undersigned shall meet to review the monitoring data and discuss the future disposition of the transmission structures. North Carolina Power will then remove all vacant, unused structures provided that their removal is more desirable than their potential for future use. All colonized structures shall be left standing for the benefit of returning birds.

This resolution was approved by the Town Council of Kitty Hawk, NC at a meeting held on November 17, 1986 by a vote of 5 in favor and 0 against.

North Carolina Power

Title

12-2-86
Date

Elizabeth A. Smith, Mayor

PATRICIA KLUSMAN, CLERK

11/17/86
Date

The Town of 1981 Kitty Hawk

Retain

BOARD OF COMMISSIONERS

WILSON W. SNOWDEN, Chairman
FRANCES P. WALKER, Vice Chairman
ERNIE BOWDEN
BARRY C. NELMS
JERRY L. OLD

COUNTY OF CURRITUCK

WILLIAM S. RICHARDSON
County Manager

P. O. BOX 39
CURRITUCK, N. C. 27929
919/232-2075

November 24, 1986

Mr. John F. Hughes, Jr., District Manager
North Carolina Power
P. O. Box 279
Manteo, NC 27954

Dear Mr. Hughes:

Enclosed please find the second original resolution for your signature and file copy that was inadvertently left out of Mr. Richardson's letter to you dated November 20, 1986.

Please execute both originals, return one to our office and retain the other for your files.

Sincerely,

Eileen M. Wirth

Eileen M. Wirth
Administrative Assistant

emw

Enclosure

COUNTY OF CURRITUCK

RESOLUTION TO SUPPORT THE EXPERIMENTAL
USE OF ABANDONED ELECTRIC TRANSMISSION
STRUCTURES AS OSPREY NESTING SITES

WHEREAS, the increased utilization of electric power poles along the Outer Banks as nesting sites by the Osprey presents a certain danger to the birds, to North Carolina Power distribution facilities and to the public; and,

WHEREAS, an opportunity exists to provide safe, alternate nesting habitat via the conversion of the twelve abandoned concrete transmission structures crossing Currituck Sound into Osprey nesting sites.

NOW, THEREFORE, BE IT RESOLVED THAT North Carolina Power and Currituck County hereby agree to work cooperatively to establish additional nesting habitat for the osprey. In this regard, the undersigned agree to leave intact the standing, for a three year period beginning January 1, 1988 and ending December 31, 1990, twelve concrete transmission structures crossing Currituck Sound so that they may be converted into Osprey nesting platforms. North Carolina Power agrees to construct, install and monitor these platforms. At the end of the study period the undersigned shall meet to review the monitoring data and discuss the future disposition of the transmission structures. North Carolina Power will then remove all vacant, unused structures provided their removal is more desirable than their potential for future use. All colonized structures shall be left standing for the benefit of returning birds.

Adopted this 17th day of November, 1986.

North Carolina Power

By: N.C. Power

Date: 11-25-86

Name: John F. Hughes

Title: District Manager

Currituck County

Wilson W. Snowden

Wilson W. Snowden
Chairman

Attest:

William S. Richardson
Clerk to the Board

RESOLUTION TO SUPPORT THE EXPERIMENTAL USE OF ABANDONED ELECTRIC TRANSMISSION STRUCTURES AS OSPREY NESTING SITES

WHEREAS, the increased utilization of electric power poles along the Outer Banks as nesting sites by the Osprey presents a certain danger to the birds, to North Carolina Power distribution facilities and to the public.

AND, an opportunity exists to provide safe, alternate nesting habitat via the conversion of the twelve abandoned concrete transmission structures crossing Currituck Sount into Osprey nesting sites.

NOW, THEREFORE, BE IT RESOLVED THAT North Carolina Power and Southern Shores hereby agree to work cooperatively to establish additional nesting habitat for the osprey. In this regard, the undersigned agree to leave intact the standing, for a three year period beginning January 1, 1988 and ending December 31, 1990, twelve concrete transmission structures crossing Currituck Sound so that they may be converted into Osprey nesting platforms. North Carolina Power agrees to construct, install and monitor these platforms. At the end of the study period the undersigned shall meet to review the monitoring data and discuss the future disposition of the transmission structures. North Carolina Power will then remove all vacant, unused structures provided their removal is more desirable than their potential for future use. All colonized structures shall be left standing for the benefit of returning birds.

North Carolina Power

By : John P. Hughes

Date : 12-18-86

Name : J. E. Hughes, Jr

Title: District Manager

Town of Southern Shores

By :

Date : December 2, 1986

Name : Kern P. Pitts

Title: Mayor

NAGS HEAD WOODS TRANSMISSION LINE

NAGS HEAD WOODS / TRANSMISSION RIGHT OF WAY VEGETATION MANAGEMENT AGREEMENT

THIS MANAGEMENT AGREEMENT, dated February 12, 2003 (an update and extension of the original agreement dated October 10, 1984), by and between ~~DOMINION~~ Virginia Electric and Power Company (Company), a Virginia corporation with headquarters at One James River Plaza, P.O. Box 26666, Richmond, Virginia 23261, and THE NATURE CONSERVANCY (Conservancy), a nonprofit corporation organized and existing under the laws of the District of Columbia with its North Carolina field office at 4705 University Drive, Suite 290, Durham, North Carolina 27707.

This agreement is for the cooperative maintenance by the Company and the Conservancy of the Company's transmission line right-of-way 50 feet in width through parcels of land owned by the Conservancy, lying and being situated in Atlantic Township of Dare County, North Carolina. The Conservancy shall provide to the Company legal documentation and plats showing the locations of Conservancy-owned land within the Company's right-of-way corridor.

For and in consideration of the mutual covenants and undertakings hereinafter expressed, the parties covenant and agree as follows:

1. The purpose of this Management Agreement is to minimize any interference with or harm to the ecological integrity of the Nags Head Woods Ecological Preserve, owned by the Conservancy, which might result from the Company's use and maintenance of said 50-foot right-of-way, including but not limited to any future low canopy shrub community created within the right-of-way, and to eliminate any potential impact on existing freshwater ponds located within the Nags Head Woods Ecological Preserve. The parties agree to conduct all activities hereinafter described in conformance with these purposes. All the terms and conditions provided for herein shall be interpreted to effectuate these goals and objectives.
2. The Conservancy, at its own expense, shall have the responsibility of maintaining the right-of-way corridor and managing the woody vegetation on the right-of-way according to the provisions herein, including resources and materials for selective herbicide applications in selected areas mutually agreed on and in

accordance with a mutually agreed on herbicide application plan. This plan shall govern the types of herbicides to be used and the methods of application.

3. The Company agrees to pay an annual fee of $5,000.00 to the Conservancy for maintaining the right-of-way corridor in accordance with this agreement. The Company agrees to make payment of the annual fee by December 1 of each year.

4. The Company will provide contract labor services to the Conservancy in support of right-of-way maintenance activities upon request in writing by the Conservancy. Contract labor forces provided by the Company under this Agreement shall be accompanied by Company and/or Conservancy personnel at all times while working on Conservancy property. The actual costs of contract labor services will be deducted by the Company from the annual fee. The Company will provide, at its expense, herbicides and related chemicals for application by qualified, North Carolina certified applicators as part of the herbicide application plan described in paragraph 2.

5. The Company shall have no liability for debts incurred by the Conservancy, its members, employees, or agents while performing any act directly or indirectly related to the provisions of this Agreement.

6. All work performed on the right-of-way shall conform with the following specifications:

   (a) The Company will to the extent possible, comply with all reasonable requests by the Conservancy to minimize interference with areas of special ecological concern to the Conservancy.

   (b) The woody vegetation on the right-of-way shall be maintained in accordance with the following formula: Starting at a point in the center line of the right-of-way and extending 10 feet on each side of that center line, vegetation will be permitted up to a height of 12 feet. From the point 10 feet from the center line of each side and extending to the edge of the right-of-way on each side, the tree and vegetation height can be increased from 12 feet at the point 10 feet from the center line linearly to a height of 22 feet at each edge; i.e., the height can be increased at a linear rate of 6.7 feet vertical for each 10 feet horizontal. The Company further agrees to authorize its representative to allow trees and vegetation to be maintained at heights exceeding the above guidelines at specific locations, with consideration being given to varied topography, hydrology, and species composition. These locations shall be mutually agreed on by the Company and the Conservancy.

(c) Should the Company discover that such vegetation is not being maintained in accordance with the above, it shall notify the Conservancy in writing to take appropriate action to correct the condition. If such condition is not corrected within two weeks from the date of notice, the Company may trim vegetation back to the above clearance limitation.

(d) The right-of-way shall be maintained in such a fashion that a meandering vehicular pathway of 12 feet in width, within the said right-of-way will remain clear of woody vegetation and a diameter of 30 feet shall be maintained clear of woody vegetation around each structure (the word structure as herein used refers to wood, steel or concrete poles, or combinations of poles or frames erected on which to attach wires and associated equipment and shall not be construed to mean buildings or substations), which includes the above-referenced pathway width.

(e) The Company shall use this meandering vehicular pathway for access to the right-of-way at all times except when wet weather or the location of existing permanent ponds prevents access by this route. When such access is prevented by wet weather or is blocked by permanent ponds, the Company shall use approved alternate access roads.

(f) When in the opinion of the Company it is possible, the Company shall plan all non-emergency line work during the months of January, February and March.

(g) If while performing work in accordance with the provisions of this agreement the Conservancy should discover conditions it believes hazardous, it shall notify the Company immediately and follow up such notice in writing, and the Company shall correct the condition, if in the Company's judgment such action is warranted.

(h) The Company shall have the exclusive responsibility for removal of danger trees (such a tree shall be any tree which in falling or being felled could come within 10 feet of any conductor) outside the right-of-way, structure maintenance, and transmission line construction and maintenance activities performed subject to the provisions herein, and including the following additional provisions as they may apply.

(i) The Company shall notify the Conservancy of its intent to remove danger trees, to perform structure maintenance, or to perform routine transmission line maintenance and line construction. Such notification shall be made as far in advance as it is practical, but not less than 48 hours prior

to work commencement. The Company shall not, however, be required to notify the Conservancy in advance of any work performed by the Company under conditions deemed by the Company to be emergencies. (Emergency is defined herein as any occasion, including but not limited to, ice storm, hurricane, and vandalism to the Company's facilities that causes or can cause an interruption of service to the Company's customers).

(j) All routine inspections of the right-of-way by the Company shall be made on foot or by aerial inspection. In the event a routine vehicular inspection is necessary, said vehicle will utilize the meandering vehicular pathway referred to in Paragraphs 6(d) and 6(e) above and the other means of access as provided for herein.

(k) The Company agrees that Conservancy staff or agents may accompany, at their option, the Company during any routine work performed by the Company on its right-of-way.

(l) When it is necessary for the Company to open temporary access at locations previously impassable due to vegetation, the Company shall restore the location to an impassable condition in a timely manner. The transplanting of suitable native vegetation from other locations on the right-of-way is the preferred method for this restoration. The installation of posts, cables, and/or gates may also be used provided they are substantial enough to provide a significant deterrent to vehicular trespass.

(m) No non-native plant species shall intentionally be introduced by seeding or planting in the Nags Head Woods Ecological Preserve by the Company.

(7) The Conservancy shall assume all liability for property damage and bodily injury (including loss of life and workman's compensation claims) resulting from actions of the Conservancy, its members, employees, or agents while performing work on the right-of-way under the terms of this agreement, and shall indemnify and save harmless the Company from any and all actions, suits, demands, claims, and judgments, and from and against all costs, expenses, pecuniary or other loss that may arise out of any damage, injury to or loss or person, life and/or property caused by an act or omission of the Conservancy, its agents, servants, and employees, and particularly caused by improper installation or use of equipment or defective equipment by the Conservancy. The Conservancy will not be responsible for or on account of, nor will it indemnify or save harmless the Company, from and against any such claim, demands, suits, actions, judgments, costs,

expenses, or losses that may arise out the any such damage injury or loss caused by the sole negligence of the Company, its agents, servants, and employees. The Conservancy shall not indemnify and save harmless the Company from any and all actions, suits, demands, claims, and judgments and from and against all costs, expenses, pecuniary, or other loss that may arise out of any damage, injury to or loss of person, life and/or property caused by an act or omission of parties other than Conservancy, its agents, servants, and employees, or invitees other than the general public. The use of the specific language herein shall not limit the application of the general terms herein.

(8) Prior to performing any work hereunder, The Conservancy shall, at its own expense, procure and thereafter keep in effect for the duration of this agreement: (a) Workman's Compensation insurance for its employees engaged in this work, sufficient to comply fully with the requirements and coverages specified by the laws of each jurisdiction in which the work is to be performed; (b) Comprehensive General Liability insurance, providing limits of not less than $1,000,000 per occurrence for bodily injury and death, and $1,000,000 per occurrence for property damage and including coverage for Contractual Liability with the Company as an additionally named insured (for the purpose of the Agreement only); and (c) such other specific insurance as may be appropriate for the work to be performed. The policies above described shall be with insurance companies satisfactory to the Company, shall conform to the laws of each jurisdiction wherein the work is to be performed, and shall provide for ten (10) days notice to the Company prior to lapse or cancellation thereof. The Conservancy shall furnish to the Company certificates covering such insurance evidencing that the above requirements have been complied with by the Conservancy and indicating expiration dates.

(9) It is mutually agreed that the Company and the Conservancy will exchange such information as it is relevant to the right-of-way management and vegetation management studies, and to fully disclose future plans for maintenance activities.

(10) This Management Agreement may be terminated by the Company if, in its reasonable opinion, the Conservancy materially violates the terms of this Agreement. Such termination shall be in writing and delivered to the Conservancy 30 days prior to date of termination. The Conservancy may terminate this agreement at any time by written notice delivered to the Company at least 30 days prior to date of termination, otherwise this agreement shall remain in effect until December 31, 2012.

(11) The terms and conditions of this Management Agreement shall extend to and be binding upon all agents, employees, contractors, sub-contractors and assigns of either party.

(12) Nothing herein shall be construed to abrogate the rights held by the Company under any existing easement agreement.

IN WITNESS WEREOF, the Company and the Conservancy have caused this Management Agreement to be executed by their duly authorized officers and their corporate seals to be hereto affixed and attested by their Assistant Secretaries or Assistant Corporate Secretaries as of the day and year first above written.

THE NATURE CONSERVANCY

BY: _____
KATHERINE D. SKINNER
VICE PRESIDENT
EXECUTIVE DIRECTOR
NORTH CAROLINA CHAPTER

ATTEST:

BY: _____
ASSISTANT SECRETARY

DOMINION

BY: _____
MANAGING DIRECTOR

ATTEST:

BY: _____
ASSISTANT SECRETARY

ROANOKE RIVER TRANSMISSION LINE

Memorandum of Understanding between Dominion Power Company and the United States Fish and Wildlife Service, Roanoke River National Wildlife Refuge

Subject: Maintenance of Utility Transmission Line Right-of-Ways (ROW) on U.S. Fish and Wildlife Service (Service) Roanoke River National Wildlife Refuge (RRNWR) Properties Company Swamp and Hampton Swamp Tracts

Purpose: To clarify between the Service and Dominion Power or any future named utility company that comes into management authority of the subject ROW the criteria under which certain management activities shall occur on the Company Swamp and Hampton Swamp Tracts under management by the Service.

The refuge management has the responsibility of managing the habitats found within the boundary of the RRNWR for the benefit of all wildlife. It is the purpose of this MOU to work with Dominion Power to enhance the habitat found within the described ROW and ensure the integrity of the habitat found outside of the described ROW while allowing the utility company to meet their objectives. This MOU shall not be construed to limit or modify the legal rights of the parties as defined by the deed and other documents forming the chain of title to the property covered by the MOU. This MOU is not legally binding on either party; rather it represents a good faith effort to address an issue of substantial importance to both parties. Each party reserves the right to terminate this MOU as it deems necessary.

Maintenance within the legal ROW as per Legal Easement and Refuge Special-Use Permit
The following points are understood by both parties and will be adhered to:
1. Any woody tree found within the ROW may be removed by mechanical or authorized chemical means.
2. If herbicides are used, the herbicide must be on the most recent approved pesticide use list see conditions in special use permit number RRNWR 05-4263001.
3. A pesticide use proposal must be completed by 15 September prior to any applications the following calendar year and Dominion Power must have an approved special use permit before application.
4. Mechanical means is restricted to woody debris that may in the opinion of company personnel pose a threat to transmission lines, support poles or guide wires.

Maintenance outside of the legal ROW
The following points are understood by both parties and will be adhered to:

1 The ROW easement states that all trees cut or removed by the Company from Owner's property outside of the said ROW will be paid for by the Company.

2 Therefore, any trees cut outside the legal ROW easement will be compensated as appropriate at the local market value using the Doyle's scale of measurement as stated in the ROW easement.

3 Compensation funds will be placed in a general account with the U. S. Government.

Criteria for Trees to be Manipulated

4. The ROW easement states that the Company has the legal right to remove trees from outside its legal ROW easement that may in the opinion of the Company pose a threat to proper and efficient operation of the subject lines.

5. Trees present outside the legal ROW will be identified as either a danger tree or a dangerous tree and are defined as follows: ' A danger tree is tall enough to hit the line if it were to fall in the direction

of the line but poses no immediate threat. ' A dangerous tree is a tree tall enough to hit a line if it falls but has a higher probability due to its physical condition.

6. Danger trees will not be cut or manipulated in any way unless authorized by refuge management and will be appropriately compensated for by the Company as stated above.

7. Dangerous trees may be manipulated by Dominion Power contractors or ROW maintenance personnel in such a way that it will no longer pose a threat to a line and the Service will not require compensation from the Company.

8. The following constitutes a dangerous tree: a tree leaning towards a line at more than 30 degrees, a tree with branches that could impair a line, a dying tree whose branches may snap off and impair a line, the base of the tree is impaired jeopardizing the stability of the tree, and other cases as they arise.

9. Before any work outside of the ROW easement commences, a management prescription will be worked up between Refuge management and Dominion's ROW managers in an effort to remove the threat of dangerous trees and still maintain the integrity of the adjacent bottomland hardwood forest communities

10. It is recommended that dangerous trees be manipulated in such a way to prevent a tree from being cut down to ground level. Management prescriptions should consider these and other methods of manipulation: removing selected branches, topping off the tree to reduce height and if suitable, creating a den tree.

11. All tree maintenance activities will occur between 1 September and 31 December unless immediate attention is warranted.

Charles D. Hardy Date Manager Transmission Right-of-Way Dominion Power

Refuge Manager Date Harvey Hill

SCUPPERNONG TRANSMISSION LINE

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890

February 20, 1988

IN REPLY REFER TO

Regulatory Branch

SUBJECT: File No. SAWC088-N-089-0221 and
State Permit No. 161-88

Virginia Electric and Power Company
North Carolina Power
Post Office Box 26666
Richmond, Virginia 23060

Gentlemen:

Reference your application for a Department of the Army permit to install an aerial, 115kV electrical crossing of the Scuppernong River, near Columbia, in Tyrrell County, North Carolina.

Your proposal has been reviewed and found to be consistent with the provisions and objectives of general permit No. SAWC080-N-000-0291. Therefore, you may commence construction activity in strict accordance with applicable State authorization, the enclosed plan and the following special conditions:

a. The permittee will install and maintain, at his expense, any signals prescribed by the U.S. Coast Guard, through regulations or otherwise, on authorized facilities.

b. The authorized structure and associated activity will no cause an unacceptable interference with navigation.

c. The permittee will notify the National Ocean Survey (NOS) and the Wilmington District Engineer, in writing, at least two weeks before beginning work and upon completion of the authorized work. The notification of completion will include a drawing which certifies the location and configuration of the completed activity (a certified permit drawing may be used). Notifications to NOS will be sent to: Director, National Ocean Survey (H/CG 222), Rockville, Maryland 20852.

d. In areas of standing water within the line right-of-way, vegetation will be cleared by hand and only the hardwood

vegetation that would interfere with the transmission line will be removed. Sub-canopy growth will be allowed to remain.

e. Within the line right-of-way in upland areas, only those hardwood trees which would interfere with the safety clearance for conductors will be removed. Areas with no hardwood growth will be left undisturbed.

f. The permittee will leave a 100-foot-wide subcanopy growth along the rivers edge as a visual buffer. The transmission line will turn slight angles on either side of the river leaving visable only a short distance of the corridor.

g. The permittee, in coordination with the North Carolina Wildlife Resources Commission, will establish a minimum of four game plots.

h. In coordination with the North Carolina Wildlife Resources Commission, the permittee will place a minimum of twelve wood duck boxes in the vicinity of the Scuppernong River.

Failure to comply with the State authorization, the conditions of the general permit or the aforementioned conditions could result in a violation of Federal law.

If any change in your work is required because of unforeseen or altered conditions or for any other reason, plans revised to show the change must be sent promptly to this office and the North Carolina Division of Coastal Management prior to performing any such change or alteration. Such action is necessary as revised plans must be reviewed and the authorization modified.

Questions or comments may be addressed to Mr. Jeffrey Richter, telephone (919) 343-4636.

Sincerely,

Charles W. Hollis
Chief, Regulatory Branch

Enclosure

Copies Furnished with enclosure:

Director, Atlantic Marine Center
National Ocean Service
ATTN: MOA 232X1
439 West York Street
Norfolk, Virginia 23510-1114

Mr. William Mills
Water Quality Section
Division of Environmental
Management
North Carolina Department of
Natural Resources and
Community Development
Post Office Box 27687
Raleigh, North Carolina 27611-7687

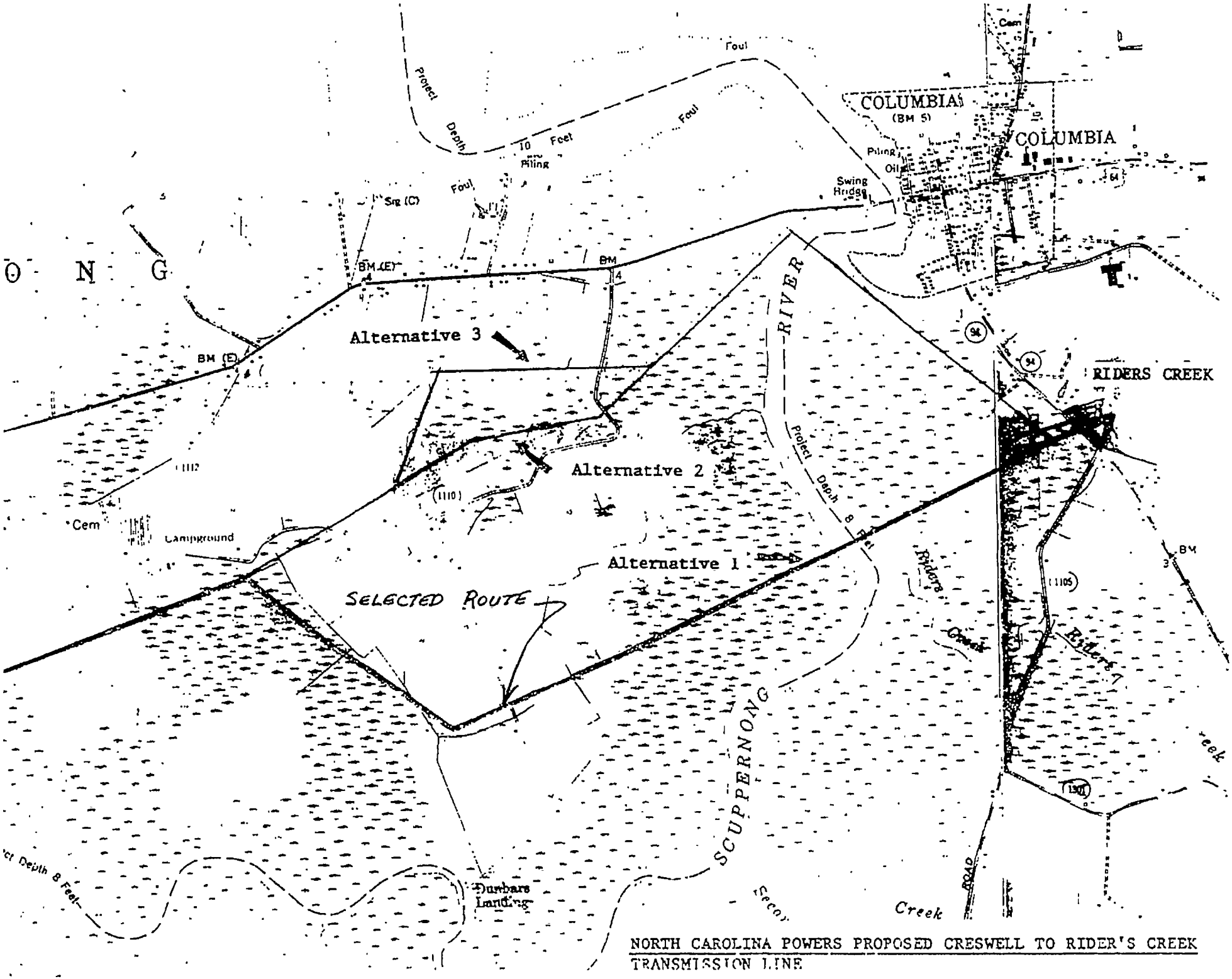
Mr. Robert F. McGhee, Chief
Wetlands Section
Region IV
Marine and Estuarine Branch
U.S. Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

Mr. John Parker
Division of Coastal Management
North Carolina Department of
Natural Resources and
Community Development
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Ms. L. K. (Mike) Gantt
U.S. Fish and Wildlife Service
Fish and Wildlife Enhancement
Post Office Box 33726
Raleigh, North Carolina 27636-3726

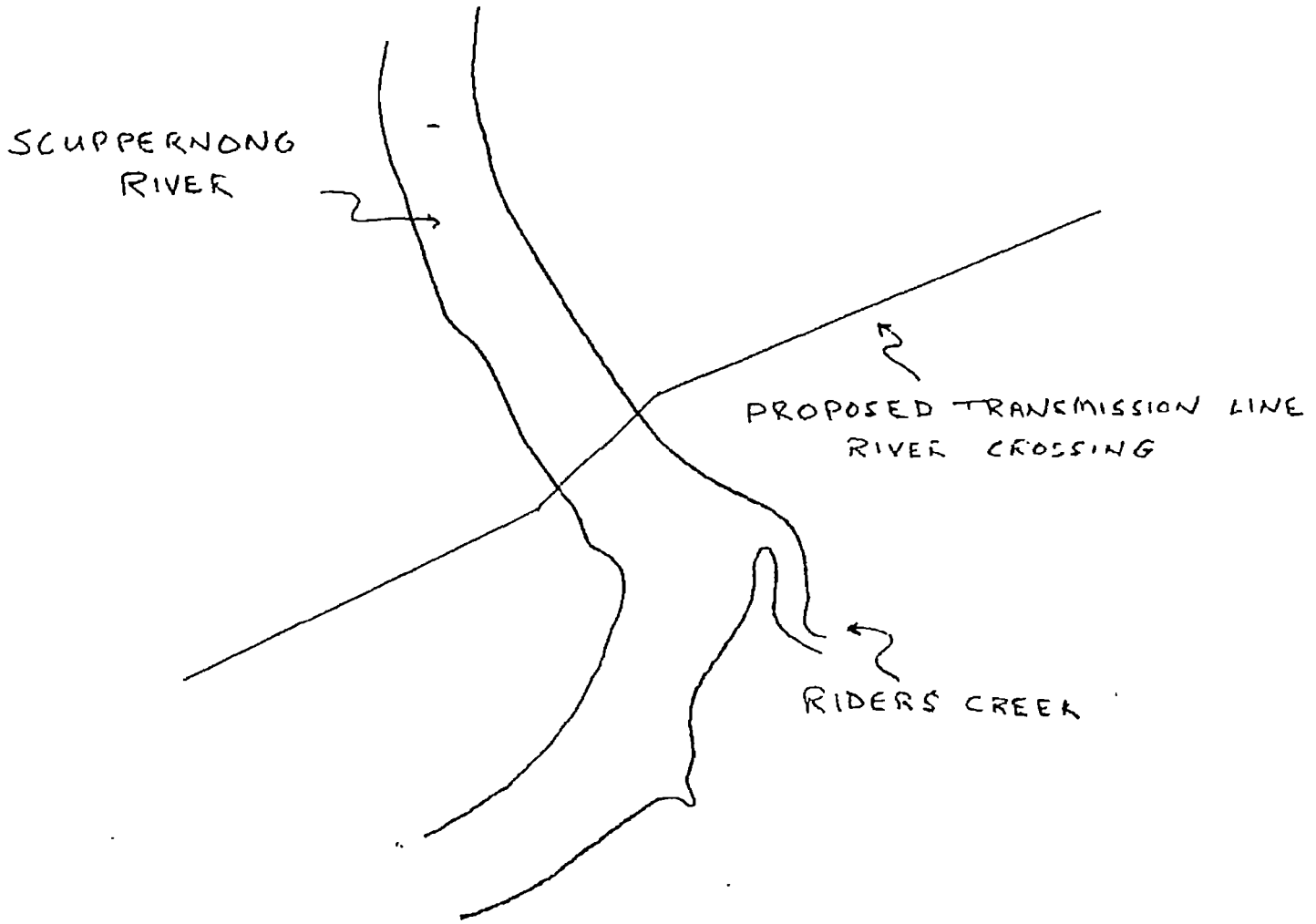
Mr. Randy Cheek
National Marine Fisheries Service
Habitat Conservation Division
Pivers Island
Beaufort, North Carolina 28516

Mr. Terry Moore
Washington Regional Office
North Carolina Division of
Coastal Management
Post Office Box 1507
Washington, North Carolina 27889



NORTH CAROLINA POWERS PROPOSED CRESWELL TO RIDER'S CREEK
TRANSMISSION LINE

566.65



SHEET 2 OF 3

VIRGINIA ELECTRIC AND POWER CO.

PLAT TO ACCOMPANY RIGHT-OF-WAY AGREEMENT WITH
SCUPPERNONG RIVER

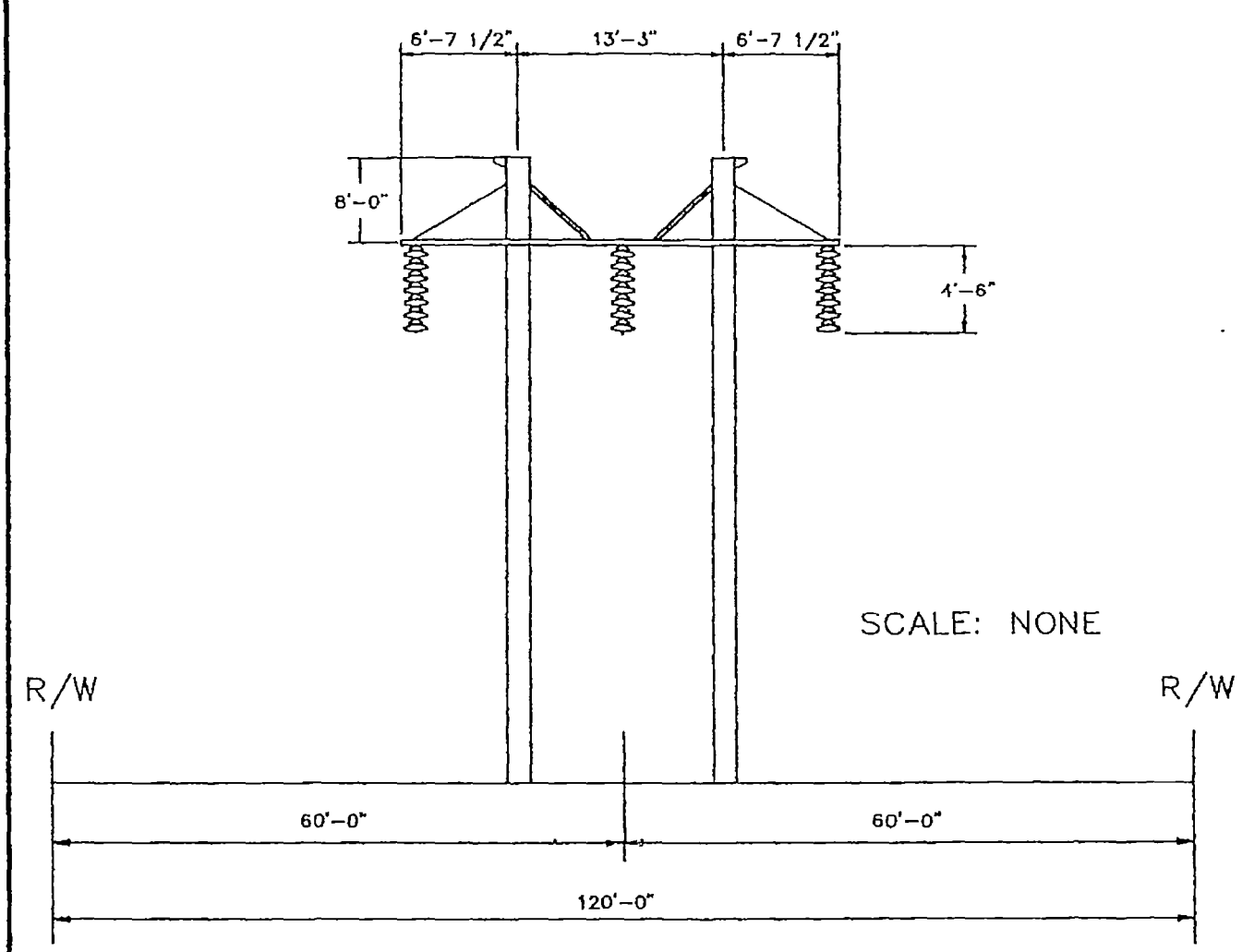
DISTRICT – TOWNSHIP	COUNTY	STATE
COLUMBIA	TYRRELL	NC

SCALE: 1 INCH = N/A FT.		SURVEYED BY NONE
DRAWN BY JBR	DATE 08/11/88	NO.

REVISIONS

4	3	2	1

PROPOSED
CRESWELL–RIDERS CREEK
115 KV TRANSMISSION LINE
TYPICAL TANGENT STRUCTURE



TYPICAL STRUCTURES FROM CRESWELL TO RIDERS CREEK
TYPE OF STRUCTURE: H–FRAME (SINGLE CIRCUIT)
APPROXIMATE AVERAGE HEIGHT: 70 FT
LENGTH OF STEEL CROSSARM: 26'–6"
APPROXIMATE AVERAGE SPAN LENGTH: 750 FT
CONDUCTOR: ALUMINUM
TOTAL LENGTH OF R/W: 8.2 MILES
R/W WIDTH: 120 FT

VIRGINIA QUAIL COUNCIL

Virginia Quail Council
Memorandum of Agreement



WHEREAS, the Northern Bobwhite Quail (*Colinus virginianus*) is a key species in Virginia's wildlife heritage; and

WHEREAS, Virginia's bobwhite quail population has declined 4.2 percent per year from 1966-2007 based on the breeding bird survey; and

WHEREAS, the decline in quail numbers has resulted in a reduction of quail harvest from approximately 250,000 in 1993 to approximately 68,000 in 2006; and

WHEREAS, the primary cause of the decline of bobwhite quail is the loss or degradation of early succession habitat; and

WHEREAS, the loss or degradation of early succession habitats is the result of large scale land use changes that have taken place in Virginia over the past 50 years; and

WHEREAS, the loss of early succession habitat has resulted in the decline in many other game and nongame wildlife; and

WHEREAS, the decline in quail hunting and wildlife associated recreation opportunities has resulted in the loss of millions of dollars of economic revenue in Virginia; and

WHEREAS, the Southeastern Association of Fish and Wildlife Agencies' Southeast Quail Study Group developed the Northern Bobwhite Conservation Initiative that sets goals and objectives for early succession habitat needed to restore quail populations to their 1980 level in Virginia; and

WHEREAS, the Board of The Department of Game and Inland Fisheries has adopted a resolution from the Director's Quail Focus group that requests "...the Department place the highest priority on the restoration of wild quail populations and promote the sport of bobwhite quail hunting both wild and preserve birds including the development of a Bobwhite Quail Action Plan encompassing management, research, education, outreach, coordination (utility and power company, DOF, timber, VDOT, ect) and specifically addressing environmental and other factors limiting quail numbers; and establishing official habitats to demonstrate the effectiveness of habitat management"; and

WHEREAS, the Virginia Quail Council, a multi-organizational task force, has been formed by the Virginia Department of Game and Inland Fisheries to facilitate the Quail Action Plan in Virginia

NOW THEREFORE, be it resolved that the undersigned organizations do agree, to the extent feasible, to actively support the Virginia Quail Action Plan through internal and external outreach, applicable research, and the promotion and application of land management practices and programs, subject to the availability of funds, to establish and maintain habitat for bobwhite quail and other early succession wildlife species in Virginia.

Robert W. Duncan, Executive Director **Virginia Department of Game and Inland Fisheries**	**Date**

THE W&OD TRAIL TRANSMISSION LINE

Memorandum of Understanding
Between

Dominion Virginia Power
And

Northern Virginia Regional Park Authority
To Establish

Vegetation Management Guidelines
For
The W&OD Trail

April 29, 2005

1. Memorandum of Understanding

Dominion Virginia Power ("Dominion") and the Northern Virginia Regional Park Authority ("Authority") hereby voluntarily enter into this Memorandum of Understanding ("MOU") in an effort to establish reasonable guidelines acceptable to both parties for the control and management of vegetation along segments of the W&OD Trail ("Trail"), where Dominion transmission lines coexist. This MOU shall not be construed to limit or modify the legal rights of the parties as defined by the deeds and other documents forming the chain of title to the property covered by the MOU. This MOU is not legally binding on either party; rather it represents a good faith effort to address an issue of substantial importance to both parties as well as Trail users, landowners adjacent to the Trail and other northern Virginia citizens. Each party reserves the right to terminate this MOU as it deems necessary.

2. Background and Overview

The Trail is a unique and special park that provides recreation and alternate transportation opportunities for millions of people. In 1987, the Trail was designated a National Recreation Trail and given the distinction of being placed on the U.S. Department of the Interior's national register of trails. It is a greenway that supports plants and wildlife and provides a respite to nature lovers. The natural setting of the Trail is an important asset to the citizens of northern Virginia and is a significant cultural and natural resource.

The Trail is owned and managed by the Authority, and is supported by local governments and a large network of community and volunteer organizations and users of the Trail.

Dominion owns transmission lines, along portions of the former W&OD Railroad property, which existed for decades prior to the origination of the Trail. Dominion owns a right-of-way easement along the Trail that, among other things, allows for removal of trees and brush that represent a danger to its lines.

Dominion has a public service obligation to maintain all of its lines, including those along the Trail, in a safe and reliable manner, so as to minimize the risk of power outages and cascading blackouts.

3. Two Missions

The Authority and Dominion have met to discuss the vegetative management practices utilized on the Trail. Dominion and the Authority voluntarily adopt these vegetation management guidelines, in order to allow for both the preservation of the recreational and natural resources of the park and the safe and reliable operation of Dominion's transmission lines. These guidelines will apply to the sections of the Trail where Dominion transmission lines coexist at the time of execution of this MOU. Both parties recognize and understand that accomplishing both missions requires compromise. The standard applicable to decisions, actions and approvals/denials of Dominion and the Authority under this MOU shall be an objective standard of reasonableness.

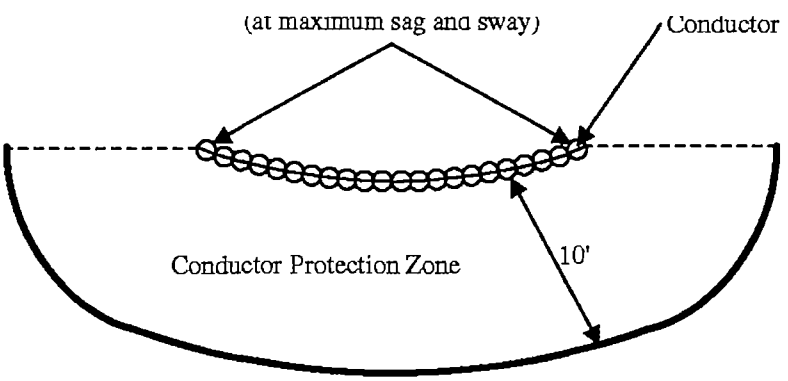
4. Compliance with Applicable Regulations

While Dominion fully intends to comply with these vegetation management guidelines, the parties acknowledge that various regulatory and other agencies, including the Federal Energy Regulatory Commission ("FERC"), the North American Electric Reliability Council ("NERC"), and the Virginia State Corporation Commission ("SCC"), may have authority over or involvement in matters relating to electric service reliability and/or tree clearing standards affecting transmission lines. Therefore, the operation of these guidelines and Dominion's ability to fully comply with them is subject to current and future regulations and requirements governing service reliability and vegetation control established by such federal and state agencies. Accordingly, Dominion and the Authority retain the right to modify this MOU by mutual agreement. Dominion will provide reasonable notice to the Authority of any proposed or final changes in federal or state regulations or requirements that affect Dominion's ability to fulfill the intent of this MOU. If any such changes affect the operation of this MOU, the parties agree to work in good faith to modify the MOU as needed.

5. Definitions

a.) Wire Zone/Border Zone Vegetation management standards around transmission lines recognize two geographic zones relative to the line. The "Wire Zone" is the area directly below the conductor and ten (10) feet to either side. The "Border Zone" consists of the remaining area extending to each border of the right-of-way.

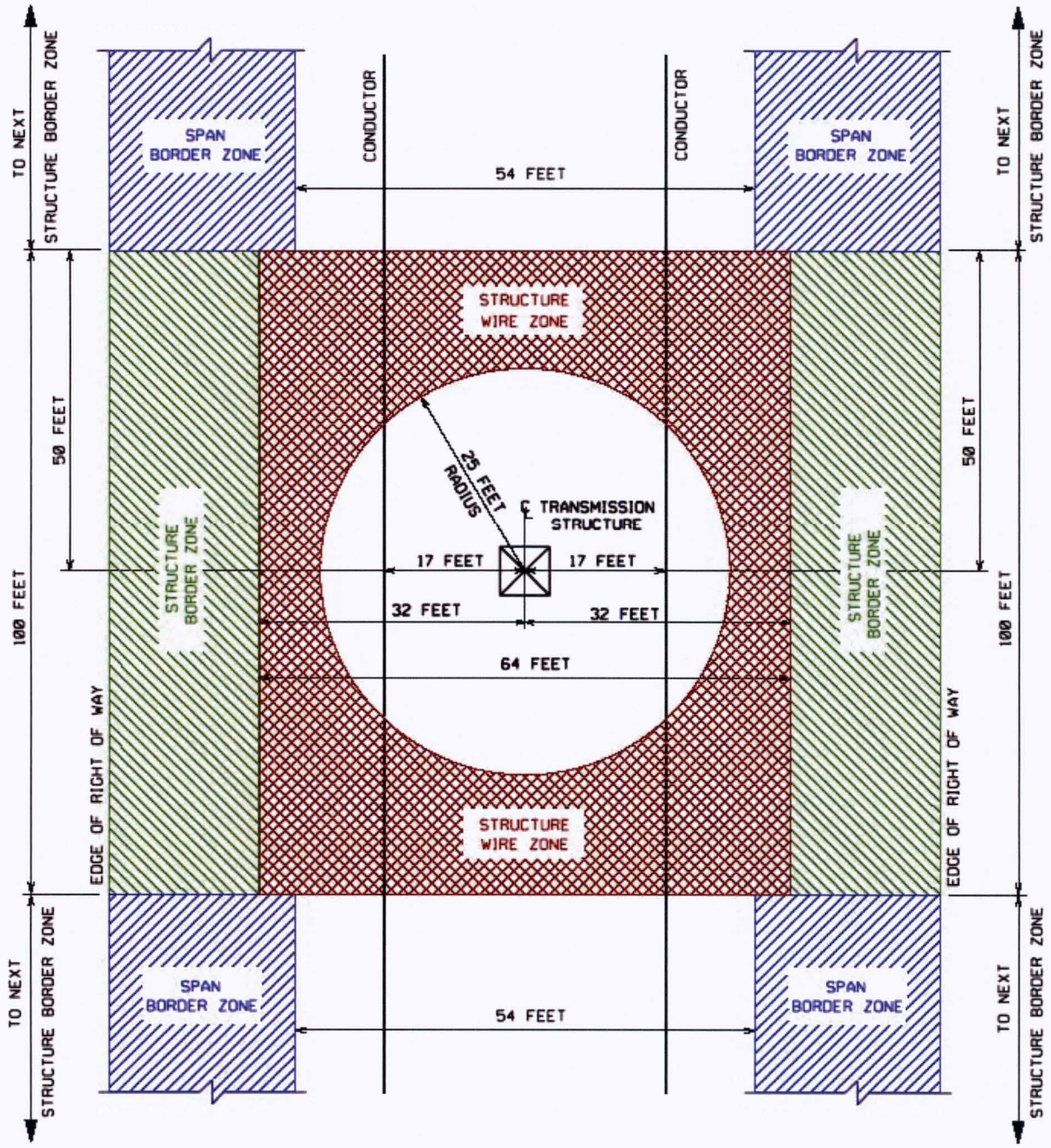
CONCEPTUAL DRAWING 2 - Not to Scale



b.) Maximum Conductor Range; Conductor Protection Zone The concepts of "Maximum Conductor Range" and "Conductor Protection Zone" have been established by Dominion and the Authority for purposes of defining a margin of safety surrounding Dominion's transmission line conductors. The "Maximum Conductor Range" is an arc that represents the full range of conductor positions, viewed in cross section at any given point linearly along the conductor, when the conductor is at maximum sag and sway. The "Conductor Protection Zone" is a space, intended to give a margin of safety, between the Maximum Conductor Range and a curve that extends ten (10) feet below and lateral to the Maximum Conductor Range.

c.) Taller Tree Planting Areas "Taller Tree Planting Areas" are designated areas along the entire length of the Trail where tall trees and shrubs may be planted that reach a mature height in a range up to one-hundred-and-five feet. Tall trees and shrubs that grow to a mature height greater than fifteen feet and up to onehundred-and-five feet may be planted along the Trail depending on location. The Authority may plant trees and shrubs that reach mature height greater than 15 feet in these areas provided that these trees and shrubs at mature height will not create a reliability Threat to the transmission lines. The Taller Tree Planting Areas have varying height restrictions according to zone and are categorized as "Structure Wire Zone", "Structure Border Zone" and "Span Border Zone", as shown in Conceptual Drawing 3.

TALLER TREE PLANTING AREAS



CONCEPTUAL DRAWING 3 – Not to Scale

Distances vary depending upon structure type and conductor configuration. Vehicle access is required at each transmission structure.

d.) Advance Patrol Team The "Advance Patrol Team" is a group of individuals that considers, evaluates and determines which trees should be pruned, removed or left untouched, and similarly makes decisions on other proposed vegetation control measures, before Dominion's tree crews or contractors begin work. The team consists of the Trail Manager or other representative of the Authority, a Dominion forester or other representative of Dominion, and other invited parties from time to time determined by the representatives of Dominion and the Authority, such as arborists or urban foresters of affected local governments and communities. Dominion will endeavor to give members of the Advance Patrol Team at least seven (7) days notice of any meeting scheduled to review plans or proposals for vegetation control work on the Trail. It is intended that all decisions as to the type and extent of vegetation control work performed on the Trail under this MOU be made by consensus of the Advance Patrol Team members. All members of the Advance Patrol Team shall act in good faith, and shall take no position or action that is arbitrary or unreasonable. Nevertheless, in the event of any unresolved disagreement among members of the Advance Patrol Team, then the mutual agreement of representatives of Dominion and the Authority will prevail. Unless otherwise specified herein, in the event of any unresolved disagreement between representatives of Dominion and the Authority, the executive director of the Authority and the managing director of Dominion will make the final decision.

e.) Tree For the purpose of this MOU, "Tree" is defined as any tree growing upon the Trail property.

f.) Brush For the purpose of this MOU, "Brush" is defined as the growth of woody stems that sprout back on Trees or Shrubs that were previously cut or treated with herbicide and the saplings of tall-growing and other undesirable trees (as determined by the Advance Patrol Team) including but not limited to oak, maple, locust, sycamore, poplar, walnut and cottonwood.

g.) Shrub For the purpose of this MOU, "Shrub" is defined as a generally low-growing, woody plant with several permanent stems instead of a single trunk.

h.) Threat Any Tree or Shrub that at any given point in time grows, could sway in high winds or could fall into the Conductor Protection Zone is deemed to be a "Threat". Any Tree or Shrub that, as a result of additional growth or other changed circumstances, can reasonably be expected to reach the potential to grow, sway in high winds or fall into the Conductor Protection Zone before the next Maintenance Cycle, is deemed to be a "Threat". A "Threat", generally, is any Tree or Shrub that places risk on either public safety or electric reliability.

i.) Herbicide "Herbicide" will have the same meaning as set forth in the Virginia Pesticide Control Act.

j.) The Right Tree in the Right Place For the purpose of this MOU, "the right tree in the right place" is defined as any existing or replacement Tree or Shrub that grows no more than fifteen (15) feet at mature height or that, because of conductor height, terrain, plant species and/or other variables, meets the criteria for Taller Tree Plantings described in Sections 5.c and 13.

6. Guiding Principles

a.) The paramount guiding principle to be used by Dominion and the Authority is that any Tree or Shrub that presents a Threat to any transmission line conductor shall, at the appropriate time, be pruned or removed as herein described, and no such Tree or Shrub should be planted as replacement plant material. From time to time, Dominion, at its discretion, may voluntarily limit the degree of pruning or removal of any such Tree, Shrub or other vegetation, when the risk is acceptable to Dominion.

b.) Absent other information, it may be presumed that the minimum conductor height on level terrain at the midpoint between towers is twenty-five (25) feet, and that no Tree or Shrub in the Wire Zone should be allowed that has a mature height taller than fifteen (15) feet. Similarly, under such conditions, no replacement Tree or Shrub that would be expected to reach a mature height of more than fifteen (15) feet should be planted as replacement material in the Wire Zone. However, Dominion and the Authority recognize and agree that many variables influence the likelihood that a Tree or Shrub might create a reliability Threat to Dominion's conductors. Such variables include height of the conductors, sag of the conductors, terrain, plant species and plant location in relation to the conductors. Therefore, reasonable efforts should be made to evaluate the minimum conductor height in certain locations with the view of allowing Trees and Shrubs greater than fifteen feet (15) in height to remain on the Trail or be planted as replacement material with the approval of a Dominion forester.

c.) In general, existing Trees, Shrubs and other desirable vegetation should be allowed to remain on the Trail unless they pose a Threat; but where it becomes necessary to remove them for the protection of Dominion's transmission line facilities, Trees and Shrubs should be reestablished to the greatest reasonable extent. Trees, Shrubs and other vegetation provide significant benefits for the Trail. Trees, Shrubs and other vegetation provide trail users and nearby residents screening, sound buffering, peaceful vistas, seasonal beauty and other positive aesthetic qualities; Trees and Shrubs improve air quality by removing gaseous air pollution and by intercepting airborne particles such as dust, soot and pollen; Trees and Shrubs improve water quality by retaining stormwater, filtering runoff, stabilizing soil and thereby decreasing erosion, and shading streams and wetlands; Trees and Shrubs serve as outdoor air conditioners by providing shade and by cooling the air by the process of transpiration; Trees, Shrubs and other vegetation provide important wildlife habitat, including vertical structure, movement corridors and food and shelter for animals; and Trees and Shrubs provide an important opportunity for humans to connect with nature in a wooded environment.

d.) As a general premise from Dominion's perspective, it may be desirable to remove all tall-growing Trees and Shrubs that currently or in the foreseeable future constitute a hazard to its transmission line conductors. The early removal of such Trees and Shrubs might not be an unreasonable goal of Dominion for a typical transmission line right-of-way. However, the parties agree that the Trail is not typical; therefore much discretion should be used in pursuing any such goal. The removal of such Trees and Shrubs should be phased where appropriate over a time period sufficient to allow desirable lower-growing species that establish naturally or have been planted as replacement Trees and Shrubs, time to reach maturity. Moreover, even greater discretion should be used in removing large, mature tall-growing Trees and Shrubs.

e.) As a general premise from the Authority's perspective, it is desirable to prune as opposed to remove any Tree or Shrub that is a Threat to the transmission line conductors. Pruning allows established Trees and Shrubs to remain on the Trail; and, generally, pruning as opposed to removal is less disruptive visually, environmentally and in terms of the physical work involved. Nevertheless, the parties agree that discretion should be used to ensure that pruning work would effectively reduce the threat to Dominion's facilities to an acceptable level of risk, that the health and vigor of the Tree or Shrub will not be adversely affected and the resulting shape and appearance of the Tree or Shrub will be acceptable to the Authority.

7. Vegetation Management Program

a.) Dominion typically maintains the right-of-way on a scheduled three-year cycle, referred to as the "Maintenance Cycle." The right-of-way is also patrolled on an annual basis. Any work that needs to be done off cycle (work outside the Maintenance Cycle) will be coordinated with the Authority. Work will be performed using arboricultural best management practices and the MOU guidelines.

8. Wire Zone Guidelines

a.) It is deemed desirable to preserve and protect specimen or decorative/landscape Trees and Shrubs that currently grow in the Wire Zone and that will not create a Threat to the transmission line. Accordingly, any specimen or decorative/landscape Tree or Shrub in the Wire Zone that meets "the right tree in the right place" objective will be left untouched. Subject to Section 8.e below, when "the right tree in the right place" objective is not met, the Tree or Shrub will be removed.

b.) Any other existing Tree or Shrub in the Wire Zone that does not meet "the right tree in the right place" objective will be removed, subject to Section 8.e below.

c.) Work to remove or control Brush will be done typically during the Maintenance Cycle once the Brush currently existing as of the date of this MOU is removed or treated to stop its growth. Brush work includes hand cutting and selective herbicide treatment as set forth in Section 11. Off cycle (work outside the normal Maintenance Cycle) Brush work that needs to be done will be coordinated with the Authority.

d.) Dominion or the Authority may plant in the Wire Zone replacement Trees and Shrubs that meet "the right tree in the right place" objective and otherwise conform to the provisions of Sections 8.e, 10 and 14.

e.) Notwithstanding the limitations on Tree and Shrub height resulting from the application of "the right tree in the right place" concept, in exceptional circumstances and on a case-by-case basis, Dominion's forester shall have the sole discretion to allow taller Trees or Shrubs to remain untouched, or to be pruned or to be planted, where it is evident to both Dominion and the Authority that such Trees and Shrubs will not constitute a public safety or electric reliability Threat.

f.) Dominion will not use any mowing equipment on the Trail corridor.

g.) Dominion work crews will take care to avoid damaging Shrubs, vines, grasses and other plants that do not have the potential to pose a danger to its conductors or do not grow in the area measured twenty-five (25) feet from the center of the base of the transmission structures; except invasive and aggressive vines that choke out native vegetation can be removed when recommended by the Advance Patrol Team. This area, a twenty-five (25) foot radius circle at the base of the Transmission structures, provides a safe working area for the maintenance crews to access the structures and conductors with their trucks and equipment.

h.) Trees, Shrubs and Brush identified by the Advance Patrol Team for pruning, removal or herbicide treatment pursuant to Section 11 will be appropriately noted or marked in such manner that will enable Dominion's tree work crew to know what work is to be performed and how the work will be performed.

9. Border Zone Guidelines

a.) It is deemed desirable to preserve and protect specimen and decorative/landscape Trees and Shrubs that currently grow in the Border Zone and that will not create a Threat to the transmission line. Accordingly, any specimen or decorative/landscape Tree or Shrub in the Border Zone that meets "the right tree in the right place" objective will be left untouched. Subject to Section 9.e below, when "the right tree in the right place" objective is not met, the Tree or Shrub will be removed.

b.) Any other existing Tree or Shrub in the Border Zone that does not meet "the right tree in the right place" objective will be removed, subject to Section 9.e below.

c.) Work to remove or control Brush will be done typically during the Maintenance Cycle once the Brush currently existing as of the date of this MOU is removed or treated to stop its growth. Brush work includes hand cutting and selective herbicide treatment as set forth in Section 11. Off cycle (work outside the normal Maintenance Cycle) Brush work that needs to be done will be coordinated with the Authority.

d.) Dominion or the Authority may plant in the Border Zone replacement Trees and Shrubs that meet "the right tree in the right place" objective and otherwise conform to the provisions of Sections 9.e, 10 and 14.

e.) Notwithstanding the limitations on Tree and Shrub height resulting from the application of "the right tree in the right place" concept, in appropriate circumstances and on a case-by-case basis, Dominion's forester shall have the sole discretion to allow taller Trees and Shrubs to remain untouched, or to be pruned or to be planted where it is evident to both Dominion and the Authority that such Trees and Shrubs will not constitute a public safety or electric reliability Threat.

f.) Dominion will not use any mowing equipment on the Trail corridor.

g) Dominion work crews will take care to avoid damaging Shrubs, vines, grasses and other plants that do not have the potential to pose a danger to its conductors.

h) Trees, Shrubs and Brush identified by the Advance Patrol Team for pruning, removal or herbicide treatment pursuant to Section 11 will be appropriately noted or marked in such manner that will enable the tree work crew to know what work is to be performed and how the work will be performed.

10. Tree Replacement Program

a.) For each Tree or Shrub with a diameter at breast height ("DBH") of four inches or more (excluding any Tree or Shrub that was previously topped and any existing Tree or Shrub determined by the Advance Patrol Team to be "undesirable") that is removed by Dominion's tree crews or contractors, Dominion will plant a new tree or shrub that, at mature height, meets the "right tree in the right place" guidelines. (For the purpose of this paragraph, an "undesirable" Tree or Shrub is any existing Tree or Shrub that the Advance Patrol Team determines is unwanted and undesirable from the perspectives of both Dominion and the Authority. Generally, undesirable species are ailanthus, black locust, willow, sassafras, cedar, sweet gum, cottonwood, paulownia, sumac, bradford pear and mimosa.) Replacement trees and shrubs will be planted in the general vicinity of the sites from which the Trees or Shrubs were removed. The following standard commercial warranty will be assigned to the replacement trees and shrubs: Trees and shrubs planted in the fall are guaranteed to be healthy and leaf out by May 15. Fall plantings that do not achieve leaf out will be replaced one time. Trees and shrubs planted in the spring are guaranteed for thirty (30) days. Spring plantings that do not achieve leaf out will be replaced one time.

b.) The Authority will select the species of replacement tree or shrub from a reasonable list provided by Dominion and also will determine the specific location for the replacement plant, provided the correlation of species and location shall conform to the "right tree in the right place" guidelines.

c.) The new trees provided by Dominion will be approximately six (6) feet in height. New shrubs will be approximately three (3) feet in height. Trees and shrubs will be replaced only during the months of March, April, October or November, unless otherwise approved by the Authority.

11. Use of Herbicides

a.) Herbicides may be used selectively in appropriate circumstances to inhibit growth on trees that were previously cut and to control the growth of Brush. The use of herbicides on the Trail is subject to the approval of the Authority based on reasonable and appropriate standards and criteria established by it, provided the Authority's decisions shall be governed by an objective standard of reasonableness.

b.) In establishing standards and criteria for herbicide use, the Authority will take into consideration, among other things: (i) the relative benefits of selective herbicide use compared to the disruption and other adverse effects of hand or mechanical cutting and the disposal of cut plant material; (ii) the benefits of selective herbicide use in controlling the growth of tall-growing trees and other undesirable vegetation while promoting an environment of shrubs, grasses, forbs and other low-growing plants; (iii) potential harm to humans, animals and environment; and (iv) the possible existence of sensitive areas where herbicide use should be restricted or prohibited.

c.) The risk of spray drift and spray drip is of substantial concern to the parties; accordingly, except for special circumstance as may be mutually agreed by the parties, foliar spray application will not be used on the Trail. Methods of application will be limited to cut stump treatment and basal stem/basal bark treatment.

d.) The use of only non-restricted herbicides will be allowed. The specific herbicides proposed for use, the locations and timing of application and the specific plants or plant groups to be treated will be subject to the approval of the Authority, provided the Authority's approval shall not be unreasonably withheld based on its standards and criteria governing herbicide use.

e.) No less than two weeks prior to any proposed herbicide application, Dominion will provide the Authority full information about its plans, including specific information about the herbicides proposed for use, the locations and timing of the proposed application, the specific plants or plant groups proposed to be treated and the proposed methods for application.

f.) Authority approval of herbicide use will not relieve Dominion of its responsibility to comply with applicable laws and regulations and appropriate herbicide application procedures. All herbicide use on the Trail will be in full compliance with the Virginia Pesticide Control Act and all other applicable state and federal regulations, including OSHA. Herbicide application will be performed only by Certified Commercial Pesticide Applicators and only with the use of handheld or backpack sprayers. The Authority may inspect the certification credentials of such applicators at any time.

g.) Herbicides mixes used by Dominion will contain dye/colorant markers that will visually indicate exactly where herbicides have been applied. As a condition of approval of herbicide use, the Authority may require Dominion to post placards that warn Trail users about the herbicide application currently taking place (i) when the herbicide product label or MSDS sheet prescribes that access to the treated area be controlled or restricted for a specified period following the time of herbicide application; or (ii) when, in the Authority's reasonable judgment, it determines that, because of the proximity of the park trail or other park improvements to areas planned for treatment or because of other compelling circumstances, there is significant risk that park users or pets would be unduly exposed to the herbicides. When posting is required by Dominion, placards of appropriate height and size will be posted at the time the herbicide application begins and will be removed immediately after expiration of any recommended absorption or drying time specified on the product label, or otherwise as the Authority may reasonably determine. Such placards will indicate the name and type of herbicide being applied, the name and telephone of Dominion's contact person pertaining to the herbicide treatment and appropriate contact information for Virginia pesticide enforcement officials. Placards will be posted at Trail access points in the vicinity of the area being treated and at other locations reasonably specified by the Authority.

h.) In order to minimize the use of herbicides, disruption to the Trail, and risk of harm to humans, animals and the environment---and in order to reduce Dominion's ongoing vegetation control costs, achieve more effective long-term vegetation control, improve wildlife habitat and generally enhance the overall aesthetics and environment of the Trail---Dominion and the Authority will continually look for new technologies, products, methods and best management practices for vegetation control in an effort to establish and develop more effective integrated vegetation management strategies.

12. Erosion Control and Steep Slope Protection

a.) Dominion will take care to ensure that its vegetation control crews and contractors avoid the operation and use of vehicles and equipment on embankments and other steep slopes, and that they are judicious in removing vegetation that tends to stabilize embankments and other steep slopes.

b.) All areas denuded, rutted or otherwise disturbed by Dominion work crews will be appropriately backfilled and raked and then overseeded with a native grass and perennial mix to further promote the establishment of desirable native vegetation, as determined by the Authority. Exposed or disturbed hillsides and areas with steep slopes may require the use of jute mesh or excelsior matting to provide stabilization.

c.) Where Dominion's work activity unavoidably causes siltation and erosion, appropriate silt fence or other erosion control measures should be employed to prevent silt runoff into streams and other water bodies.

13. Taller Tree Plantings

a.) The Authority may plant trees and shrubs that reach a mature height greater than fifteen (15) feet in the Taller Tree Planting Areas located in the Structure Wire Zone, Structure Border Zone and the Span Border Zone (as shown in Conceptual Drawing 3) provided that these trees and shrubs at mature height will not create a reliability Threat to the transmission lines.

b.) The Authority should take into account variations in ground elevation when determining which species of trees and shrubs to plant.

c.) The locations of the Taller Tree Planting Areas as shown on Conceptual Drawing 3 were developed with the following thoughts in mind: maintain a safe environment to the public; allow as many tall trees and shrubs to be planted as possible without causing a Threat to the line; allow maximum mature height of tree and shrub plantings without causing a Threat to the line; and maintain access for emergency vehicles and personnel around the transmission structures.

d.) The heights of the lowest conductor on each transmission structure along the Trail are attached as Exhibit B, titled "Lowest Conductor Heights by Structure". Exhibit B is to be used to determine acceptable mature tree and shrub heights for Taller Tree Plantings in the Structure Wire Zones and the Structure Border Zones (not for the Span Border Zone).

e.) The Structure Wire Zone is a rectangular-shaped area generally measuring one hundred (100) feet in length and sixty-four (64) feet in width as shown on Conceptual Drawing 3 (with its center coinciding with the center of the transmission structure), but excluding the transmission structure work and access area that is a twenty-five (25) foot radius circle having its radius point at the center of the transmission structure. (The actual dimensions of the Structure Wire Zone may vary depending on the transmission structure type and location and conductor configuration.) The Authority may plant trees and shrubs in these areas provided their mature height is twenty (20) feet below the lowest conductor height listed for each structure in Exhibit
B.

f.) The Structure Border Zone is an area beginning thirty-two (32) feet from the centerline of the transmission structure as measured perpendicular to the line and extending to the edge of the right-of-way. It is one hundred (100) feet in length, centered along the transmission structure, and measured parallel to the line. (The actual dimensions of the Structure Border Zone may vary depending on the transmission structure type and location and conductor configuration.) The Authority may plant trees and shrubs in these areas provided their mature height does not exceed the lowest conductor height listed for each structure in Exhibit B.

g.) The Span Border Zone is an area beginning fifty (50) feet from the center of the transmission structure as measured parallel to the line and twenty-seven (27) feet from the structure centerline, measured perpendicular to the line. It parallels each transmission span between structures along the entire length of the Trail. (The actual dimensions of the Span Border Zone may vary depending on the transmission structure type and location and conductor configuration.) The Authority may plant trees and shrubs in these areas provided their mature height is thirty (30) feet below the conductor height. Because the height of the conductor varies between structures, the Authority, using a device that measures conductor height called a SupaRule (or equivalent), will determine the conductor heights in these areas. Dominion will provide one SupaRule to the Authority.

14. <u>Other New Plantings</u>

a.) The Authority hereby agrees that the concept of "the right tree in the right place" will apply to all new plantings along the Trail installed by, or on behalf of, the Authority. With the exception of the Taller Tree Plantings described above, no tree or shrub that will exceed fifteen
(15) feet at mature height will be planted by the Authority without Dominion's good faith concurrence, pursuant to relevant portions of these guidelines.

b.) Dominion and the Authority will make reasonable efforts to communicate the "right tree in the right place" concept to park volunteer organizations and volunteers and to other third parties that might from time to time be interested or involved in the planting of new trees and shrubs along the trail.

15. <u>Other</u>

a.) Dominion will endeavor to give advance notice to adjoining property owners of plans for Tree and Shrub removal and pruning and Brush removal work on the Trail.

b.) Dominion will inform its tree crews and contractors of the substance of this MOU and Dominion will ensure their compliance with the guidelines set forth in the MOU.

c.) Dominion will give the Authority advance notice of the names of its tree contractors on the Trail, together with names and telephone numbers of the contractors' contact persons.

d.) Dominion's tree crews and contractors will comply with the Authority's guidelines (attached as Exhibit A) titled "Conditions for Working on the W&OD Trail," to the extent that such guidelines are not inconsistent with this MOU.

e.) Both Dominion and the Authority will periodically obtain advice and opinion on best practices in vegetation management and herbicide use from experts in these fields.

Northern Virginia Regional Park Authority Date

Dominion Virginia Power Date

EXHIBIT A

Conditions For Working on the W&OD Trail

The word "trail" shall mean either the asphalt paved trail or the rock dust gravel trail.

Driving on the Trail

- Use the gravel horse trail whenever possible. It's less crowded and easier to repair if damage occurs.
- Your speed should be 15 miles per hour or less
- Always yield to the people on the trail. Pull off to the side and stop when someone comes towards you. If passing someone from behind, wait until they see you before passing them. **Don't blow your horn to get their attention!**
- Don't cross a street while a trail user on either side is waiting to cross.
- Dominion Virginia Power and its contractors do not have access rights on any of the bridges on the W&OD Trail.
- All vehicles should bear the name of the company.

Working on the Trail

- You must have "Work Ahead" or similar signs posted at least 200 feet in advance of the work area. The signs should not hang into the area of the trail but should be completely on the shoulder. The signs should be no more than ½ mile from the work area.
- Place cones around each end of any equipment blocking the trail.
- Always leave at least half of the trail open and clear so trail users can safely pass through the work area. Don't place trucks, cut trees, equipment or other materials in the open area.
- If cutting and chipping leave wood chips on the paved trail surface, the trail should be blown or swept regularly.
- According to Dominion Virginia Power's easement, all wood chips, limbs and logs must be removed from park property.
- When leaving equipment on the property at the end of the workday, keep five feet away from the edge of either trail. Vehicles should be locked and keys removed from equipment. Cut saplings should be chipped and not left beside the trail.
- Remove or drop signs at the end of the workday.

EXHIBIT B

Lowest Conductor Heights by Structure

Listed below are the individual transmission structures along the Trail with their respective lowest conductor heights. This information is to be used to determine what species of trees can be planted in the Taller Tree Planting Areas located in the Border Zone adjacent to each transmission structure.

Structure No.	Lowest Conductor Height (Feet)	County
274/241& 227/181	70	Loudoun
274/240 & 227/180	65	Loudoun
274/239 & 227/179	50	Loudoun
274/238 & 227/178	50	Loudoun
274/237 & 227/177	50	Loudoun
274/236 & 227/176	65	Loudoun
274/235 & 227/175	50	Loudoun
274/234 & 227/174	50	Loudoun
274/233 & 227/173	80	Loudoun
274/232 & 227/172	65	Loudoun
274/231 & 227/171	65	Loudoun
274/230 & 227/170	65	Loudoun
274/229 & 227/169	65	Loudoun
274/228 & 227/168	80	Loudoun
274/227 & 227/167	65	Loudoun
274/226 & 227/166	50	Loudoun
274/225 & 227/165	50	Loudoun
274/224 & 227/164	50	Loudoun
274/223 & 227/163	50	Loudoun
274/222 & 227/162	50	Loudoun
274/221 & 227/161	65	Loudoun
274/220 & 227/160	57	Loudoun
274/219 & 227/159	57	Loudoun
274/218 & 227/158	57	Loudoun
274/217 & 227/157	57	Loudoun
274/215 & 227/155	57	Loudoun
274/214 & 227/154	57	Loudoun
274/213 & 227/153	57	Loudoun
274/212 & 227/152	57	Loudoun

Structure No.	Lowest Conductor Height (Feet)	County
274/211 & 227/151	57	Loudoun
274/210 & 227/150	65	Loudoun
274/209 & 227/149	65	Loudoun
274/208 & 227/148	65	Loudoun
274/207 & 227/147	65	Loudoun
274/206 & 227/146	65	Loudoun
274/205 & 227/145	65	Loudoun
274/204 & 227/144	72	Loudoun
274/203 & 227/143	57	Loudoun
274/202 & 227/142	72	Loudoun
274/201 & 227/141	72	Loudoun
274/200 & 227/140	72	Loudoun
274/199 & 227/139	72	Loudoun
274/198 & 227/138	72	Loudoun
274/197 & 227/137	72	Loudoun
274/196 & 227/136	72	Loudoun
274/195 & 227/135	81	Loudoun
274/193 & 227/133	86	Loudoun
274/192 & 227/132	72	Loudoun
274/191 & 227/131	57	Loudoun
274/190 & 227/130	78	Loudoun
274/189 & 227/129	68	Loudoun
274/188 & 227/128	72	Loudoun
274/187 & 227/127	72	Loudoun
274/186 & 227/126	72	Loudoun
274/185 & 227/125	72	Loudoun
274/184 & 227/124	72	Loudoun
274/183 & 227/123	65	Loudoun
274/182 & 227/122	65	Loudoun
274/181 & 227/121	65	Loudoun
274/180 & 227/120	65	Loudoun
274/179 & 227/119	57	Loudoun
274/178 & 227/118	65	Loudoun
274/177 & 227/117	57	Loudoun
274/176 & 227/116	72	Loudoun
274/175 & 227/115	65	Loudoun
274/174 & 227/114	65	Loudoun
274/173 & 227/113	65	Loudoun

Structure No.	Lowest Conductor Height (Feet)	County
274/172 & 227/112	65	Loudoun
274/170 & 2033/110	65	Loudoun
274/169 & 2033/109	65	Loudoun
274/168 & 2033/108	57	Loudoun
274/167 & 2033/107	65	Loudoun
274/166 & 2033/106	65	Loudoun
274/165 & 2033/105	65	Loudoun
274/164 & 2033/104	65	Loudoun
274/163 & 2033/103	72	Loudoun
274/162 & 2033/102	72	Loudoun
274/161 & 2033/101	65	Loudoun
274/160 & 2033/100	65	Fairfax
274/159 & 2033/99	72	Fairfax
274/158 & 2033/98	57	Fairfax
274/157 & 2033/97	72	Fairfax
274/156 & 2033/96	72	Fairfax
274/155 & 2033/95	75	Fairfax
274/154 & 2033/94	72	Fairfax
274/153 & 2033/93	72	Fairfax
274/152 & 2033/92	72	Fairfax
274/151 & 2033/91	72	Fairfax
274/150 & 2033/90	80	Fairfax
274/149 & 2033/89	72	Fairfax
274/148 & 2033/88	72	Fairfax
274/147 & 2033/87	72	Fairfax
274/146 & 2033/86	78	Fairfax
274/145 & 2033/85	75	Fairfax
274/144 & 2033/84	57	Fairfax
274/143 & 2033/83	57	Fairfax
274/142 & 2033/82	57	Fairfax
274/141 & 2033/81	68	Fairfax
274/140	80	Fairfax
2062/141 & 2033/79	59	Fairfax
2015/79 & 2043/136	54	Fairfax
2062/140 & 2033/78	54	Fairfax
2015/78 & 2043/137	50	Fairfax
2062/139 & 2033/77	65	Fairfax
2015/77 & 2043/138	47	Fairfax

Structure No.	Lowest Conductor Height (Feet)	County
2062/138 & 2033/76	69	Fairfax
2015/76 & 2043/139	50	Fairfax
2062/137 & 2033/75	70	Fairfax
2015/75 & 2043/140	57	Fairfax
2062/136 & 2033/74	83	Fairfax
2015/74 & 2043/141	65	Fairfax
2062/135 & 2033/73	68	Fairfax
2015/73 & 2043/142	65	Fairfax
2062/134 & 2033/72	46	Fairfax
2015/72 & 2043/143	56	Fairfax
2062/133 & 2033/71	62	Fairfax
2015/71 & 2043/144	56	Fairfax
2062/132 & 2033/70	44	Fairfax
2015/70 & 2043/145	50	Fairfax
2062/131 & 2033/69	60	Fairfax
2010/120 & 2033/68	45	Fairfax
2033/67 & 264/67	62	Fairfax
2010/119	32	Fairfax
2010/118	32	Fairfax
2010/117	32	Fairfax
2010/116	32	Fairfax
2033/66 & 264/66	72	Fairfax
2010/115	57	Fairfax
2010/114	42	Fairfax
2010/113	42	Fairfax
2033/65 & 264/65	72	Fairfax
2010/112	37	Fairfax
2010/111	32	Fairfax
2010/110	37	Fairfax
2033/64 & 264/64	70	Fairfax
2010/109	42	Fairfax
2010/108	32	Fairfax
2010/107	42	Fairfax
2033/63 & 264/63	65	Fairfax
2010/106	32	Fairfax
2010/105	42	Fairfax
2033/62 & 264/62	94	Fairfax
2010/104	76	Fairfax

Structure No.	Lowest Conductor Height (Feet)	County
2033/61 & 264/61	95	Fairfax
2010/103	87	Fairfax
2010/102	32	Fairfax
2033/60 & 264/60	55	Fairfax
2010/101	37	Fairfax
2010/100	34	Fairfax
2010/99	27	Fairfax
2033/59 & 264/59	57	Fairfax
2010/98	52	Fairfax
2010/97	32	Fairfax
2033/58 & 264/58	55	Fairfax
2010/96	27	Fairfax
2010/95	37	Fairfax
2033/57 & 264/57	50	Fairfax
2010/94	37	Fairfax
2033/56 & 264/56	55	Fairfax
2010/93	32	Fairfax
2010/92	32	Fairfax
2010/91	37	Fairfax
2033/55 & 264/55	57	Fairfax
2010/90	47	Fairfax
2010/89	37	Fairfax
2033/54 & 264/54	54	Fairfax
2010/88	32	Fairfax
2010/87	32	Fairfax
2010/86	37	Fairfax
2033/53 & 264/53	50	Fairfax
2010/85	27	Fairfax
2033/52 & 264/52	42	Fairfax
2010/84	62	Fairfax
2010/83	61	Fairfax
2010/82	27	Fairfax
2010/81	27	Fairfax
2010/80	37	Fairfax
2010/79	32	Fairfax
2033/49 & 2005/49	64	Fairfax
2010/78	27	Fairfax
2010/77	32	Fairfax

Structure No.	Lowest Conductor Height (Feet)	County
2010/76	37	Fairfax
2033/48 & 2005/48	62	Fairfax
2010/75	32	Fairfax
2010/74	42	Fairfax
2033/47 & 2005/47	57	Fairfax
2010/73	32	Fairfax
2010/72	32	Fairfax
2033/46 & 2005/46	65	Fairfax
2010/71	37	Fairfax
2010/70	37	Fairfax
2033/45 & 2005/45	57	Fairfax
2010/69	27	Fairfax
2010/68	27	Fairfax
2010/67	32	Fairfax
2033/44 & 2005/44	54	Fairfax
2010/66	31	Fairfax
2010/65	32	Fairfax
2033/43 & 2005/43	47	Fairfax
2010/64	32	Fairfax
2010/63	32	Fairfax
2033/42 & 2005/42	70	Fairfax
2010/62	32	Fairfax
2010/61	27	Fairfax
2010/60	37	Fairfax
2033/41 & 2005/41	70	Fairfax
2010/59	32	Fairfax
2010/58	31	Fairfax
2033/40 & 2005/40	47	Fairfax
2010/57	32	Fairfax
2010/56	37	Fairfax
2033/39 & 2005/39	75	Fairfax
2010/55	27	Fairfax
2010/54	37	Fairfax
2033/38 & 2005/38	62	Fairfax
2010/53	31	Fairfax
2010/52	35	Fairfax
2033/37 & 2005/37	55	Fairfax
2010/51	36	Fairfax

Structure No.	Lowest Conductor Height (Feet)	County
2033/36 & 2005/36	59	Fairfax
2033/35 & 2005/35	65	Fairfax
2033/34 & 2005/34	58	Fairfax
2033/33 & 2005/33	50	Fairfax
202/34	65	Fairfax
202/33	65	Fairfax
202/32	82	Fairfax
202/31	80	Fairfax
202/30	68	Fairfax
202/29	68	Fairfax
202/28	65	Fairfax
202/27	79	Fairfax
202/26	65	Fairfax
202/25	50	Fairfax
202/24	65	Fairfax
202/23	65	Fairfax
202/22	65	Fairfax
202/21	65	Fairfax
202/20	59	Fairfax
202/19	60	Fairfax
202/18	58	Fairfax
202/17	62	Fairfax
202/16	58	Fairfax
202/15	58	Fairfax
202/14	58	Fairfax
202/13	60	Fairfax
202/12	60	Fairfax
202/11	60	Fairfax
202/10	75	Fairfax
202/9	75	Fairfax
202/8	105	Fairfax
202/7	100	Fairfax
202/6	78	Fairfax
202/5	67	Fairfax
202/4	50	Fairfax
251/3 & 266/185	45	Fairfax
251/4 & 266/186	41	Fairfax
251/5 & 266/187	31	Fairfax

Structure No.	Lowest Conductor Height (Feet)	County
251/6 & 266/188	32	Fairfax
251/7 & 266/189	35	Fairfax
251/8 & 266/190	32	Fairfax
251/9 & 266/191	35	Fairfax
251/10 & 266/192	41	Fairfax
251/11 & 266/193	34	Fairfax
251/12 & 266/194	36	Fairfax
251/13 & 266/195	33	Fairfax
251/14 & 266/196	56	Fairfax
251/15 & 266/197	50	Fairfax
251/16 & 266/198	38	Fairfax
251/17 & 266/199	48	Fairfax
251/18 & 266/200	37	Fairfax
251/19 & 266/201	31	Fairfax
251/20 & 266/202	31	Fairfax
251/21 & 266/203	31	Fairfax
251/22 & 266/204	51	Fairfax
251/23 & 266/205	51	Fairfax
251/24 & 266/206	31	Fairfax
251/25 & 266/207	31	Fairfax
251/26 & 266/208	31	Fairfax
251/27 & 266/209	31	Fairfax
251/28 & 266/210	31	Fairfax
251/29 & 266/211	31	Fairfax
251/30 & 266/212	31	Fairfax
251/31 & 266/213	31	Fairfax
251/32 & 266/214	31	Fairfax
251/33 & 266/215	31	Fairfax
251/34 & 266/216	31	Fairfax
251/35 & 266/217	31	Fairfax
251/36 & 266/218	31	Fairfax
251/37 & 266/219	31	Fairfax
251/38 & 266/220	31	Fairfax
251/39 & 266/221	31	Fairfax
251/40 & 266/222	38	Arlington
251/41 & 266/223	38	Arlington
251/42 & 266/224	62	Arlington
251/43 & 266/225	44	Arlington

Structure No.	Lowest Conductor Height (Feet)	County
251/44 & 266/226	50	Arlington
251/45 & 266/227	50	Arlington
251/47 & 266/229	64	Arlington
251/48 & 266/230	70	Arlington
251/49 & 266/231	68	Arlington
251/50 & 266/232	65	Arlington
251/51 & 266/233	77	Arlington
251/52 & 266/234	73	Arlington
251/53 & 266/235	53	Arlington
251/54 & 266/236	51	Arlington
251/55 & 266/237	63	Arlington
251/56 & 266/238	42	Arlington
251/57 & 266/239	33	Arlington
251/58 & 266/240	30	Arlington
251/59 & 266/241	34	Arlington
251/60 & 266/242	38	Arlington
251/61 & 266/243	49	Arlington
251/62 & 266/244	39	Arlington
251/63 & 266/245	34	Arlington
251/64 & 266/246	36	Arlington
251/65 & 266/247	34	Arlington
251/66 & 266/248	32	Arlington
251/67 & 266/249	31	Arlington
251/71 & 273/2	49	Arlington
251/72 & 273/3	44	Arlington
251/73 & 273/4	38	Arlington
251/74 & 273/5	41	Arlington
251/75 & 273/6	57	Arlington
251/76 & 273/7	56	Arlington
251/77 & 273/8	34	Arlington
251/78 & 273/9	49	Arlington
251/79 & 273/10	33	Arlington
251/80 & 273/11	51	Arlington
251/81 & 273/12	43	Arlington
251/82 & 273/13	36	Arlington
251/83 & 273/14	34	Arlington
251/84 & 273/15	35	Arlington
251/85 & 273/16	44	Arlington

Structure No.	Lowest Conductor Height (Feet)	County
251/86 & 273/17	39	Arlington
251/87 & 273/18	43	Arlington
251/88 & 273/19	47	Arlington
251/89 & 273/20	31	Arlington
251/90 & 273/21	36	Arlington
251/91 & 273/22	56	Arlington
251/92 & 273/23	61	Arlington
251/93 & 273/24	35	Arlington
251/94 & 273/25	35	Arlington
251/95 & 273/26	34	Arlington
251/96 & 273/27	34	Arlington
251/97 & 273/28	36	Arlington
251/98 & 273/29	41	Arlington
251/99 & 273/30	41	Arlington
251/100 & 273/31	33	Arlington
251/101 & 273/32	32	Arlington
251/102 & 273/33	37	Arlington
251/103 & 273/34	32	Arlington
250/81 & 258/28	45	Arlington
250/82 & 258/29	44	Arlington
250/83 & 258/30	45	Arlington
250/84 & 258/31	40	Arlington
250/85 & 258/32	45	Arlington
250/86 & 258/33	41	Arlington
250/87 & 258/34	45	Arlington
250/88 & 258/35	50	Arlington
250/89 & 258/36	37	Arlington
250/90 & 258/37	37	Arlington
250/91 & 258/38	38	Arlington
250/92 & 258/39	38	Arlington
250/93 & 258/40	38	Arlington
250/94 & 258/41	45	Arlington
250/95 & 258/42	38	Arlington
250/96 & 258/43	45	Arlington

Enclosure 3
Attachment 2

INVASIVE SPECIES MANAGEMENT, GUIDANCE DOCUMENT, OCTOBER 3, 2016, DOMINION

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

GUIDANCE DOCUMENT

INVASIVE SPECIES MANAGEMENT

Written Date: April 20, 2011

Revision Date: October 3, 2016

Document Owner: Matt Overton

Table of Contents

1.0	Scope	3
2.0	Safety	3
3.0	Dominion Facilities Impacted	3
4.0	Background	3
5.0	Regulatory Guidance	5
6.0	Species of Concern	7
7.0	Contacts	15
8.0	Distribution List	16
Figures		17
Appendix 1:	Boat and Trailer Disinfection Procedure	28
Appendix 2:	Dominion Asset Invasive Species	29

GUIDANCE DOCUMENT

INVASIVE SPECIES MANAGEMENT

1.0 Scope:

This document contains information pertaining to invasive species (terrestrial and aquatic) that are of concern to Dominion facilities and operations and the methods used to address (control or eradicate) invasive species. The purpose of this document is to provide Dominion employees, contractors and consultants with guidance on invasive species issues. The goals of this document are: awareness of invasive species; identification of species which may pose a concern for Dominion operations; what to do when an invasive species is identified; and methods for preventing introduction and controlling the spread of invasive species.

2.0 Safety

Safety is a core Dominion value and all field sampling 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 will conform to the expectations described in the Dominion Safety Policy, (http://dnet.dominionnet.com/shared_services/facilities/pdf/DomSafetyPol.pdf), the DES Safety Work Practice (Safety Work Practice for Biology; available on the Dominion Environmental Work Practices webpage), and the policies of the business unit where the work is being done.

When doing any work at Dominion, including but not limited to chemical applications and mechanical removal of invasive species, personal safety is of the utmost importance. Chemicals should only be applied by certified personnel and proper personal protective equipment (PPE) should be worn. Do not eat, drink or smoke while handling chemicals. When cleaning bird feces or removing nesting materials, be sure to practice proper handling procedures and wear PPE (see Dominion's Protective Guidelines for Fungal and Animal Hazards, http://dnet.dominionnet.com/corporate_safety/compliance/protective_guidelines_for_fungal_and_animal_hazards.jsp).

3.0 Dominion Facilities Impacted:

This guidance document pertains to all Dominion assets (Table 2) as well as all employees, contractors and consultants involved with any company-related construction or operational activities at terrestrial or aquatic locations.

4.0 Background

Invasive species are non-native plant, animal or microbial species that cause, or are likely to cause, economic or environmental harm or harm to human health (Presidential Executive Order 13112). "Non-native" species (or "alien", "exotic", or "non-indigenous" species) are species that have been introduced by human action, intentionally or accidentally, to a region outside of their natural geographic range through a variety of pathways (such as ballast water in overseas tankers or via the aquarium industry). Invasive species can be both terrestrial and aquatic; plant and animal. Most intentional non-native species introductions are beneficial. While most accidental introductions have no negative impact on a new landscape, the species that do become invasive can cause significant ecological and economic harm. Often without any natural enemies, invasive species can become agricultural pests, infest riparian areas, displace native plant species, reduce wildlife habitat, degrade scenic landscapes and alter natural processes.

If an invasive species is suspected at a facility, Dominion Environmental Biology (see contacts section) should be contacted to confirm the identification of the species and to discuss proper control/eradication measures, if applicable. Invasive species management and control is a very complex and constantly evolving process. These species have become invasive because they are fast spreading and tolerant of usual treatments. This document will highlight some practices to help deal with invasive species that are currently affecting Dominion. The following website, www.invasive.org, is a great source for current information on invasive species. In dealing with invasive species issues, prevention of translocation or spread of the species is imperative. Efforts at preventing the spread and establishment of invasive species are usually more successful than trying to control an existing established invasive species. Early detection and rapid response (EDRR) is the key to keeping invasive species under control. More on EDRR can be found at http://www.invasive.org/edrr/index.cfm.

The spread of invasive species can occur in different life stages through a wide variety of ways. Risk of spread will differ by species and depend largely on suitability of the environment in which the species is spreading. Dominion employees, consultants, and contractors should use caution when working in areas with invasive species. An understanding of how each species spreads will aid in preventing the spread of invasive species throughout Dominion facilities. Some general guidelines should be followed when working in areas with invasive species:

- Be aware of native species before restoration activities
- Use weed free mulch if concerns over potential invasive species are present
- Plant native species whenever possible
- Cut or remove invasive species during the time of year that they do not have seeds, otherwise the seeds will fall off the plant during removal and new plants will develop
- Take all necessary precautions not to transport invasive species

- Thoroughly clean equipment (boats, trailers, landscape equipment) when moving between facilities to remove seeds, mussels and larvae, tubers, plant parts, or anything that could lead to establishment of a new population. See Appendix 1 for a detailed boat and trailer disinfection procedure. In addition to this procedure, station personnel must be sure to follow any local, state, or federal boat and trailer disinfection guidelines.

5.0 Regulatory Guidance

Many state and federal agencies are involved with invasive species management. Regulations apply primarily to agricultural activities, nursery stock, etc. and generally focus on the prevention of introduction of invasive species. Most states either have or are in the process of developing state-specific 'Invasive Species Guidelines' highlighting the most pervasive and destructive species. To date, regulations requiring control have not been promulgated by any state in which Dominion does business that pertain to activities, functions and/or operations Dominion performs to conduct its business. States are generally dealing with invasive species on an "ad-hoc" basis.

Most states have developed lists of invasive species.

5.1 California

http://www.iscc.ca.gov/species.html

5.2 Connecticut

http://www.ct.gov/deep/cwp/view.asp?a=2702&q=323494&deepNav_GID=1641%20

5.3 Georgia

http://www.georgiawildlife.org/Conservation/InvasiveManagement

5.4 Indiana

http://www.in.gov/dnr/3123.htm

5.5 Maryland

http://www.dnr.state.md.us/invasives/

5.6 New York

http://www.dec.ny.gov/animals/265.html

5.7 North Carolina

http://www.invasivespeciesinfo.gov/unitedstates/nc.shtml

5.8 Ohio

http://ohiodnr.gov/invasivespecies

5.9 Pennsylvania

http://www.dcnr.state.pa.us/conservationscience/invasivespecies/

5.10 Rhode Island

http://www.invasivespeciesinfo.gov/unitedstates/ri.shtml

5.11 Virginia

http://www.dcr.virginia.gov/natural_heritage/vaisc/

http://www.dcr.virginia.gov/natural_heritage/invsppdflist.shtml

5.12 West Virginia

http://www.wvdnr.gov/wildlife/invasivespecies.shtm

5.13 Wisconsin

http://dnr.wi.gov/topic/invasives/

5.14 South Carolina

http://www.invasivespeciesinfo.gov/unitedstates/sc.shtml

5.15 Utah

http://www.invasivespeciesinfo.gov/unitedstates/ut.shtml

5.16 Tennessee

https://ag.tennessee.edu/EPP/Pages/Invasive%20Species/IS.aspx

5.17 Dominion Specific Requirements

Dominion Electric Transmission has a "Phragmites vigilance" permit requirement in a constructed electric transmission right-of-way (ROW) which stipulates that Dominion control the invasive plant species that occur in the ROW. These permits are specific to certain projects and have varied timelines. Detailed descriptions of these permits are beyond the scope of this document. In addition to any permitting requirements, Dominion gas and electric ROWs are maintained by mowing and herbicide application. Gas transmission and delivery do not have any invasive species control or prevention policies, but gas transmission does have requirements for facilities located in some Pennsylvania State Forests. These requirements are part of the agreements allowing installation of the facilities in the State Forests, which are under the jurisdiction of the Pennsylvania Department of Conservation and Natural Resources (PADCNR). These requirements are specific to certain projects and detailed descriptions of these requirements are beyond the scope of this document. For future natural gas projects on Pennsylvania State Forest lands, PADCNR is likely to require implementation of their guidelines. For more information please contact Gas Environmental Services (GES).

Invasive species may have significant adverse impacts on Dominion facilities or operations, thereby requiring some type of control and/or removal. For Dominion, control is generally voluntary and occurs when invasive species either directly or indirectly impact Company operations or facilities. There may, however, be instances where states request or require the Company to address invasive species. This process may involve measures such as conducting surveys of invasive species, identification of invasive species occurrences, development of appropriate treatment protocols, the proper application of identified treatments (which may require application certification), monitoring and reporting of treatment and results, and post-project re-vegetation for disturbed areas.

Dominion employees should contact Mike Brucato (Electric Transmission), Jay Griles (Electric Distribution) or Neal Robertson (Gas Environmental Business Support) when encountering any invasive species resulting in adverse impacts on Dominion ROW facilities. Impacts include any plant that is greater than 10 feet tall when mature or plants that encroach on transmission towers or pipelines. Dominion biologists can be contacted if there is a need to explore studies, surveys, treatment or the best treatment options at other Dominion facilities.

6.0 Species of Concern

The following section provides a description of invasive species that have presented both ongoing and historical challenges to Dominion and the practices employed to address them:

6.1 **Zebra mussel** (*Dreissena polymorpha*) and **Quagga mussel** (*Dreissena rostriformis bugensis*)

Description: There are two species of highly invasive freshwater mussels in North America. The zebra and quagga mussels are small freshwater (salinity < 5 ppt) mollusks. Zebra mussels typically range in size from 0.63 to 3.8 cm. Quagga mussels can grow to be slightly larger than zebra mussels. Zebra (Figure 1) and quagga mussels both have elongate, slightly pointed shells and typically have a light and dark striped pattern. Zebra and quagga mussels have a similar appearance but can be separated by the symmetry of their shell (Figure 2). Quagga mussels also have a slightly more rounded shape than zebra mussels.

Zebra and quagga mussels can be found in freshwater lakes and rivers with temperature ranges between 0- 30° C. Spawning will generally not occur in temperatures less than 12° C for zebra mussels and 9° C for quagga mussels. The distribution of zebra and quagga mussels can be limited by physical and chemical properties of water bodies. For example, they are unlikely to become established in systems with calcium concentrations below 25 milligrams per liter (mg/l) unless there is a source of larvae from upstream habitats with higher levels of calcium. Levels of dissolved oxygen (DO) and pH may limit zebra mussel success (Table 1). Quagga mussels are thought to have similar limitations.

Zebra and quagga mussels produce millions of larvae; therefore, have the ability to rapidly adapt to a changing environment. These mussels have the ability to multiply rapidly as well as colonize on themselves. Zebra and quagga mussels attach to hard surfaces with byssal threads. This is a very strong connection which creates great difficulty for removal. These traits lead to a high potential for macrofouling, the principal concern with these types of mussels because of colonizing and clogging intake pipes, wells, and screen systems. As a result, colonization of these mussels can significantly increase operating costs.

In addition to directly affecting Dominion operations, zebra and quagga mussels can have significant ecological impacts. Zebra mussels have had a tremendous impact on the Lake Michigan ecosystem. Colonies of mussels filter massive volumes of water each day. One zebra mussel alone can filter up to one liter a day. Filter feeding at this level can deplete phytoplankton and suspended particulate organic matter, the primary food resource for many aquatic species. Transfer of this suspended material to the lake bottom in mussel waste products leads to increased water clarity and excessive growth of aquatic plants. This, in turn, decreases the biological oxygen demand and further degrades the lake's ecosystem. These mussels can also displace or out-compete native mussels and other animals that eat plankton.

Dominion Practices: If zebra or quagga mussels are found, note the location (as precisely as possible, using preferably GPS coordinates) and contact the station Environmental Compliance Coordinator(s) (ECC) and Environmental Biology immediately.

Three principal locations, Chesterfield, Possum Point, and Mt. Storm, remain the most at risk for zebra mussel colonization. These three locations are "most at-risk" based mainly on suitable water quality, e.g., dissolved calcium levels (>12mg/l) and a suitable introduction vector (ballast water from large commercial vessels or recreational divers in the case of Mt. Storm). In addition, waterbodies at the Clover Power Station are monitored for zebra mussels.

There are a wide range of control and management strategies for these mussels which fall into the following three categories: chemical, physical, and biological. To date there is no single method of control that has proven completely effective for controlling these invasive mussels. Instead, strategies made up of a combination of several different methods prove to be most effective. Zebra and quagga mussel control strategies should be developed individually for a particular facility. Strategies need to be well thought out with specific goals outlined. Care must be taken to minimize environmental impacts of any control strategies which include (but are not limited to): chemical applications, thermal control, and introduction of biological control agents. Changes in control practices or new control practices should be reviewed to determine whether changes in permits are required prior to implementing new or modified practices.

When using boats or other equipment in areas with invasive mussels, caution should be used to ensure mussels are not transported. Trailers and boat hulls should be disinfected before being used in a different area. See Appendix 1 for a detailed boat and trailer disinfection procedure. In addition to this procedure, station personnel must be sure to follow any local, state, or federal boat and trailer disinfection guidelines.

Table 1. Potential risk of zebra mussel establishment based on select physicochemical parameters.

	Potential risk of establishment		
	High	Moderate	Low
pH	7.5-8.7	7.3-7.5 or 8.7-9.0	< 7.3 or >9.0
Calcium concentration (mg/l)	> 25	15-25	< 15
Dissolved oxygen (mg/l)	> 8	6-8	< 6

6.2 Asiatic clam (*Corbicula fluminea*)

Description: The Asiatic clam (also known as the Asian clam) is a small (<5mm; Figure 3) freshwater clam, native to Southeast Asia, now common in Europe, Africa, the Pacific Islands, and North and South America. Once introduced to North America, this clam spread rapidly because of its high reproductive capacity, fast growth, early maturity, effectiveness at all stages of development to readily disperse by water currents, and tolerance to a wide range of environmental stresses. Its ability to clog industrial water systems makes the Asiatic clam a very costly problem for water-dependent industries. By fouling water systems at electric generating stations, particularly nuclear power stations, the Asiatic clam causes significant safety problems as well. Asiatic clams have been found in many major waterways where Dominion generating facilities are located, including those in Virginia, West Virginia, North Carolina, and Indiana.

Dominion Practices: Although found near several Dominion facilities (e.g., North Anna, Bremo, Mt. Storm, and Chesterfield Power Stations), Asiatic clams have not been found in water systems at levels that would merit control measures (low-level chlorination, biocide application). Station personnel should notify their ECC and DES Environmental Biology when any small mussels or clams are found in water systems, and specimens should be saved to confirm their identity. Prior to implementing any control measures to Dominion water systems, DES should be contacted to assist in choosing the most appropriate method and to resolve any permitting issues. As a general work practice for this and other aquatic invasive species, boats and boat trailers can be a major vector for introduction to new waterbodies, so care should be taken to thoroughly clean boats and trailers to prevent spread. See Appendix 1 for a detailed boat and trailer disinfection procedure. In addition to this procedure, station personnel must be sure to follow any local, state, or federal boat and trailer disinfection guidelines.

6.3 Rock dove or "pigeon" (*Columba livia*)

Description: Pigeons are large bodied doves, approximately 11 inches in length, and have variable coloration (Figure 4). Pigeons were introduced into the United States in the 1800's and are now widely distributed throughout North America. Pigeons have adapted well to urban and industrialized environments. Pigeons prefer urban and suburban environments and often nest in artificial structures forming dense colonies. Pigeons can be a nuisance to personnel; nests and nesting materials can pose fire hazards; and accumulation of pigeon feces can be a problem where pigeons roost and nest. Pigeon feces can pose problems with corrosion, present slipping hazards, are unattractive, and are associated with various diseases in humans.

Dominion Practices: Pigeons are not protected by the Migratory Bird Treaty Act of 1918 (MBTA). Problems with pigeons should be brought to the attention of the station ECC and/or Environmental Biology. In addition to removal by a certified Nuisance Wildlife Control Operators (NWCOs), pigeon management strategies should include exclusion measures where appropriate. Pigeon exclusion and habitat modifications are the best defense against colonization. Pigeons will quickly re-colonize areas if not

excluded. Re-colonization occurs through immigration from surrounding populations and/or a dramatic increase in the reproductive success of remaining individuals. There are many different methods of pigeon exclusion. Choosing appropriate methods of exclusion will vary by facility and location. In general, physical exclusion devices such as bird control spikes or netting will be most effective. Visual and audio deterrents (i.e. playing predatory bird calls), while having some immediate effect, have generally been proven ineffective over time. In addition to exclusion, reducing the food supply of pigeons can reduce the number of pigeons in an area. This can be achieved through securing access to garbage and prohibiting personnel and visitors from feeding pigeons.

Although the risk of disease transmission from bird feces is low when cleaning areas contaminated with pigeon feces, care should be taken not to inhale dry dust from the feces. Individuals should follow Dominion's Protective Guidelines for Fungal and Animal Hazards, (http://dnet.dominionnet.com/corporate_safety/compliance/protective_guidelines_for_fungal_and_animal_hazards.jsp).

6.4 European starling (*Sturnus vulgaris*)

Description: The European starling is a bird which is relatively small (approximately 6 inches), black with green and purple iridescence, and has a yellow pointed beak (Figure 5). It is often found in large flocks. The European starling was introduced to the United States in the 1890s. Since their introduction, starlings have spread rapidly and are distributed widely throughout North America. Starlings prefer urban and suburban environments and often nest in artificial structures. Starlings present several threats to Dominion equipment and operations. Starlings nest in transformers or other electrical equipment (particularly in winter due to heat generated by the devices) and pose fire hazards, form large roosts on power lines, and their corrosive feces can damage equipment. Starling feces can also pose safety risks as slipping hazards and potential disease risks.

Dominion Practices: The European starling is not protected by the MBTA. Before proceeding with any bird control methods for starlings, care must be taken to properly identify the birds and ensure no harm is done to birds protected under the MBTA. Problems with starlings should be brought to the attention of the station ECC and/or Environmental Biology. Starling management should include removal by certified NWCOs and exclusion to prevent further problems. In addition to the removal of birds, nests should be removed to prevent any fire hazard. Exclusion methods for starlings are similar to those listed for pigeons in Section 6.3. In general, the most effective means of exclusion will be those that physically limit starling access to nesting and roosting areas. This includes bird control spikes, netting, and other modifications of potential nesting areas. Visual and audio deterrents (i.e. playing predatory bird calls), while having some immediate effect, have generally been proven ineffective over time. In addition to exclusion, reducing the food supply of starlings can reduce the number of starlings in an area. This can be achieved through securing access to garbage and prohibiting personnel and visitors from feeding starlings.

Although the risk of disease transmission from bird feces is low, while cleaning areas contaminated with pigeon feces, care should be taken not to inhale dry dust from the feces. Individuals should follow Dominion's Protective Guidelines for Fungal and Animal Hazards, (http://dnet.dominionnet.com/corporate_safety/compliance/protective_guidelines_for_fungal_and_animal_hazards.jsp).

6.5 Northern Snakehead (*Channa argus*)

Description: The northern snakehead is a highly invasive fish that is native to Asia and has been introduced throughout the world including the Potomac River system where it has become established. Recently in 2014, snakehead fish have been observed in the Rappahannock drainage. The snakehead feeds on other fish and can be destructive to native fish populations and the ecosystem. The snakehead looks similar to the native bowfin and can also be confused with the American eel. Figure 6 compares the snakehead to the bowfin and American eel and can be used to aid in identification. Possession and transportation of live snakeheads is illegal.

Dominion Practices: To date, the northern snakehead is confined to the Potomac River drainage within Dominion's facilities. Although snakeheads do not have an immediate effect on power station operations, fishing is often conducted at or around Dominion facilities. If a snakehead is caught, the fish must be killed and reported to Dominion Environmental Biology. Dominion biologists will take care of reporting the catch to the appropriate state and/or federal agencies. The fish may be killed by removing the head, separating the gill arches from the body, or by removing the internal organs. The location of catch is important, and GPS coordinates, if possible, are preferred. If a snakehead is caught and the angler wants to keep the fish, the fish must be killed by one of the methods above and the angler's name, date of catch, location of catch and size of the fish must be reported to DES biology.

6.6 Hydrilla (*Hydrilla verticillata*)

Description: Hydrilla is a highly aggressive aquatic weed native to Asia, Africa, Europe, and Australia and was likely released by aquarists in Florida some 40 years ago. Hydrilla occurs in still or slow-moving fresh water and can grow up to 30 ft. in length (Figures 7 and 8). Hydrilla can tolerate a wide range of conditions that other plants find stressful, including reduced light levels, high turbidity and sedimentation, air exposure during drawdown periods, and warm water temperatures. Today, Hydrilla is found in every one of the 48 contiguous states and results in billions of dollars spent on control. Hydrilla has reached nuisance levels in some Dominion lakes, such as Lake Anna, Lake Gaston, and the Bath County Recreational Ponds.

Dominion Practices: Control measures include herbicides, mechanical harvesting and biological control. Hydrilla control at Dominion has consisted of introduction of sterile grass carp (*Ctenopharyngodon idella*) at the North Anna Power Station and the Bath County Power Station as well as assistance to homeowner and lake committees at Lake

Gaston. Permits for grass carp must be obtained through appropriate state wildlife agencies and DES Environmental Biology takes the lead on this effort. Herbicide treatment on smaller areas of infestation is an option by licensed/certified herbicide applicators (Each State has a list of licensed applicators). Spread of this species can be limited through the practice of cleaning boats and trailers prior to re-launching in another water body. See Appendix 1 for a detailed boat and trailer disinfection procedure. In addition to this procedure, station personnel must be sure to follow any local, state, or federal boat and trailer disinfection guidelines.

6.7 Common reed, Phragmites (*Phragmites australis*)

Description: Phragmites is a tall perennial marsh-grass plant that grows to 5 m and has the ability to spread to any disturbed and wet area. Leaves are lanceolate, often 20 to 40 cm long and 1 to 4 cm wide (Figure 9). *Phragmites* is a wind pollinated plant that is self-incompatible, meaning that it cannot pollinate itself. Flowers develop by mid-summer and are arranged in brownish spikelets with many tufts of silky hair. The seed beds are produced in the fall and winter and the seeds germinate in the spring. Phragmites can also spread vegetatively by rhizomes (underground horizontal stems that can produce new plants) and can produce large colonies that out-compete native vegetation.

Phragmites is an issue for Dominion in many ways. It occurs at many facilities including Yorktown Power Station where it is growing in and around the ash ponds affecting the capacity of the pond as well as the pH (a permitted parameter in the station's VPDES permit) of the pond as older dead plants decompose.

Dominion Practices: Phragmites is treated mechanically and chemically at Dominion station treatment ponds and ROWs. Mechanical and manual removal should be completed in the spring before they have a chance to flower and produce seeds. Do not remove plants that have seeds because the seeds will fall off of the plant and germinate the following spring. Follow-up chemical control includes a glyphosate application. Glyphosate is approved by the EPA for use in aquatic areas, including tidal marshes. It should be selectively applied to individual plants by painting the herbicide on the shoot.

Transmission Forestry has had success using two to three selective treatments per year using a mixture containing AquaNeat ™ and Habitat ™. AquaNeat™ has an active ingredient of glyphosate and Habitat ™ has an active ingredient of imazapyr. Imazapyr is a broad-spectrum herbicide that controls terrestrial annual and perennial grasses, broadleaved herbs, woody species as well as riparian and emergent aquatic species. Imazapyr has a low toxicity to fish and invertebrates and is registered for use in aquatic areas including brackish and coastal waters to control emergent, floating and riparian/wetland species. Chemical treatments should be applied by certified personnel only.

It is important to remember that Phragmites re-sprouts from energy stored in its underground rhizomes or roots. Keeping Phragmites cut will deplete the energy stores

in the rhizomes and the plant will eventually die. This practice combined with chemical applications may be the best plan for eradication.

6.8 Narrow-leaved Cattails (*Typha angustifolia*)

Description: Narrow-leaved cattail is a non-native, invasive plant that can cross-breed with the native broad-leaved cattails (*T. latifolia*) to produce the invasive hybrid *T. x glauca*. Both the narrow-leaved and hybrid cattails can be distinguished from the native form by the 2 – 20 cm gap between the male and female flowers (velvety brown cigar-shaped spikes; Figure 10). Narrow-leaved cattail was introduced from Europe, and now occurs throughout much of the United States. Stands of narrow-leaved cattail can be found in many types of wetland habitats, such as marshes, lakeshores, river backwaters and roadside ditches, and can thrive in disturbed areas as well as brackish and polluted waters. Given its wide habitat tolerances, narrow-leaved cattails often out-compete native wetland plants and form dense monoculture stands.

Dominion Practices: If cattails become a problem, treatments can include mechanical or manual removal of dead leaves in early spring followed by flooding of the plant with 1-2 m of water for one to two years. In addition, a two-phase disking of the infested area followed by flooding is used to reduce the biomass and expose the native seed bank for germination. Lethal flood time will depend on the amount of starch stored by the plant the previous year, but should coincide with soil temperatures that are conducive to cattail sprouting (typically April – late June). Herbicides may also be used for control but care must be taken to select herbicides which are approved for use in wetland areas. AquaNeat ™ and Habitat ™ breakdown quickly in water and are approved for use in wetland areas. Chemical treatments should be applied by certified personnel only. When applying herbicides, care should be taken to make sure only the target plants are treated with the chemicals because non-target species may also die from the herbicide application.

6.9 Tree-of heaven, Ailanthus (*Ailanthus altissima*)

Description: Tree-of-heaven is non-native tree species which has deciduous, lanceolate leaves and smooth bark that is grey or brown in color (Figure 11). It can often be confused with smooth sumac (*Rhus glabra*). Tree-of-heaven flowers from April-June with large clusters of yellowish-green flowers with 5 petals and 5 sepals. Male and female flowers occur on separate trees. Female trees produce a tan winged fruit which is spread by wind and water.

Although Tree-of-heaven does not directly pose a threat to Dominion operations on electric transmission rights-of-way (ROWs), state agencies have asked for company participation in eradication of this pervasive nuisance species. Tree-of-heaven spreads aggressively by seed and vegetatively by root sprouts. This tree also re-grows rapidly after being cut.

Dominion Practices: Young shoots and trees can be manually removed but care should be taken to make sure the entire plant (including all roots) is removed. Larger trees can be cut but the cutting of plants that have fruit would cause the seeds to disperse and new plants to grow. After trees are cut, the stumps should be treated with an herbicide 5-20 minutes after being cut. The herbicide should be applied to the entire stump but especially the outer edge so the herbicide can move to the roots of the plant. Please contact Transmission Forestry for the current herbicide being used to treat Tree-of-heaven. Chemical treatments should be applied by certified personnel only.

6.10 Golden bamboo (*Phyllostachys aurea)*

Description: Bamboo is an introduced perennial grass with hollow stems with solid joints that grow to 15 cm in diameter. Bamboo has alternate leaves and flowering is very rare. Bamboo spreads by rhizomes and is common around old home sites and will rapidly infest disturbed ground. Bamboo is one of the fastest growing plants in the world. Growth is dependent on soil and climatic conditions but bamboo has the potential to grow 60 cm per day. Bamboo has been seen on Dominion ROWs and is problematic due to its rapid growth.

Dominion Practices: Transmission Forestry has treated bamboo with glyphosate herbicides such as AquaNeat ™ and Habitat ™. AquaNeat ™ and Habitat ™ break down quickly in water and are approved for use in wetland areas. The selected herbicide should be sprayed on the foliage of the plant. Large areas can be treated this way, but care should be taken to make sure only the target plants are treated with the chemicals because non-target species may also die from the herbicide application. Application of chemicals should be done when air temperatures are above 65°F to promote absorption of chemicals by the plant. Chemical treatments should be applied by certified personnel only.

6.11 Kudzu (*Pueraria lobata*)

Description: Kudzu is a climbing plant that can grow to lengths of 30 m. Its leaves are compound and alternate with lobed leaflets (Figure 12). It has purple flowers which form long racemes and form 3 seeds that mature from September to October. Kudzu can also form roots and nodes anywhere the vine touches the soil. Kudzu is native to Asia and was first introduced as an ornamental plant. Kudzu was transplanted throughout the United States to battle erosion. Capable of growing in a variety of habitats, Kudzu can quickly colonize almost any disturbed area and is often found in old fields, vacant lots, and roadsides. Once established, its vines spread rapidly (up to one foot per day) and can quickly out-compete and eliminate native species including trees, shrubs, and herbaceous understory plants. Kudzu is a noxious weed due to its rapid growth and ability to take over an area. Kudzu has been seen at the Mecklenburg Power Station but has not manifested into a problem.

Dominion Practices: Manual removal of Kudzu can be done but care must be taken to make sure the entire plant in removed especially all of the root system. This is

manageable with small plants. In larger plants the stem should be cut 2 inches above the ground and an herbicide containing glyphosate, such as AquaNeat ™ and Habitat ™, should be immediately applied to the stem. Larger plants can also be treated by digging out and cutting the root crown and applying a 50% glyphosate solution to the cut root. Chemical treatments should be applied by certified personnel only.

6.12 **Autumn Olive** (*Elaeagnus umbellata*)

Description: Autumn olive grows as a deciduous shrub or small tree, typically up to 3.5 m tall, with a dense crown. It commonly bears sharp thorns in the form of spur branches. The leaves are alternate, 4–10 cm long and 2–4 cm wide, entire, but with wavy margins. The leaves are covered with minute silvery scales when they emerge early in spring, but turn greener above as the scales wear off during the summer. The flowers are borne in the leaf axils in clusters of 1-7. They are pale yellowish-white, fragrant, (often heavily fragrant) and have a four-lobed corolla 1 cm long. The fruit is a small round drupe 1/4 to 1/3 inches (0.65 to 0.85 cm) in diameter. The unripe fruit is silvery-scaled and yellow. It ripens to red, dotted with silver or brown. When ripe, the fruit is juicy and edible, and also makes a good dried fruit. Though the fruit are small, the tree bears them abundantly. They are tart-tasting, with chewable seeds.

Dominion Practices: Young shoots and trees can be manually removed but care should be taken to make sure the entire plant (including all roots) is removed. Larger trees can be cut but the cutting of plants that have fruit would cause the seeds to disperse and new plants to grow. After trees are cut, the stumps should be treated with an herbicide 5-20 minutes after being cut. The herbicide should be applied to the entire stump but especially the outer edge so the herbicide can move to the roots of the plant. Chemical treatments should be applied by certified personnel only.

7.0 Contacts

For more information, contact Paul Vidonic, Matt Overton, John Swenarton, Mike Brucato, Jay Griles, or Karen Canody, regarding known or potential invasive species issues.

Name	Office	Cell
Paul Vidonic (EB)	804-271-5307	804-201-1223
Matt Overton (EB)	804-271-5373	804-339-6288
John Swenarton (EB Millstone)	860-447-1791 ext. 4534	860-333-3215
Jay Griles (Distribution Forestry)	804-771-6190	804-921-0530
Mike Brucato (Transmission Forestry)	804-257-4907	804-310-5187
Karen Canody (Manager Biology)	804-273-3893 804-271-5301	804-627-3262

8.0 Distribution List

This Guidance Document will be distributed to the most current personnel list for the following departments.

Environmental Services
Environmental Regulation
Electric Environmental Services
Environmental Biology
Environmental Laboratory
Environmental Business Support
Gas Environmental Services
Dominion Generation
Dominion Virginia Power
Transmission Forestry
Dominion Energy
Dominion Transmission Inc.
East Ohio Gas
Nuclear, Fossil & Hydro Station Management
Electric ECCs
Legal
Audit Services

Figures

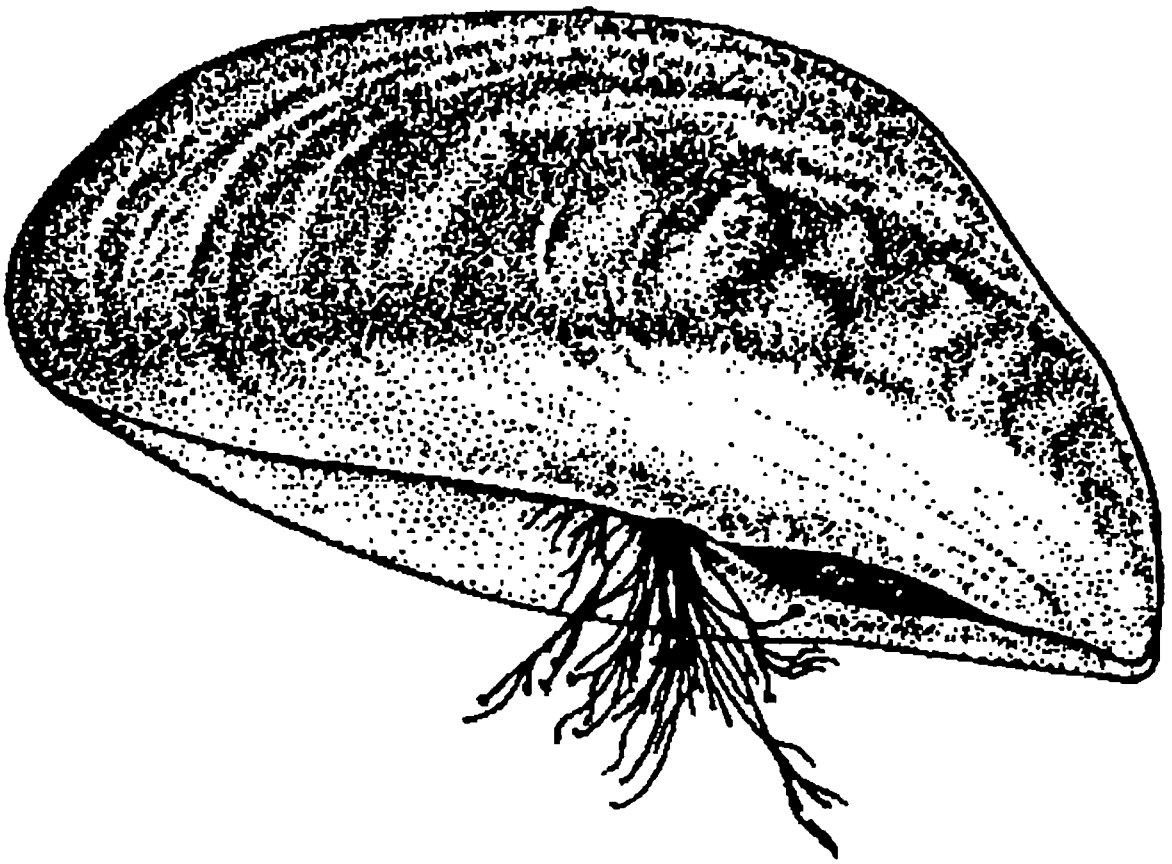


Figure 1: Illustration of zebra mussel (*Dreissena polymorpha*) showing byssus. Image from NOAA, Great Lakes Environmental Research Laboratory, used with permission.

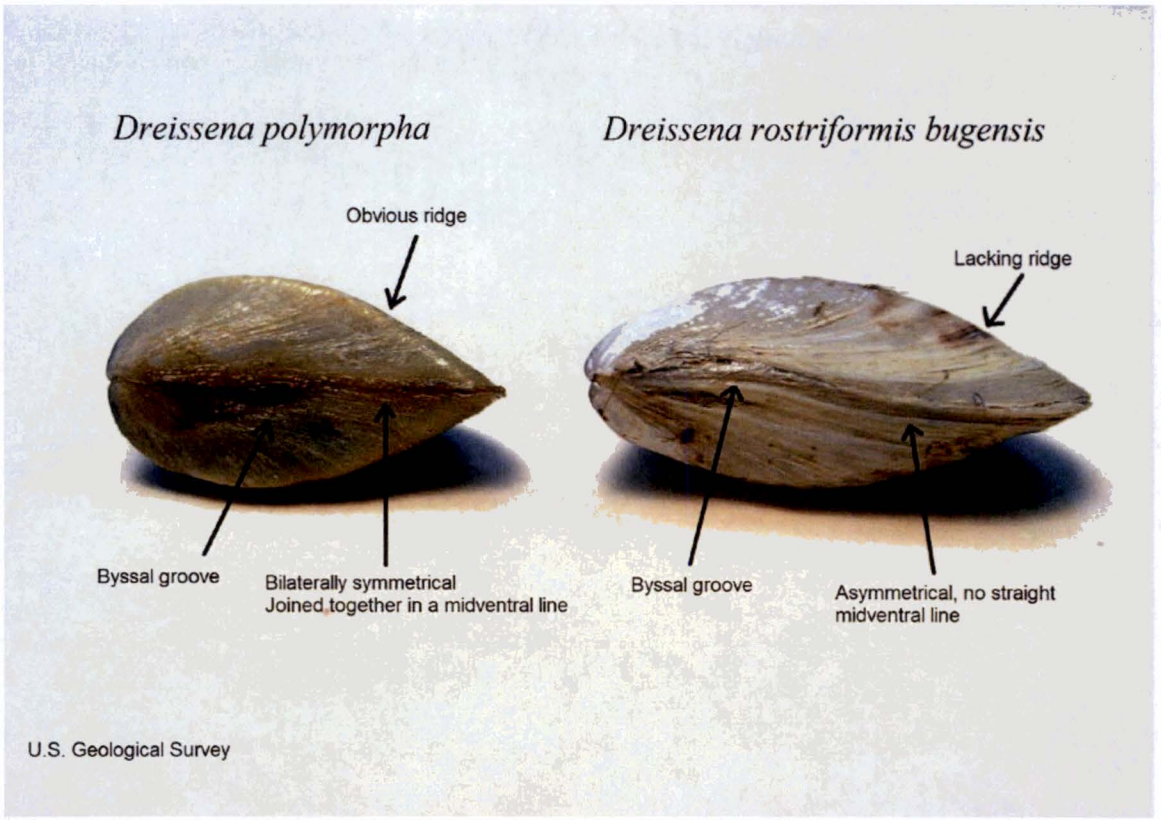


Figure 2: Comparison of zebra (left) and quagga mussels (right).

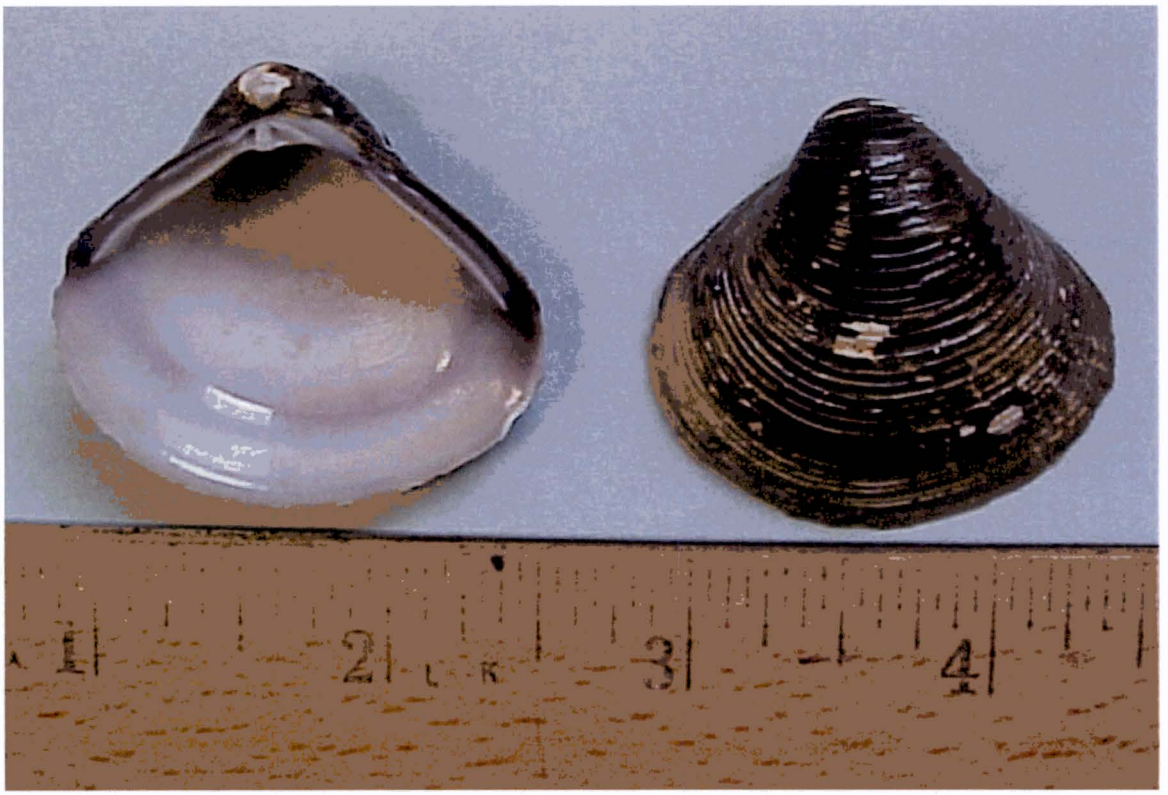


Figure 3: Photo of an Asiatic clam (*Corbicula fluminea*)

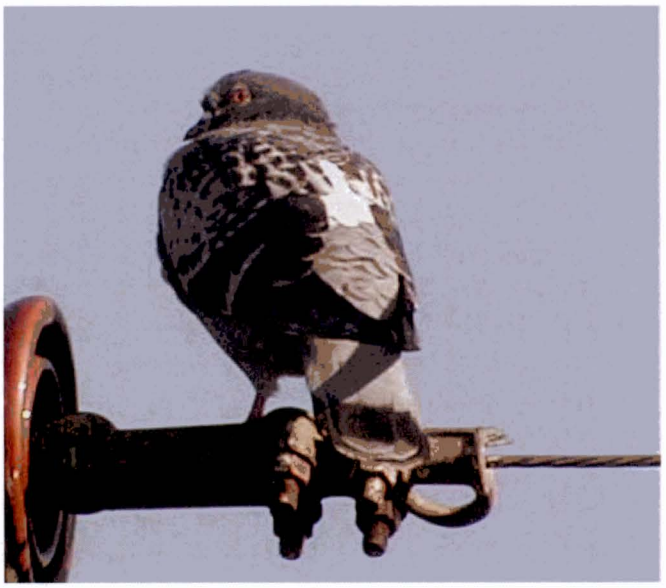


Figure 4: Photo of a rock dove or "pigeon" (*Columba livia*). Photo credit: Gregory Gough, USGS.

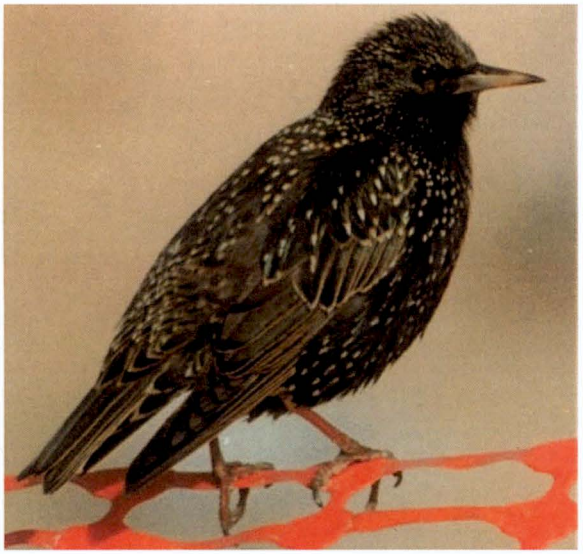
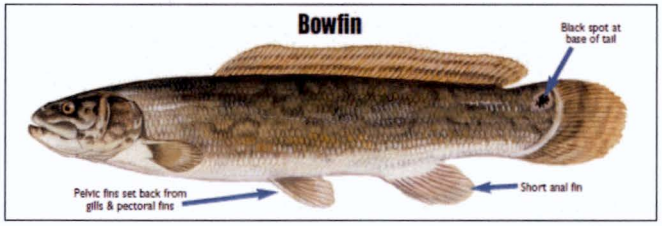


Figure 5: Photo of a European starling (*Sturnus vulgaris*). Photo credit: Marshall Iliff, USGS.

DO YOU KNOW THE DIFFERENCE ?



Similar-Appearing Native Species





If you find a snakehead fish, do NOT release it. Kill the fish, put it on ice, and immediately contact the Virginia Department of Game and Inland Fisheries toll-free at 1-800-770-4951.

KNOW THE FACTS

Snakehead Fish

- As a family, snakeheads are native to parts of Asia and Africa. The northern snakehead is native to China, and possibly Korea and Russia.
- Typically found in a wide variety of habitats
- Northern snakeheads grow to a maximum length of about 33 inches
- Generally tan in appearance, with dark brown mottling; body somewhat elongated; long dorsal fin; jaws contain numerous canine-like teeth (similar to pike or pickerel)
- Capable of breathing air using an air bladder that works as a primitive lung (not found in most fish)
- Able to hibernate in cracks and crevices during cold temperatures and to go dormant in the mud during droughts
- Voracious top-level predator, eating mostly fish, but also eats other aquatic wildlife and frogs
- Capable of moving short distances on land using its pectoral fins; can live out of water for as many as three days
- Favored as a food fish throughout southeast Asia; also believed to have curative powers. Also sold in the aquarium trade.
- Four species have been found in the U.S., in eight states, probably the result of releases from personal aquariums or to develop local food sources
- No natural predators in the U.S.

Why Should We Care?

Exotic species like snakeheads may have significant impacts in the U.S., including:

- Impacts to local fish populations through predation or displacement and competition for food; disruption of native aquatic systems
- Transmission of parasites or diseases, including those affecting humans
- Potential impacts on local economies dependent on fishing or related resources

What Can You Do?

- If you find a snakehead fish, kill it and put it on ice, then contact the Department toll-free at **1-800-770-4951**.
- If you can no longer care for an exotic pet, contact the Virginia Department of Game and Inland Fisheries at (804) 367-1000 or dgifwebsideif.state.va.us for assistance.

Similar-Appearing Native Fishes

Bowfin

- In Virginia, native to the Coastal Plain and possibly lower Piedmont; occasionally found in other parts of the state
- Typically associated with swamps and sluggish open marsh-fringed rivers; found in both shallower and deeper waters in Virginia
- Grows to a maximum length of about 32 inches
- Generally tan-olive in appearance, with dark olive reticulation; body somewhat elongated; long dorsal fin; bony scales; jaws contain small canine and peglike teeth; black spot at the base of the tail (more prominent in males)
- Capable of breathing surface air using an air bladder as a lung (not found in most fish)
- Able to withstand periodic droughts by going dormant in the mud
- Nocturnal, but most active at dusk and dawn; predatory generalist eating fish, aquatic invertebrates and frogs

American Eel

- Native to most of Virginia, as far west as the New River system; not known from southwestern Virginia
- Typically associated with a range of habitats, including mountain streams, warm lakes, estuaries and the ocean
- Grows to a maximum length of approximately 40 inches
- Ranging from olive-brown to yellow-olive to almost black in appearance, with silver sheen on lower side; body very elongated; no pelvic fin; long dorsal and anal fins, converging with the caudal fin to create the appearance of one continuous fin; jaws with small teeth

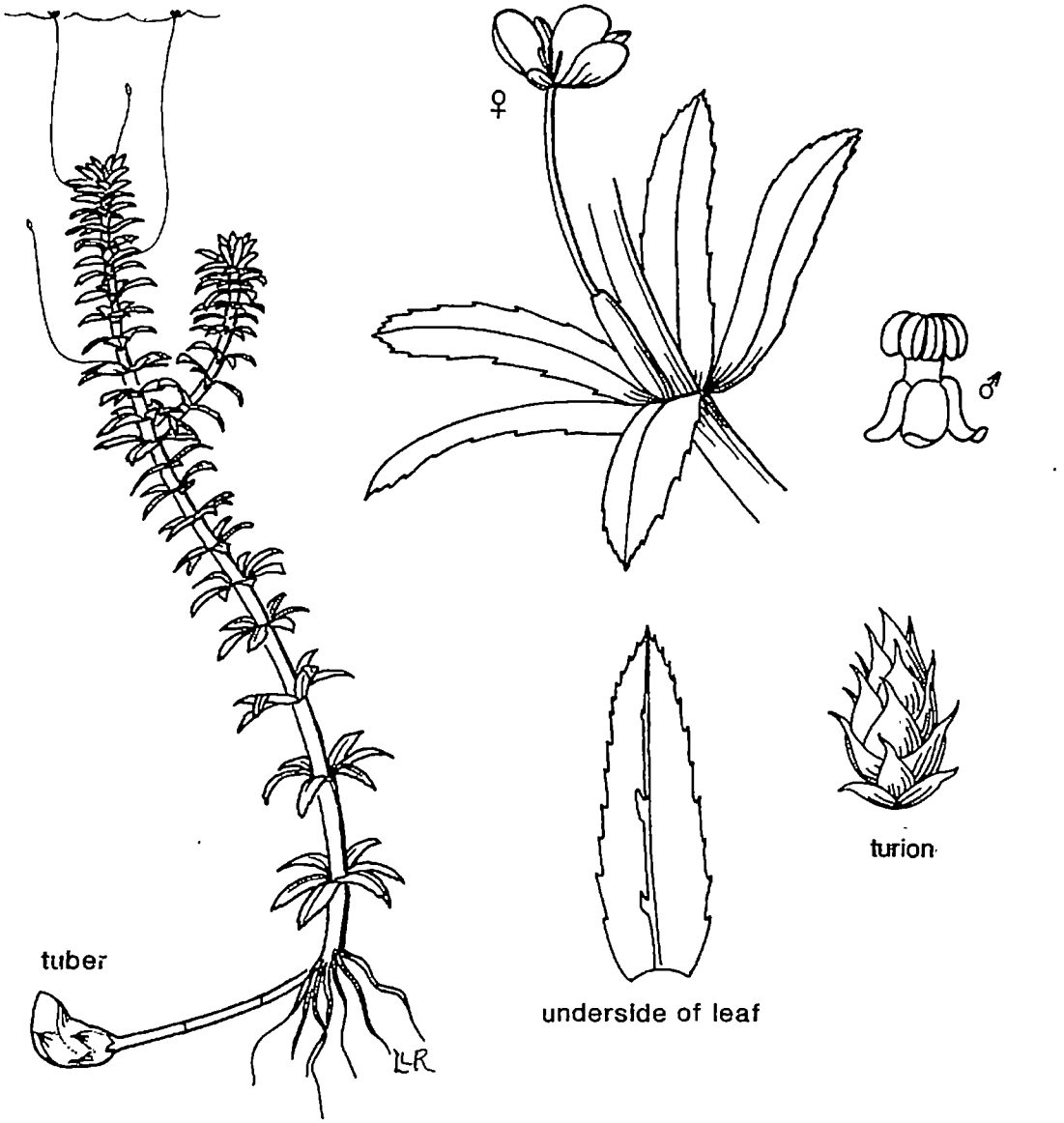
Sea Lamprey

- Native to coastal Virginia; migrates to spawn
- Grows to 12-20 inches in length; eel-like body
- Circle-shaped mouth full of teeth
- Dark brown to black backs and light yellow to pale brown bellies; large reddish eyes

For more information, contact the Virginia Department of Game and Inland Fisheries at (804) 367-1000 or visit online at www.dgif.virginia.gov.

Photos: USFWS/D. Raver; USGS/NAS
Last Updated: 20 May 2004

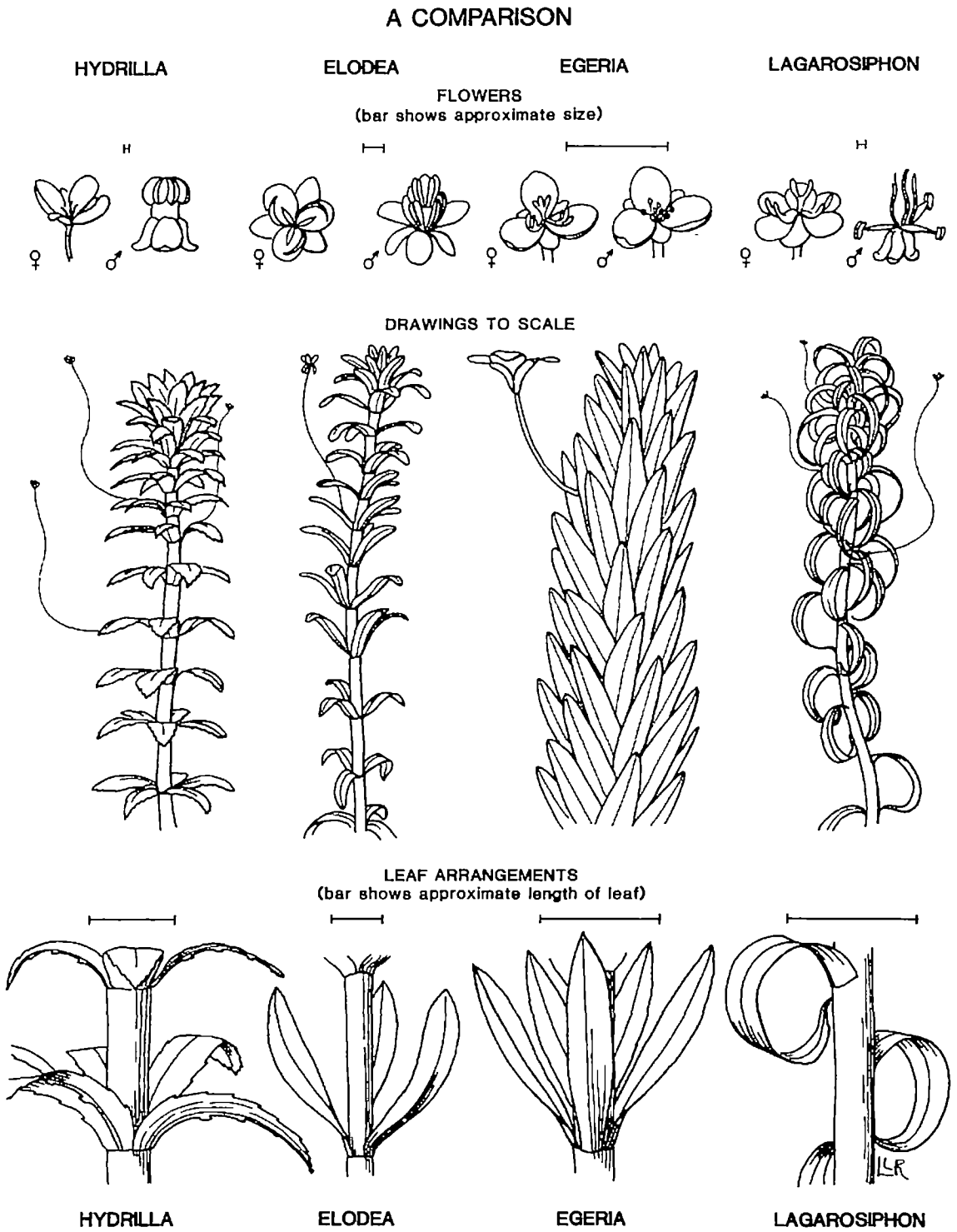
Figure 6: Comparison of snakehead and native bowfin.



Copyright 1991 University of Florida
Center for Aquatic and Invasive Plants

Hydrilla verticillata
Hydrilla

Figure 7: Illustration of Hydrilla. Used with permission from University of Florida.



Copyright 1991 University of Flordia
Center for Aquatic and Invasive Plants

Hydrilla Comparison 2

Figure 8: Comparison of Hydrilla with several other species of submerged aquatic vegetation. Used with permission from University of Florida.

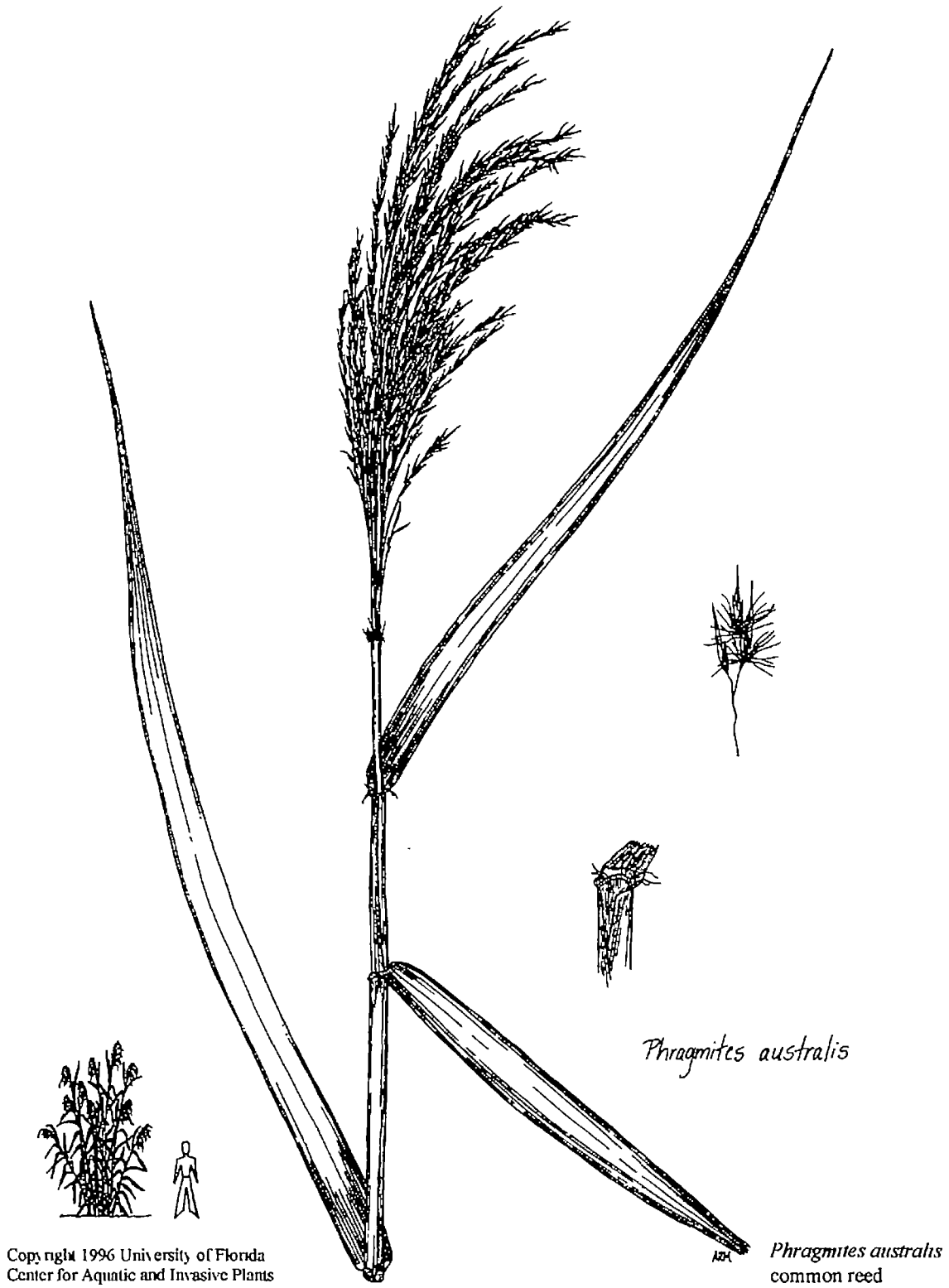


Figure 9: Illustration of Phragmites. Used with permission from University of Florida.



Figure 10: Illustration of narrow-leaved cattail.

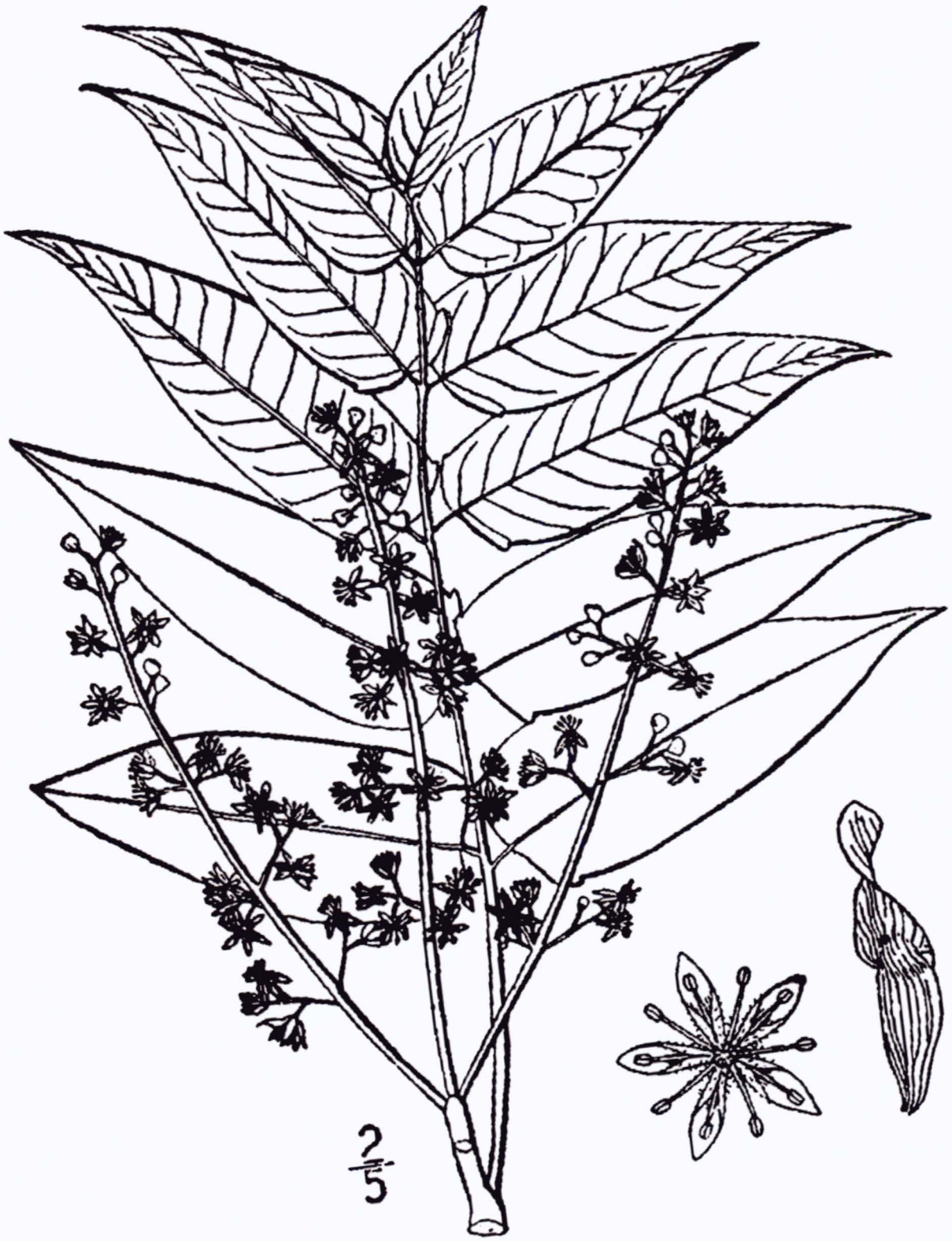


Figure 11: Illustration of tree-of-heaven.

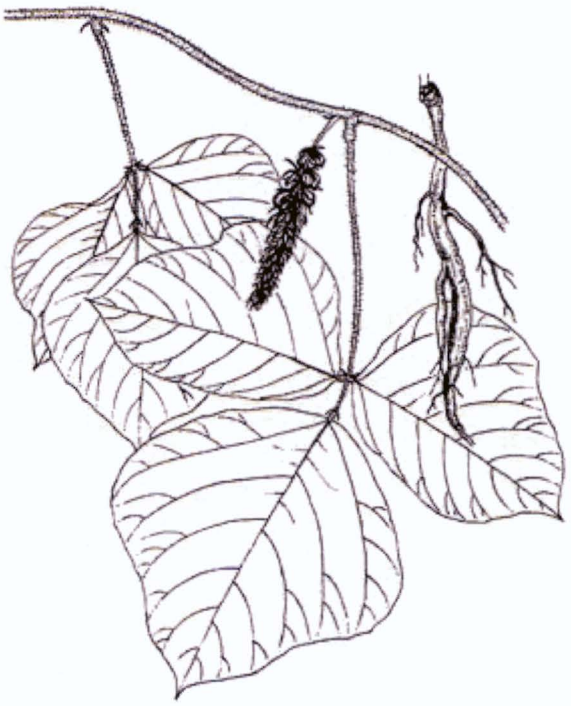


Figure 12: Illustration of Kudzu.



Figure 13: Autumn Olive

Appendix 1: Boat and Trailer Disinfection Procedure

1. Inspect and remove aquatic plants, animals, and mud from boat, trailer, equipment and gear.
2. Drain all water from your boat, motor, live well, bilge, transom wells, as well as from equipment and gear, including but not limited to tracked vehicles, barges, silt or turbidity curtain, hoses, sheet pile and pumps.
3. Dispose of unwanted aquatic plants and animals in an appropriate way.
4. Disinfect boat, equipment, and gear by either:
   a. Washing with ~212° F water (steam clean), OR
   b. Drying thoroughly for 5 days after cleaning with soap and water and/or high pressure water, OR
   c. Disinfecting with a 200 ppm (1 tablespoon per gallon) chlorine solution for 10-minute contact time.

APPENDIX 2. Dominion Asset Invasive Species

Table 2. Known Invasive Species at Dominion assets as reported in response to a 2010 survey to facility ECCs.

	Zebra/Quagga Mussel	Asiatic Clam	Hydrilla	Phragmites	Narrow-leaved Cattail	Tree-of-Heaven	Bamboo	Kudzu	Autumn Olive	Pigeon	Starling	Snakehead
Altavista										X		
Bath County			X							X		
Bear Garden										X		
Bellmeade										X		
Bremo Bluff										X		
Chesapeake				X						X		
Chesterfield										X		
Clover										X		
Cove Point				X		X						
Cushaw										X		
Electric T & D /Forestry				X	X	X	X					
Gas T & D					X							
Gaston			X							X		
Hopewell										X		
Kewaunee	X			X						X		
Manchester Street										X		
Mecklenburg		X						X		X		
Millstone										X		
Mt Storm		X								X		

Table 2 (continued). Known Invasive Species at Dominion assets as reported in response to a 2010 survey to facility ECCs.

	Zebra/Quagga Mussel	Asiatic Clam	Hydrilla	Phragmites	Narrow-leaved Cattail	Tree-of-Heaven	Bamboo	Kudzu	Autumn Olive	Pigeon	Starling	Snakehead
North Anna		X	X							X	X	
Pittsylvania										X		
Possum Point				X						X		
Roanoke Rapids			X							X		
South Hampton										X		
Surry				X						X		
Virginia Hybrid Energy Center								X	X	X		
Yorktown				X						X		

Enclosure 4

SURFACE WATER TOPICAL AREA DOCUMENTS

Attachment 1 - Letter from J. Williams to S. Mackert, dated October 15, 2018, re: VPDES Permit No. VA0052451 Application for Permit Reissuance

Attachment 2 - Letter from J. Williams to S. Mackert, dated March 12, 2019, re: VPDES Permit No. VA0052451: Application for Permit Reissuance – 316(b) 40 CFR §122.21 (r)(10)-(13). [*without Appendices and Attachment*]

Attachment 3 - Letter from J. Schneider to K. Roller, dated September 16, 2020, re: Operating License Renewal Response to Request Regarding Section 401 Certification

Enclosure 4
Attachment 1

LETTER FROM J. WILLIAMS TO S. MACKERT, DATED OCTOBER 15, 2018, RE: VPDES PERMIT NO. VA0052451 APPLICATION FOR PERMIT REISSUANCE

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Dominion Energy Services, Inc
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

October 15, 2018

Ms. Susan Mackert
Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, VA 22193

RE: Dominion Energy North Anna Power Station - VPDES Permit No. VA0052451
Application for Permit Reissuance

Dear Ms. Mackert:

Enclosed is the application for reissuance of the VPDES Permit No. VA0052451 for the North Anna Power Station. A supplemental section is included as part of the application in order to clarify certain information provided in the application forms and/or to provide information on items not directly addressed in those forms.

As required by the CWA 316(b) regulations (40 CFR Part 125), we are including the information regarding with the facility's water intake structure required by 40 CFR Part 122.2.r.(2)-(9). Also, included is the DEQ's approval letter to submit the information required by 40 CFR Part 122.2.r. (10)-(13) by March 15, 2019.

North Anna Power Station currently operates under a Clean Water Act (CWA) Section 316(a) thermal variance. There are no plans to increase the station's thermal loading to the river beyond existing thermal limitations. Dominion Energy believes that the data generated during previous 316(a) demonstration studies remain representative for Lake Anna and for our station operations, and therefore, we request that the 316(a) variance and the alternative effluent limitations referenced in the current VA0052452 permit be continued in the reissued permit.

Additional requests are included in the supplemental information section of the application. The requests pertain to the new motor operated valve for the control of releases from the Lake Anna dam, and other conditions in the permit.

We look forward to working with you during the permit development process. Please feel free to contact Oula Shehab-Dandan via email at oula.k.shehab-dandan@dominionenergy.com or at 804-273-2697 should you have any related questions.

Sincerely,

Jason E. Williams
Director, Environmental

Attachments

cc:

Regional Administrator
U.S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, Georgia 30303-1257
RE: North Anna Units 1 and 2
Docket Nos. 50-338/50-339
License Nos. NPF-4/NPF-7

U. S. Nuclear Regulatory Commission
Attention Document Control Desk
Washington, DC 20555
RE: North Anna Units 1 and 2
Docket Nos. 50-338/50-339
License Nos. NPF-4/NPF-7

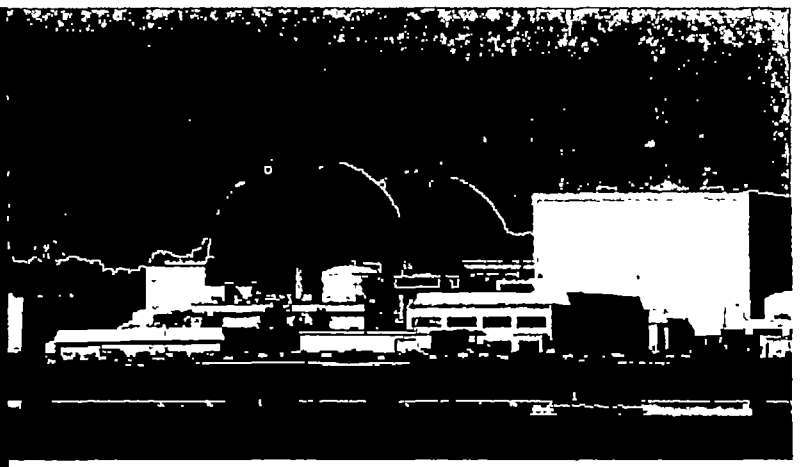
NRC Resident Inspector
North Anna Power Station

EBC the link to Documentum:

Pamela Faggert
Daniel Stoddard
Amanda Tornabene
Jason Williams
Kenneth Roller
Larry Lane
Bill Standley
Randy Markey
Donald Taylor
Oula Shehab-Dandan
Herbert Chriscoe
Lauren Faulkner
Taylor Allen
Karen Canody
Tony Banks

Documentum:

Title/File Name= NA VA0052451 Application Reissuance Application 2018
Document type = Permit – Applications
Environmental Program = Water – NDPES
Facility Name = North Anna



DOMINION ENERGY

NORTH ANNA POWER STATION

VPDES PERMIT NO. VA0052451

APPLICATION FOR PERMIT REISSUANCE

October 15, 2018

Dominion Energy North Anna Power Station

VPDES Permit No. VA0052451

Permit Reissuance Application

TABLE OF CONTENTS

EPA Form 1

EPA Form 2C

EPA Form 2A

EPA Form 2F

VPDES Permit Application Addendum

VPDES Sludge Application

Public Notice Authorization

Permit Billing Information

Attachments

Attachment A	Site Maps
Attachment B	Process Line Drawings
Attachment C	Potential Discharges Not Covered by Analysis
Attachment D	Effluent Sampling Documents
Attachment E	Site Drainage Maps
Attachment F	Stormwater Pollution Prevention
Attachment G	Supplemental Information
Attachment H	CWA §316 (a) Variance Request
Attachment I	CWA §316 (b) NPDES Permit Applications Requirements

EPA Form 1

Please print or type in the unshaded areas only.

Form Approved. OMB No. 2040-0086.

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

6		TVA	C
F	110001891114		D
1 2	13	14	15

LABEL ITEMS	PLEASE PLACE LABEL IN THIS SPACE
I. EPA I.D. NUMBER	
III. FACILITY NAME	
V. FACILITY MAILING ADDRESS	
VI. FACILITY LOCATION	

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms.**

SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	Mark "X" YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.**? (FORM 2A) Form 2A was included for internal outfall 111 at the request of DEQ.		X	X	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.**? (FORM 2B)		X	
	16	17	18		19	20	21
C. Is this a facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	X		X	D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)		X	
	22	23	24		26	26	27
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3) Form 3 was not included per Form 1 instructions (the appropriate Federal permit has already been obtained).	X			F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
	28	29	30		31	32	33
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
	34	35	36		37	38	39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area**? (FORM 5)		X	
	40	41	42		43	44	45

III. NAME OF FACILITY

C		
1	SKIP	Dominion Energy-North Anna Power Station
15	16 - 29	30

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*
C 2 Williams, Jason - Director, Environmental	(804) 273-2646
15 16	48 49 51 52 55

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX
C 3 5000 Dominion Boulevard
15 16 45

B. CITY OR TOWN	C. STATE	D. ZIP CODE
C 4 Glen Allen	VA	23060
15 16 40	41 42	47 51

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER
C 5 1022 Haley Drive
15 16 45

B. COUNTY NAME
Louisa
46 70

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE *(if known)*
C 6 Mineral	VA	23117	109
15 16 40	41 42	47 51	52 55

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
7 4911 *(specify)* Electric Services	7 *(specify)* --
C. THIRD	**D. FOURTH**
7 *(specify)* --	7 *(specify)* --

VIII. OPERATOR INFORMATION

A. NAME	B. Is the name listed in Item VIII-A also the owner?
8 Virginia Electric & Power Company	☑ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box: if "Other," specify.)*			D. PHONE *(area code & no.)*
F = FEDERAL S = STATE P = PRIVATE	M = PUBLIC *(other than federal or state)* O = OTHER *(specify)*	P *(specify)* --	A (804) 273-2929

E. STREET OR P.O. BOX	
5000 Dominion Blvd.	

F. CITY OR TOWN	G. STATE	H. ZIP CODE	IX. INDIAN LAND
B Glen Allen	VA	23060	Is the facility located on Indian lands? ☐ YES ☑ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*	D. PSD *(Air Emissions from Proposed Sources)*	
9 N VA0052451	9 P	
B. UIC *(Underground Injection of Fluids)*	**E. OTHER** *(specify)*	*(specify)*
9 U	9 40726	Air Permit Registration No. (Station ID# 51-109-0025)
C. RCRA *(Hazardous Wastes)*	**E. OTHER** *(specify)*	*(specify)*
9 R VAD065376279	9 VAR104462 & ESCP06-2017	Construction Stormwater General Permit & Land Disturbance permit

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers, and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

Generation of electricity with steam produced by the fission of nuclear materials.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
Larry Lane - Site Vice President	[signature]	10/15/18

COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 2C

Please type or print in the unshaded areas only

EPA ID Number *(Copy from Item 1 of Form 1)*
110001891114

Form Approved
OMB No. 2040-0086
Approval expires 3-31-98

Form **2C** NPDES

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICUTLRAL OPERATIONS
Consolidated Permits Program

Outfall Location

For this outfall, list the latitude and longitude of its location to the nearest 15 seconds and name of the receiving water.

Outfall Number *(list)*	Latitude			Longitude			Receiving Water *(name)*
	Deg	Min	Sec	Deg	Min	Sec	
001	38	00	30.2	-77	43	43	Lake Anna
101	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
103	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
104	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
105	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
107	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
108	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
109	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
110	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
111	38	03	46	-77	47	13.4	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
112	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
113	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
114	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
115	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
116	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
117	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
118	38	03	5.8	-77	47	3.1	Discharge Canal to Waste Heat Treatment Facility to Lake Anna
009	38	03	43.6	-77	47	31	Lake Anna
013	38	03	43.6	-77	47	24.4	Lake Anna
016	38	03	43.6	-77	47	24.4	Lake Anna
020	38	03	43.6	-77	47	24.4	Lake Anna
021	38	03	43.6	-77	47	24.4	Lake Anna
028	38	03	39.2	-77	46	57.3	Lake Anna

II. Flows, Sources of Pollution, and Treatment Technologies

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g. for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures. **See Attachment B.**

B. For each outfall, provide a description of (1) all operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and stormwater runoff; (2) the average flow contributed by each operation; and (3) the treatment received by the wastewater. Continue on additional sheets if necessary.

1. Outfall Number	2. Operations Contributing Flow		3. Treatment		
	a. OPERATION *(list)*	b. AVERAGE FLOW	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	
001	Discharges from the Waste Heat Treatment Facility (WHTF), which includes internal outfalls, at Dike 3	2440.52 MGD	Discharge to Lake Anna	4-A	–
101	Condenser cooling water	1850.56 MGD	Discharge to discharge canal	1-O	–
103	Process wastewater clarifier, including flow from the liquid radioactive waste management system, Steam generator blowdown, Package boiler blowdown, Mat sump system, Ion exchange waste, Sevice water system high capacity blowdown (intermittent)	0.288MGD	Ion exchange; discharge to discharge canal	2-J	1-O
104	Turbine building sumps 1, 2, &3 Storm water, Fire water system line drains, Misc. discharges of purified or raw lake water from various infrequent plant maintenance activities, Chiller water, Service water, Condensate Storage Tanks, AST Containment Sump, Demineralizer Sump, Plant condensers, Bearing cooling water Temporary package boiler blowdown	0.288 MGD	O/W separator, discharge to discharge canal Neutralization	1-H 2-K	1-O

105	Bearing cooling tower blowdown • Continuous blowdown • Lake to lake operation (intermittent)	0 00281 MGD	Discharge to discharge canal	1-O	–
107	Bearing cooling tower blowdown • Continuous blowdown • Lake to lake operation (intermittent) Strainer blowdown	Intermittent (has not discharged during 2015-2017 time period)	Discharge to discharge canal	1-O	–
108	Service water overboard Batch blowdown overflow Straight-through cooling water Header maintenance	Intermittent (0 15 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-O	–
109	Hot well drain – Unit 1 Secondary system condenstate	Intermittent (0.1368 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-O	–
110	Hot well drain – Unit 2 Secondary system condenstate	Intermittent (0.1368 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-O	–
111	Unit 1 & 2 Sewage Ttreatment Plant	0 03 MGD design daily avg flow 0 00586 MGD daily avg flow	See EPA Form 2A, Discharge to discharge canal	1-T, 1-L, XX, 3-A, 5-A, 1-U, 2-F	1-O
112	Steam generator blowdown – Unit 1	0 1872 MGD	Discharge to discharge canal	1-O	–
113	Steam generator blowdown – Unit 2	0.1872 MGD	Discharge to discharge canal	1-O	–
114	Service water tie-on vault drain	Intermittent (0.00285 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-O	–
115	Service water system high capacity blowdown	Intermittent (0 15 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-O	–
116	Vaccum Priming Pump	0.072 MGD	Discharge to discharge canal	1-O	–
117	Salt storage pond	Intermittent (0 47 MGD for the 2015-2017 time period)	Discharge to discharge canal	1-U	1-O
118	Beyond Design Basis Pumps/Portable Emergency Water Supply Pumps	Intermittent (has not discharged during 2015-2017 time period)	Discharge to discharge canal	1-O	
009	Settling pond: Groundwater, storm water; RO unit backwash; Bearing cooling tower water during maintenance activities; Ionics emergency shower wash post neutralization in holding tank	0.828 MGD	Sedimentation; Discharge to Lake Anna	1-U, 4-A	–
013	Turbine building sumps #1 and #2, Stormwater, Plant condensers Bearing cooling water, Misc. discharges of purified or raw lake water from various infrequent plant maintenance activities	Intermittent (has not discharged during 2015-2017 time period)	Discharge to Lake Anna	4-A	–
016	Intake screen wash water	3 368 MGD	Discharge to Lake Anna	4-A	–
020	Reverse Osmosis (RO) reject	0.1834MGD	Discharge to Lake Anna	4-A	–
021	RO drain line	Intermittent (has not discharged during 2015-2017 time period)	Discharge to Lake Anna	4-A	–
028	Beyond Design Basis Pumps/Portable Emergency Water Supply Pumps	Intermittent (0.384 MGD for the 2015-2017 time period)	Discharge to Lake Anna	4-A	–

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

X YES *(complete the following table)* ☐ NO *(go to Section III)*

1. OUTFALL NUMBER (list)	2. OPERATION(s) CONTRIBUTING FLOW *(list)*	3. FREQUENCY a. DAYS PER WEEK *(specify average)*	3. FREQUENCY b. MONTHS PER YEAR *(specify average)*	4. FLOW a. FLOW RATE *(in mgd)* 1. LONG TERM AVERAGE	4. FLOW a. FLOW RATE *(in mgd)* 2. MAXIMUM DAILY	4. FLOW b. TOTAL VOLUME *(specify with units* 1. LONG TERM AVERAGE	4. FLOW b. TOTAL VOLUME *(specify with units* 2. MAXIMUM DAILY	4. FLOW c DURATION *(in days)*
107	Bearing cooling tower blowdown • Continuous blowdown • Lake to lake operation (intermittent) Strainer blowdown	Varies	Varies	No discharge during 2015-2017 time period				n/a
108	Service water overboard Batch blowdown overflow Straight-through cooling water Header maintenance	Varies	Varies	0 15	0.15	0 15 MG	0.15 MG	1
109	Hot well drain – Unit 1 Secondary system condenstate	1/ outage	1/ 18 months	0.1368	0 1368	0 1368 MG	0.1368 MG	1
110	Hot well drain – Unit 2 Secondary system condenstate	1/ outage	1/ 18 months	0.1368	0.1368	0.1368 MG	0.1368 MG	1
114	Service water tie-in vault drain	Varies	Varies	0 000285	0.000513	0.000285 MG	0 000513 MG	1
115	Service water system high capacity blowdown	Varies	Varies	0.15	0.15	0.15 MG	0.15 MG	1
117	Salt Storage Pond	Varies	Varies	0 47	1 15	0.47 MG	1 15 MG	1
118	Beyond Design Basis Pumps/Portable Emergency Water Supply Pumps	Varies	Varies	No discharge during 2015-2017 time period				n/a
013	Turbine building sumps #1 and #2; stormwater	Varies	Varies	No discharge during 2015-2017 time period				n/a
021	RO drain line	Varies	Varies	No discharge during 2015-2017 time period				n/a
028	Beyond Design Basis Pumps/Portable Emergency Water Supply Pumps	Varies	Varies	0 384	0.384	0 384 MG	0 384 MG	1

III. PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

X YES *(complete Item III-B)* ☐ NO *(go to Section IV)*

B Are the limitations in the applicable effluent guideline expressed in terms of production *(or other measure of operation)*?

☐ YES *(complete Item III-C)* X NO *(go to Section IV)*

C. If you answered "yes" to Item III-B, list the quantity which represents an actual measurement of your level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. AVERAGE DAILY PRODUCTION a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. *(specify)*	2. AFFECTED OUTFALLS *(list outfall numbers)*
N/A			

IV. IMPROVEMENTS

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading, or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES *(complete the following table)* X NO *(go to Item IV-B)*

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS a. NO.	2. AFFECTED OUTFALLS b. SOURCE OF DISCHARGE	3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE a. REQUIRED	4. FINAL COMPLIANCE DATE b. PROJECTED
N/A					

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs *(or other environmental projects which may affect your discharges)* you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction.

☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAM IS ATTACHED

CONTINUED FROM PAGE 2

V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding - Complete one set of tables for each outfall - Annotate the outfall number in the space provided. **NOTE:** Tables V-A, V-B, and V-C are included on separate sheets number V-1 through V-9.

Use the space below to list any of the pollutants listed in Tables 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE
No 2C-3 pollutants are known or believed to be discharged from any outfall.			

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

Is any pollutant listed in Item V-C a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

X **YES** *(list all such pollutants below)* ☐ **NO** *(go to Item VI-B)*

As radioactive releases at this facility are regulated by the Nuclear Regulatory Commission (NRC), they have not been listed here.
See **Attachment C** for a list of other potential discharges not covered by analysis.

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

X YES *(identify the test(s) and describe their purpose below)* ☐ NO *(go to Section VIII)*

Toxicity testing and reporting have been conducted in accordance with the requirements of Part I.C of the VPDES permit. For outfall 001, the permit requires chronic 3-brood static renewal survival and reproduction tests with *Ceriodaphnia dubia* and chronic 7-day static renewal survival and growth tests with *Pimephales promelas*. A summary of the test results from 2014-2018 are below.

Test Date Month/Year	*C. dubia* NOEC Survival	*C. dubia* NOEC Reproduction	*P. promelas* NOEC Survival	*P. promelas* NOEC Growth
October 2015	100%	100%	100%	100%
October 2016	100%	100%	100%	100%
August 2017	100%	100%	100%	100%
May 2018	100%	100%	100%	100%

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

X YES *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ NO *(go to Section IX)*

A. NAME	B. ADDRESS	C. TELEPHONE *(area code & no.)*	D. POLLUTANTS ANALYZED *(list)*
Air Water & Soil Laboratories, Inc	**1941 Reymet Road Richmond, VA 23237**	**(804) 358-8295**	**Total metals, Dissolved metals, VOCs, SVOCs, Pesticides, Herbicides, PCBs, E coli, Enterrococci, Ammonia, Cyanide, Nonylphenol, Bromide, Chloride, Sulfide, Nitrate, Nitrate-Nitrite,TKN, Total Nitrogen, Phosphorus, Oil & Grease, Color, BOD, COD, TOC, TSS, TDS, Phenol, Sulfate, Hydrogen Sulfide, MBAS**
Pace Analytical Services Inc.	**1638 Roseytown Road Greensburg, PA 15601**	**(724) 850-5600**	**Gross Alpha/Beta, Radium 226, Radium 228, Total Radium, Total Uranium KPA**
Pace Analytical Services Inc.	**9800Kincey Avenue Hubtersville, NC 28078**	**(704)875-9092**	**Total Mercury, Dissolved Mercury, Sulfide**
Cape Fear Analytical	**3306 Kitty Hawk Road Wilmington, NC 28405**	**(910) 795-0421**	**2,3,7,8- TCDD**
Universal Laboratories	**20 Research Drive Hampton, VA 23666**	**(800) 695-2162**	**Tributyltin**

IX. 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.

A. NAME & OFFICIAL TITLE *(type or print)*	B. PHONE NO. *(area code & no.)*
Larry Lane, Site Vice President	**(540) 894-2101**
C. SIGNATURE Larry Lane	D. DATE SIGNED 10/15/18

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I.D. NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

OUTFALL NO 001

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. Pollutant	2. EFFLUENT						d. No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand (BOD)	< 0.2	< 5380 3	--	--	--	--	1	mg/L	kg/d	< 0.2	--	1
b. Chemical Oxygen Demand (COD)	11 0	295917	--	--	--	--	1	mg/L	kg/d	< 10 0	--	1
c. Total Organic Carbon (TOC)	3.9	104916	--	--	--	--	1	mg/L	kg/d	3.7	--	1
d. Total Suspended Solids (TSS)	1.38	37124 1	--	--	--	--	1	mg/L	kg/d	< 1 00	--	1
e. Ammonia (as N)	< 0 10	< 2690 15	--	--	--	--	1	mg/L	kg/d	< 0.10	--	1
f. Flow	VALUE 3225 6		VALUE		VALUE 2440 52		156	MGD	--	VALUE --		--
g Temperature (winter)	VALUE 24		VALUE --		VALUE 16 0		77	°C		VALUE --		--
h Temperature (summer)	VALUE 35 4		VALUE --		VALUE 29 2		79	°C		VALUE 20.5		1
i pH	MINIMUM 6.3	MAXIMUM 7.6	MINIMUM --	MAXIMUM --	[redacted]		156	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*if available*)	2.MARK 'X'		3. EFFLUENT						d. No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)	X		0 022	591 833	--	--	--	--	1	mg/L	kg/d	0.023	--	1
b. Chlorine, Total Residual	X		< 0.1	< 2690 15	--	--	--	--	36	mg/L	kg/d	< 0.1	--	1
c Color	X		8 5	--	--	--	--	--	1	pcu	--	7.7	--	1
d Fecal Coliform		X	Waived	--	--	--	--	--	--	--	--	--	--	--
e. Fluoride (16984-48-8)	X		< 0 1	2690 15	--	--	--	--	1	mg/L	kg/d	< 0 1	--	1
f Nitrate - Nitrite (as N)	X		0.22	5918.33	--	--	0.12	2442 47	6	mg/L	kg/d	0.13	--	1

ITEM V-B CONTINU

OUTFALL NO 001

1. Pollutant and CAS NO (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (*as N*)	X		< 0 3	< 8070.45	--	--	--	--	1	mg/L	kg/d	< 0 3	--	1
h Oil & Grease	X		< 5.0	< 134508	--	--	--	--	1	mg/L	kg/d	< 5 0	--	1
i Phospliorus (as P), Total (7723-14-0)	X		0.08	2152.12	--	--	0 03	610 6	6	mg/L	kg/d	0 023	--	1
j. Radioactivity														
(1) Alpha	X		< 1.96	--	--	--	--	--	1	pCi/L	--	< 1 45	--	1
(2) Beta	X		1.89	--	--	--	--	--	1	pCi/L	--	< 1.61	--	1
(3) Radium, Total	X		< 1 70	--	--	--	--	--	1	pCI/L	--	< 1.90	--	1
(4) Radium 226, Total	X		< 0 579	--	--	--	--	--	1	pCi/L	--	< 0 782	--	1
k. Sulfate (*as SO_4*) (14808-79-8)	X		5 9	158719	--	--	--	--	1	mg/L	kg/d	5 9	--	1
l Sulfide (*as S*)	X		< 0.1	< 2690 15	--	--	--	--	1	mg/L	kg/d	< 0 1	--	1
m Sulfite (as SO_3) (14265-45-3)		X	Waived	--	--	--	--	--	--	--	--	--	--	--
n Surfactants	X		< 0.100	< 2690 15	--	--	--	--	1	mg/L	kg/d	< 0 1	--	1
o. Aluminum, Total (7429-90-5)	X		0.0281	755 932	--	--	--	--	1	mg/L	kg/d	0 0453	--	1
p. Barium Total (7440-39-3)	X		0.0179	481 537	--	--	--	--	1	mg/L	kg/d	0 0182	--	1
q Boron, Total (7440-42-8)	X		< 0.05	< 1345 08	--	--	--	--	1	mg/L	kg/d	0 053	--	1
r Cobalt, Total (7440-48-4)	X		< 0 001	< 26 9015	--	--	--	--	1	mg/L	kg/d	< 0 001	--	1
s. Iron, Total (7439-89-6)	X		0 0629	1692.1	--	--	--	--	1	mg/L	kg/d	0.0831	--	1
t Magnesium, Total (7439-95-4)	X		2 55	68598 8	--	--	--	--	1	mg/L	kg/d	2.53	--	1
u Molybdenum, Total (7439-98-7)	X		0 00871	234 312	--	--	--	--	1	mg/L	kg/d	0.00757	--	1
v Manganese, Total (7439-96-5)	X		0.0123	330 888	--	--	--	--	1	mg/L	kg/d	0 0124	--	1
w. Tin, Total (7440-31-5)	X		< 0.007	< 188 311	--	--	--	--	1	mg/L	kg/d	< 0 007	--	1
x Titanium, Total (7440-32-6)	X		< 0 003	< 80.7045	--	--	--	--	1	mg/L	kg/d	< 0 003	--	1

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinotrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT						d. No OF ANALYSES	4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)	X	X		< 0 0002	< 5 3803008	--	--	--	--	1	mg/L	kg/d	< 0 0002	--	1
2M Arsenic, Total (7440-38-2	X	X		< 0 00083	< 22.328248	--	--	--	--	1	mg/L	kg/d	< 0 00083	--	1
3M Beryllium, Total (7440-41-7)	X	X		< 0 0002	< 5.3803008	--	--	--	--	1	mg/L	kg/d	< 0 0002	--	1
4M Cadmium, Total (7440-43-9)	X	X		< 0.0002	< 5 3803008	--	--	--	--	1	mg/L	kg/d	< 0.0002	--	1
5M. Chromium, Total (7440-47-3)	X	X		< 0 0003	< 8 0704512	--	--	--	--	1	mg/L	kg/d	< 0.0003	--	1
6M Copper, Total (7440-50-8)	X	X		0 00161	43 311421	--	--	--	--	1	mg/L	kg/d	0.0016	--	1
7M Lead, Total (7439-92-1)	X	X		0 000295	7 9359437	--	--	--	--	1	mg/L	kg/d	< 0 0002	--	1
8M. Mercury, Total (7439-97-6)	X	X		0.000000642	0.0172708	--	--	--	--	1	mg/L	kg/d	0.00000072	--	1
9M. Nickel, Total (7440-02-0)	X	X		< 0.00028	< 7 5324211	--	--	--	--	1	mg/L	kg/d	< 0 00028	--	1
10M Selenium, Total (7782-49-2)	X	X		< 0 001	< 26 901504	--	--	--	--	1	mg/L	kg/d	< 0 001	--	1
11M. Silver, Total (7440-22-4	X	X		< 0 00001	< 0 269015	--	--	--	--	1	mg/L	kg/d	< 0 00001	--	1
12M Thallium, Total (7440-28-0)	X	X		< 0 0004	< 10 760602	--	--	--	--	1	mg/L	kg/d	< 0 0004	--	1
13M Zinc, Total (7440-66-6)	X	X		0.00341	91.734129	--	--	--	--	1	mg/L	kg/d	0 0019	--	1
14M Cyanide, Total (57-12-5)	X	X		< 0 01	< 269 01504	--	--	< 0 01	< 203 539	4	mg/L	kg/d	< 0 01	--	1
15M Phenols, Total	X	X		< 0.030	< 807.04512	--	--	--	--	1	mg/L	kg/d	< 0.03	--	1
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS Outfall 001 <10 6 pg/l Intake <11.2 pg/l											

OUTFALL NO. 001

1. Pollutant and CAS NO. (if available)	2. MARK 'X'			3. EFFL						d. No. OF ANALYSES	4. UNITS (specify if blank)		5 IN (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X	X		< 0.03	< 807.0451	--	--	< 0.021525	< 438.11849	4	mg/L	kg/d	< 0.03	--	1
2V. Acrylonitrile (107-13-1)	X	X		< 0.0085	< 228.6628	--	--	< 0.0068	< 138.40677	4	mg/L	kg/d	< 0.0085	--	1
3V. Benzene (71-43-2)	X	X		< 0.002	< 53.80301	--	--	< 0.00105	< 21.371634	4	mg/L	kg/d	< 0.002	--	1
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required	--	--		--		--	--	--	--	--	--
5V. Bromoform (75-25-2)	X	X		< 0.002	< 53.80301	--	--	< 0.001325	< 26.968966	4	mg/L	kg/d	< 0.002	--	1
6V. Carbon Tetrachloride (56-23-5)	X	X		< 0.0025	< 67.25376	--	--	< 0.001175	< 23.915876	4	mg/L	kg/d	< 0.0025	--	1
7V. Chlorobenzene (108-90-7)	X	X		< 0.002	< 53.80301	--	--	< 0.000775	< 15.774301	4	mg/L	kg/d	< 0.002	--	1
8V. Chlorodibromomethane (124-48-1)	X	X		< 0.00175	< 47.07763	--	--	< 0.0009875	< 20.099513	4	mg/L	kg/d	< 0.00175	--	1
9V. Chloroethane (75-00-3)	X	X		< 0.0035	< 94.15526	--	--	--	--	1	mg/L	kg/d	< 0.0035	--	1
10V. 2-Chloroethylvinyl Ether (110-75-8)	X	X		< 0.005	< 134.5075	--	--	--	--	1	mg/L	kg/d	< 0.005	--	1
11V. Chloroform (67-66-3)	X	X		< 0.0025	< 67.25376	--	--	< 0.001175	< 23.915876	4	mg/L	kg/d	< 0.0025	--	1
12V. Dichlorobromomethane (75-27-4)	X	X		< 0.002	< 53.80301	--	--	< 0.00105	< 21.371634	4	mg/L	kg/d	< 0.002	--	1
13V. Dichlorodifluoromethane (75-71-8)				Not Required	--	--		--		--	--	--	--	--	--
14V. 1,1-Dichloroethane (75-34-3)	X	X		< 0.003	< 80.70451	--	--	--	--	1	mg/L	kg/d	< 0.003	--	1
15V. 1,2-Dichloroethane (107-06-2)	X	X		< 0.0035	< 94.15526	--	--	< 0.0017	< 34.601693	4	mg/L	kg/d	< 0.0035	--	1
16V. 1,1-Dichloroethylene (75-35-4)	X	X		< 0.0035	< 94.15526	--	--	< 0.001425	< 29.00436	4	mg/L	kg/d	< 0.0035	--	1
17V. 1,2-Dichloropropane (78-87-5)	X	X		< 0.002	< 53.80301	--	--	< 0.001325	< 26.968966	4	mg/L	kg/d	< 0.002	--	1
18V. 1,3-Dichloropropylene (542-75-6)	X	X		< 0.005	< 134.5075	--	--	< 0.001825	< 37.145935	4	mg/L	kg/d	< 0.005	--	1
19V. Ethylbenzene (100-41-4)	X	X		< 0.002	< 53.80301	--	--	< 0.000775	< 15.774301	4	mg/L	kg/d	< 0.002	--	1
20V. Methyl Bromide (74-83-9)	X	X		< 0.004	< 107.606	--	--	< 0.00155	< 31.548602	4	mg/L	kg/d	< 0.004	--	1
21V. Methyl Chloride (74-87-3)	X	X		< 0.00475	< 127.7821	--	--	--	--	1	mg/L	kg/d	< 0.00475	--	1

CONTINUED FROM PA[illegible]-4

OUTFALL NO 001

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)	X	X		< 0 005	< 134 50752	--	--	< 0 003775	< 76 8361114	4	mg/L	kg/d	< 0 005	--	1
23V 1,1,2,2-Tetrachloroethane (79-34-5)	X	X		< 0 0015	< 40 352256	--	--	< 0 0012	< 24 4247242	4	mg/L	kg/d	< 0 0015	--	1
24V Tetrachloroethylene (127-18-4)	X	X		< 0 002	< 53 803008	--	--	< 0 00105	< 21 3716336	4	mg/L	kg/d	< 0 002	--	1
25V Toluene (108-88-3)	X	X		< 0 0025	< 67 25376	--	--	< 0 000977	< 19 8857963	4	mg/L	kg/d	< 0 0025	--	1
26V 1,2-Trans-Dichloroethylene (156-60-5)	X	X		< 0 003	< 80 704512	--	--	< 0 0013	< 26 4601178	4	mg/L	kg/d	< 0 003	--	1
27V 1,1,1-Trichloroethane (71-55-6)	X	X		< 0 003	< 80 704512	--	--	--	--	1	mg/L	kg/d	< 0 003	--	1
28V 1,1,2-Trichloroethane (79-00-5)	X	X		< 0 0025	< 67 25376	--	--	< 0 001175	< 23 9158757	4	mg/L	kg/d	< 0 0025	--	1
29V Trichloroethylene (79-01-6)	X	X		< 0 002	< 53 803008	--	--	< 0 00085	< 17 3008463	4	mg/L	kg/d	< 0.002	--	1
30V Trichlorofluoromethane (75-69-4)	X	X		< 0.004	< 107 60602	--	--	--	--	1	mg/L	kg/d	< 0 004	--	1
31V Vinyl Chloride (75-01-4)	X	X		< 0 0025	< 67 25376	--	--	< 0 000975	< 19 8450884	4	mg/L	kg/d	< 0 0025	--	1
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	X	X		< 0 00106	< 28 515594	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
2A 2,4-Dichlorophenol (120-83-2)	X	X		< 0 00106	< 28 515594	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
3A 2,4-Dimethylphenol (105-67-9)	X	X		< 0 00053	< 14 257797	--	--	< 0 0005225	< 10.634932	4	mg/L	kg/d	< 0 00054	--	1
4A 4,6-Dinitro-O-Cresol (534-52-1)	X	X		< 0 00106	28 515594	--	--	< 0 00104	21 1680943	4	mg/L	kg/d	< 0 00109	--	1
5A. 2,4-Dinitrophenol (51-28-5)	X	X		< 0 00053	< 14 257797	--	--	< 0 0005225	< 10 634932	4	mg/L	kg/d	< 0 00054	--	1
6A 2-Nitrophenol (88-75-5)	X	X		< 0 00104	< 27 977564	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
7A 4-Nitrophenol (100-02-7)	X	X		< 0 00104	< 27 977564	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
8A P-Chloro-MCresol (59-50-7)	X	X		< 0 00833	< 224 08953	--	--	--	--	1	mg/L	kg/d	< 0 0087	--	1
9A Pentachlorophenol (87-86-5	X	X		< 0 0106	< 285 15594	--	--	< 0 0079	< 160 796101	4	mg/L	kg/d	< 0 0109	--	1
10A Phenol (108-95-2)	X	X		< 0 0103	< 277 08549	--	--	< 0 00936	< 190 512848	4	mg/L	kg/d	< 0 0087	--	1
11A 2,4,6-Trichlorophenol (88-05-2)	X	X		< 0 00106	< 28 515594	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1

CONTINUED FROM P/ '-5

OUTFALL NO 001

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUEN							4. UNITS (specify if blank)		5. INTAK (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (If available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (If available) (2) MASS	c LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c LONG TERM AVG. VALUE (if available) (2) MASS	d No. OF ANALYSES	a. CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE (1) CONCENTRATION	a LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GS/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)	X	X		< 0 0103	< 277 085	--	--	< 0 0033575	< 68 3383428	4	mg/L	kg/d	< 0 00109	--	1
2B Acenaphtylene (208-96-8)	X	X		< 0 0035	< 94 1553	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
3B Anthracene (120-12-7)	X	X		< 0 0103	< 277 085	--	--	< 0 0033575	< 68 3383428	4	mg/L	kg/d	< 0 00109	--	1
4B Benzidine (92-87-5)	X	X		< 0 0532	< 1431 16	--	--	< 0 052075	< 1059 93126	4	mg/L	kg/d	< 0 0543	--	1
5B Benzo (a) Anthracene (56-55-3)	X	X		< 0 0103	< 277.085	--	--	< 0 00936	< 190 512848	4	mg/L	kg/d	< 0 0087	--	1
6B Benzo (a) Pyrene (50-32-8)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
7B 3,4-Benzofluoranthene (205-99-2)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
8B Benzo (ghi) Perylene (191-24-2)	X	X		< 0 00104	< 27 9776	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
9B Benzo (k) Fluoranthene (207-08-9)	X	X		< 0.00106	< 28 5156	--	--	< 0.00104	< 21.1680943	4	mg/L	kg/d	< 0 00109	--	1
10B Bis (2-Chloroethoxy) Methane (111-91-1)	X	X		< 0 00104	< 27.9776	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
11B Bis (2-Chloroethyl) Ether (111-44-4)	X	X		< 0 00106	< 28.5156	--	--	< 0 00104	< 21.1680943	4	mg/L	kg/d	< 0 00109	--	1
12B Bis (2-Chloroisopropyl) Ether (102-80-1)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21.1680943	4	mg/L	kg/d	< 0 00109	--	1
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
14B. 4-BromophenylPhenyl Ether (101-55-3)	X	X		< 0 0104	< 279 776	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
15B Butyl Benzyl Phthalate (85-68-7)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
16B 2-Chloronaphthalene (91-58-7)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)	X	X		< 0 00104	< 27 9776	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
18B Chrysene (218-01-9)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21 1680943	4	mg/L	kg/d	< 0 00109	--	1
19B Dibenzo (a,h) Anthracene (53-70-3)	X	X		< 0 00106	< 28 5156	--	--	< 0 00104	< 21.1680943	4	mg/L	kg/d	< 0 00109	--	1
20B 1,2-Dichlorobenzene (95-50-1)	X	X		< 0 002	< 53.803	--	--	< 0 00125	< 25 442421	4	mg/L	kg/d	< 0 002	--	1
21B 1,3-Di-chlorobenzene (541-73-1)	X	X		< 0.0015	< 40 3523	--	--	< 0 001125	< 22 8981789	4	mg/L	kg/d	< 0 0015	--	1

CONTINUED FROM P/ '-6

OUTFALL NO 001

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3. EFFLUENT						4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GS/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	X	X		< 0 002	< 53 80301	--	--	< 0 00125	< 25 44242	4	mg/L	kg/d	< 0 002	--	1
23B 3,3-Dichlorobenzidine (91-94-1)	X	X		< 0 00426	< 114 6004	--	--	< 0 0041875	< 85 23211	4	mg/L	kg/d	< 0 00435	--	1
24B Diethyl Phthalate (84-66-2)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
25B Dimethyl Phthalate (131-11-3)	X	X		< 0 00106	< 28 51559	--	--	< 0.00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
26B Di-N-Butyl Phthalate (84-74-2)	X	X		< 0 00213	< 57 3002	--	--	< 0 0020825	< 42 38707	4	mg/L	kg/d	< 0 00217	--	1
27B 2,4-Dinitrotoluene (121-14-2)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
28B. 2,6-Dinitrotoluene (606-20-2)	X	X		< 0 00104	< 27 97756	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
29B Di-N-Octyl Phthalate (117-84-0)	X	X		< 0 00104	< 27 97756	--	--	--	--	1	mg/L	kg/d	< 0 00109	--	1
30B. 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	X	X		< 0 0103	< 277 0855	--	--	< 0 00936	< 190 5128	4	mg/L	kg/d	< 0 0087	--	1
31B Fluoranthene (206-44-0)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
32B Fluorene (86-73-7)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
33B Hexachlorobenzene (118-74-1)	X	X		< 0 00266	< 71 558	--	--	< 0 002605	< 53 02201	4	mg/L	kg/d	< 0 00272	--	1
34B Hexachlorobutadiene (87-68-3)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
35B Hexachlorocyclopentadiene (77-47-4)	X	X		< 0 00106	< 28 51559	--	--	< 0.00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
36B Hexachloroethane (67-72-1)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X	X		< 0.00106	< 28 51559	--	--	< 0 00104	< 21,16809	4	mg/L	kg/d	< 0 00109	--	1
38B Isophorone (78-59-1)	X	X		< 0 00106	< 28 51559	--	--	< 0 00104	< 21 16809	4	mg/L	kg/d	< 0 00109	--	1
39B Naphthalene (91-20-3)	X	X		< 0 00833	< 224.0895	--	--	--	--	1	mg/L	kg/d	< 0 0087	--	1
40B Nitrobenzene (98-95-3)	X	X		< 0 0103	< 277 0855	--	--	< 0 00936	< 190 5128	4	mg/L	kg/d	< 0.0087	--	1
41B N-Nitrosodimethylamine (62-75-9)	X	X		< 0 00213	< 57 3002	--	--	< 0 00208525	< 42 44305	4	mg/L	kg/d	< 0 00217	--	1
42B N-Nitrosodi- N-Propylamine (621-64-7)	X	X		< 0 00213	< 57 3002	--	--	< 0 0020825	< 42 38707	4	mg/L	kg/d	< 0.00217	--	1

CONTINUED FROM V-7

OUTFALL NO. 001

1. Pollutant and CAS NO. (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTA. (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG. VALUE (if available)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GS/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)	X	X		< 0 0103	< 277 08549	--	--	< 0.00936	< 190 5128	4	mg/L	kg/d	< 0.0087	--	1
44B Phenanthrene (85-01-8)	X	X		< 0 00833	< 224 08953	--	--	--	--	1	mg/L	kg/d	< 0 0087	--	1
45B Pyrene (129-00-0	X	X		< 0 0103	< 277.08549	--	--	< 0 00936	< 190.5128	4	mg/L	kg/d	< 0.0087	--	1
46B. 1,2,4-Trichlorobenzene (120-82-1)	X	X		< 0 00213	< 57 300204	--	--	< 0 0020825	< 42 38707	4	mg/L	kg/d	< 0 0087	--	1
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)	X	X		< 0 000005	< 0 1345075	--	--	< 0.000005	< 0 10177	4	mg/L	kg/d	< 0 000005	--	1
2P. α-BHC (319-84-6)	X	X		< 0 000005	< 0.1345075	--	--	< 0 000005	< 0.10177	4	mg/L	kg/d	< 0 000005	--	1
3P β-BHC (319-85-7)	X	X		< 0 00002	< 0.5380301	--	--	< 0 00000875	< 0.178097	4	mg/L	kg/d	< 0.000022	--	1
4P. γ-BHC (58-89-9)	X	X		< 0.000005	< 0 1345075	--	--	< 0 000005	< 0.10177	4	mg/L	kg/d	< 0 000005	--	1
5P. δ-BHC (319-86-8)	X	X		< 0 00002	< 0 5380301	--	--	--	--	1	mg/L	kg/d	< 0.000005	--	1
6P Chlordane (57-74-9)	X	X		< 0 000208	< 5.5955128	--	--	< 0 0002035	< 4.142026	4	mg/L	kg/d	< 0 00022	--	1
7P. 4,4'-DDT (50-29-3)	X	X		< 0 000005	< 0 1345075	--	--	< 0 000005	< 0 10177	4	mg/L	kg/d	< 0 000005	--	1
8P 4,4'-DDE (72-55-9)	X	X		< 0.000005	< 0.1345075	--	--	< 0.000005	< 0.10177	4	mg/L	kg/d	< 0.000005	--	1
9P. 4,4'-DDD (72-54-8)	X	X		< 0 000005	< 0 1345075	--	--	< 0 000005	< 0 10177	4	mg/L	kg/d	< 0.000005	--	1
10P Dieldrin (60-57-1)	X	X		< 0 000005	< 0.1345075	--	--	< 0 000005	< 0.10177	4	mg/L	kg/d	< 0 000005	--	1
11P. α-Enosulfan (115-29-7)	X	X		< 0.000005	< 0 1345075	--	--	< 0 000005	< 0 10177	4	mg/L	kg/d	< 0.000005	--	1
12P. β-Endosulfan (115-29-7)	X	X		< 0 000005	< 0.1345075	--	--	< 0 000005	< 0.10177	4	mg/L	kg/d	< 0 000005	--	1
13P. Endosulfan Sulfate (1031-07-8)	X	X		< 0 000005	< 0 1345075	--	--	< 0.000005	< 0 10177	4	mg/L	kg/d	< 0.000005	--	1
14P. Endrin (72-20-8	X	X		< 0 000005	< 0.1345075	--	--	< 0 000005	< 0 10177	4	mg/L	kg/d	< 0 000005	--	1
15P. Endrin Aldehyde (7421-93-4)	X	X		< 0 000005	< 0.1345075	--	--	< 0 000005	< 0 10177	4	mg/L	kg/d	< 0 000005	--	1
16P. Heptachlor (76-44-8	X	X		< 0 000005	< 0.1345075	--	--	< 0.000005	< 0 10177	4	mg/L	kg/d	< 0 000005	--	1

EPA I D. NUMBER (copy from Item 1 of Form 1) 1891114 | OUTFALL NO. 001

CONTINUED FROM P. V-8

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)	X	X		< 0.000005	< 0 134508	--	--	< 0 000005	< 0.1017697	4	mg/L	kg/d	< 0 000005	--	1
18P PCB-1242 (53469-21-9)	X	X		< 0.0005	< 13 45075	--	--	< 0.000155	< 3.1548602	4	mg/L	kg/d	< 0.0002	--	1
19P PCB-1254 (11097-69-1)	X	X		< 0.0005	< 13.45075	--	--	< 0 000155	< 3 1548602	4	mg/L	kg/d	< 0.00002	--	1
20P PCB-1221 (11104-28-2)	X	X		< 0.0005	< 13.45075	--	--	< 0 000275	< 5 5973326	4	mg/L	kg/d	< 0 00003	--	1
21P. PCB-1232 (11131-16-5)	X	X		< 0.0005	< 13 45075	--	--	< 0 00014	< 2 8495512	4	mg/L	kg/d	< 0.0002	--	1
22P PCB-1248 (12672-29-6)	X	X		< 0 0005	< 13 45075	--	--	< 0.0001625	< 3 3075147	4	mg/L	kg/d	< 0 00002	--	1
23P PCB-1260 (11096-82-5)	X	X		< 0 0005	< 13.45075	--	--	< 0 0001525	< 3.1039754	4	mg/L	kg/d	< 0.00005	--	1
24P. PCB-1016 (12674-11-2)	X	X		< 0.0005	< 13.45075	--	--	< 0.0001475	< 3 0022057	4	mg/L	kg/d	< 0 00003	--	1
25P Toxaphene (8001-35-2)	X	X		< 0.000208	< 5.595513	--	--	< 0 0002035	< 4.1420261	4	mg/L	kg/d	< 0 00004	--	1

Additional Testing Results

OUTFALL NO 001

1. Pollutant and CAS NO. (*If available*)	2. MARK "X"			3. EFFLUENT						d. No OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Tl (dissolved)		X		0 000637	17 13626	--	--	0 000159	3 2363	4	mg/L	kg/d	< 0 0004	--	1
Sb (dissolved)		X		< 0 03	< 807 045	--	--	< 0 01505	< 306 3267	4	mg/L	kg/d	< 0 0002	--	1
Pb (dissolved)		X		< 0 0002	< 5 3803	--	--	< 0 000175	< 3.5619	4	mg/L	kg/d	< 0 0002	--	1
Ni (dissolved)		X		0 000436	11 729	--	--	0 000109	2 2186	4	mg/L	kg/d	0 0108	--	1
Hg (dissolved)		X		0 000000608	0,01636	--	--	0 000000152	0 0031	4	mg/L	kg/d	< 0 000000541	--	1
Cu (dissolved)		X		0,00139	37 393	--	--	0 000969	19 7230	4	mg/L	kg/d	0 00124	--	1
Cr (dissolved)		X		< 0 0003	< 8 070	--	--	--	--	1	mg/L	kg/d	< 0 0003	--	1
Cd (dissolved)		X		< 0,0002	< 5 3803	--	--	< 0,000175	< 3 5619	4	mg/L	kg/d	< 0 0002	--	1
As (dissolved)		X		< 0,01	< 269 015	--	--	< 0 0074575	< 151 7895	4	mg/L	kg/d	< 0 00083	--	1
Ag (dissolved)		X		0 000167	4 493	--	--	0 0000025	0 0509	4	mg/L	kg/d	< 0 00001	--	1
Zn (dissolved)		X		0 00238	64 03	--	--	0 000595	12 1106	4	mg/L	kg/d	0 0014	--	1
Total Hardness as $CaCO_3$		X		19 2	516508 88	--	--	17	346016 93	4	mg/L	kg/d	14 7	--	1
Chlorides		X		6 9	185620 38	--	--	--	--	1	mg/L	kg/d	6 4	--	1
Chromium +3 as Cr^{3+}		X		< 0,01	< 269 02	--	--	< 0 0085	< 173 0085	4	mg/L	kg/d	< 0 010	--	1
Chromium +6 as Cr^{6+}		X		< 0,005	< 134 51	--	--	< 0 0035	< 71 2388	4	mg/L	kg/d	< 0 003	--	1
Hydrogen Sulfide		X		< 1	< 26901 50	--	--	< 0 55	< 11194 6652	4	mg/L	kg/d	< 0 1	--	1
Calcium		X		1 85	49767 78	--	--	--	--	1	mg/L	kg/d	1 71	--	--
Nonylphenol		X		< 0 005	< 134 508	--	--	< 0 0038075	< 77 4976	4	mg/L	kg/d	< 0 00272	--	1
Tributyltin		X		< 0 00003	< 0,807	--	--	--	--	1	mg/L	kg/d	< 0 00003	--	1
Kepone		X		< 0,00213	< 57,300	--	--	< 0,001619	< 32 9530	4	mg/L	kg/d	< 0 00217	--	1
Methoxychlor		X		< 0,000005	< 0 135	--	--	< 0,000005	< 0 1018	4	mg/L	kg/d	< 0 000005	--	1
Mirex		X		< 0,000005	< 0 135	--	--	< 0 00000275	< 0 0560	4	mg/L	kg/d	< 0 000005	--	1
Chlorpyrifos		X		< 0 0002	< 5 380	--	--	< 0 0002	< 4,0708	4	mg/L	kg/d	< 0 0002	--	1
Demeton		X		< 0 001	< 26 902	--	--	< 0 00085	< 17 3008	4	mg/L	kg/d	< 0 0004	--	1
Diazinon		X		< 0 001	< 26 902	--	--	< 0 0008	< 16 2831	4	mg/L	kg/d	< 0,0002	--	1
Guthion		X		< 0 001	< 26 902	--	--	< 0 0008	< 16 2831	4	mg/L	kg/d	< 0 0002	--	1
Malathion		X		< 0,001	< 26 902	--	--	< 0 0008	< 16 2831	4	mg/L	kg/d	< 0 0002	--	1
Parathion		X		< 0 001	< 26 902	--	--	< 0 0008	< 16 2831	4	mg/L	kg/d	< 0 0002	--	1
Se (dissolved)		X		< 0 001	< 26 902	--	--	--	--	1	mg/L	kg/d	< 0 001	--	1
Ba (dissolved)		X		0 0178	478 847	--	--	--	--	1	mg/L	kg/d	0 0151	--	1
Mn (dissolved)		X		0 00194	52 189	--	--	--	--	1	mg/L	kg/d	0 0161	--	1
Fe (dissolved)		X		0,0371	998 046	--	--	--	--	1	mg/L	kg/d	0 0259	--	1
2,4-D		X		< 0,0002	< 5 380	--	--	--	--	1	mg/L	kg/d	< 0 0002	--	1
Silvex		X		< 0 0001	< 2 690	--	--	--	--	1	mg/L	kg/d	< 0 0001	--	1
Enterrococci		X		< 1	--	--	--	--	--	1	MPN	--	< 1	--	1
E coli		X		1	--	--	--	--	--	1	MPN	--	1	--	1
TKN		X		0 44	11836 66	--	--	0 30	< 6106,1810	6	mg/L	kg/d	< 0 2	--	1
Total Dissolved Solids		X		54	1452681 22	--	--	--	--	1	mg/L	kg/d	61	--	1
Radium 228		X		< 1 12	--	--	--	--	--	1	pCi/L	--	< 1 12	--	1
Total Uranium		X		< 0,262	--	--	--	--	--	1	ug/l	--	< 0 262	--	1
N-Nitrosodiethylamine		X		< 0 0026	< 30 04	--	--	--	--	1	mg/L	kg/d	< 0 00272	--	--
Total Nitrogen		X		0 6	16140 90	--	--	0 42	8548 7	6	mg/L	kg/d	0 13	--	1

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use me format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 009

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	1.5	21 6	--	--	--	--	1	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	14 6	210 4	--	--	--	--	1	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	4.3	61 97	--	--	--	--	1	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	3 0	43.2	--	--	0.67	4 6	12	mg/L	kg/d	--	--	--
e. Ammonia *(as N)*	< 0.10	< 1.4	--	--	--	--	1	mg/L	kg/d	--	--	--
f. Flow	VALUE 1 728		VALUE --		VALUE 0 828		72	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE 21.8		VALUE --		VALUE --		1	°C		VALUE --		--
h. Temperature (*summer*)	VALUE 23.9		VALUE --		VALUE --		1	°C		VALUE --		--
i pH	Maximum 8 9	Minimum 6.2	Maximum --	Minimum --	[redacted]		72	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)	X		0 021	0.30	--	--	--	--	1	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual	X		< 0.1	< 1 44	--	--	--	--	1	mg/L	kg/d	--	--	--
c Color	X		9.2	--	--	--	--	--	1	PCU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)	X		< 0.1	< 1 44	--	--	--	--	1	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*	X		< 0.1	< 1 44	--	--	--	--	1	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO. 009

1 Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4 UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic *(as N)*	X		< 0 3	< 4 3	--	--	--	--	1	mg/L	kg/d	--	--	--
h. Oil & Grease	X		5	72 1	--	--	0.42	2.9	12	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)	X		0 033	0.476	--	--	--	--	1	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha	X		< 0 914	--	--	--	--	--	1	pCi/L	--	--	--	--
(2) Beta	X		2.99	--	--	--	--	--	1	pCi/L	--	--	--	--
(3) Radium, Total	X		< 1.42	--	--	--	--	--	1	pCi/L	--	--	--	--
(4) Radium 226, Total	X		< 0 601	--	--	--	--	--	1	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)	X		7.9	113.85	--	--	--	--	1	mg/L	kg/d	--	--	--
l Sulfide *(as S)*	X		< 0 1	< 1 44	--	--	--	--	1	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants	X		< 0 1	< 1 44	--	--	--	--	1	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)	X		0 204	2 94	--	--	--	--	1	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)	X		0.0281	0.40	--	--	--	--	1	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)	X		0 0729	1 051	--	--	--	--	1	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)	X		< 0 001	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)	X		0 375	5 404	--	--	--	--	1	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)	X		3.31	47 702	--	--	--	--	1	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)	X		0 00838	0.121	--	--	--	--	1	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)	X		0 161	2 320	--	--	--	--	1	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)	X		< 0 007	< 0 101	--	--	--	--	1	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)	X		< 0 003	< 0 043	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAC

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1 Pollutant and CAS NO (*If available.*)	2. MARK 'X'			3 EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)	X	X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2	X	X		< 0 00083	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)	X	X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)	X	X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)	X	X		0 00118	0 0170	--	--	--	--	1	mg/L	kg/d	--	--	--
6M. Copper, Total (7440-50-8)	X	X		0 00131	0 0189	--	--	--	--	1	mg/L	kg/d	--	--	--
7M. Lead, Total (7439-92-1)	X	X		< 0 0002	< 0.0029	--	--	--	--	1	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)	X	X		0 000000664	0 000010	--	--	--	--	1	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)	X	X		0 000543	0 0078	--	--	--	--	1	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)	X	X		< 0 001	< 0 0144	--	--	--	--	1	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4	X	X		< 0 00001	< 0 0001	--	--	--	--	1	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)	X	X		< 0 0004	< 0.0058	--	--	--	--	1	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)	X	X		0 00158	0 0228	--	--	--	--	1	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)	X	X		< 0.01	< 0 1441	--	--	--	--	1	mg/L	kg/d	--	--	--
15M. Phenols, Total	X	X		< 0 03	< 0 4323	--	--	--	--	1	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS No Sample											

CONTINUED FROM PA[illegible]-3

OUTFALL NO 009

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU[illegible]						d No OF ANALYSES	4. UNITS *(specify if blank)*		5. INTA[illegible] *optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(If available)*			a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X	X		< 0.03	< 0.4323	--	--	--	--	1	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)	X	X		< 0.0085	< 0 1225	--	--	--	--	1	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required											
5V Bromoform (75-25-2)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)	X	X		< 0.0025	< 0 0360	--	--	--	--	1	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)	X	X		< 0 00175	< 0 0252	--	--	--	--	1	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)	X	X		< 0 0035	< 0 0504	--	--	--	--	1	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)	X	X		< 0 005	< 0 0721	--	--	--	--	1	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)	X	X		< 0.0025	< 0 0360	--	--	--	--	1	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)	X	X		< 0 002	< 0.0288	--	--	--	--	1	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required											
14V. 1,1-Dichloroethane (75-34-3)	X	X		< 0.003	< 0.0432	--	--	--	--	1	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)	X	X		< 0.0035	< 0.0504	--	--	--	--	1	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)	X	X		< 0.0035	< 0 0504	--	--	--	--	1	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)	X	X		< 0 005	< 0 0721	--	--	--	--	1	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)	X	X		< 0 004	< 0 0576	--	--	--	--	1	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)	X	X		< 0 00475	< 0 0685	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 4

OUTFALL NO 009

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT						d No. OF ANALYSES	4. UNITS (*specify if blank*)		5 INTAKE (optional)		
	a. Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)	X	X		< 0 005	< 0 0721	--	--	--	--	1	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)	X	X		< 0 0015	< 0 0216	--	--	--	--	1	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)	X	X		< 0 002	< 0.0288	--	--	--	--	1	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)	X	X		< 0 0025	< 0.0360	--	--	--	--	1	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)	X	X		< 0 003	< 0 0432	--	--	--	--	1	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)	X	X		< 0 003	< 0 0432	--	--	--	--	1	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)	X	X		< 0 0025	< 0 0360	--	--	--	--	1	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)	X	X		< 0 004	< 0 0576	--	--	--	--	1	mg/L	kg/d	--	--	--
31V. Vinyl Chloride (75-01-4)	X	X		< 0 0025	< 0 0360	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	X	X		< 0.0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)	X	X		< 0 0011	< 0.0159	--	--	--	--	1	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)	X	X		< 0 0011	< 0 0159	--	--	--	--	1	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)	X	X		< 0 00879	< 0.1267	--	--	--	--	1	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5	X	X		< 0 00879	< 0.1267	--	--	--	--	1	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE

OUTFALL NO. 009

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (opt		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG VALUE (if available)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
7B. 3,4-Benzofluoranthene (205-99-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)	X	X		< 0 0022	< 0.0317	--	--	--	--	1	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)	X	X		< 0.0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
18B. Chrysene (218-01-9)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
19B. Dibenzo (a,h) Anthracene (53-70-3)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
21B 1,3-Dichlorobenzene (541-73-1)	X	X		< 0 0015	< 0 0216	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 6

OUTFALL NO 009

1 Pollutant and CAS NO (*If available*)	2 MARK 'X'			3. EFFLUENT						d No OF ANALYSES	4. UNITS (*specify if blank*)		5 INTAKE (*opt.*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c LONG TERM AVG VALUE (*If available*)			a. CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B. 1,4-Dichlorobenzene (106-46-7)	X	X		< 0 002	< 0 0288	--	--	--	--	1	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131 - 11-3)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)	X	X		< 0 0044	< 0 0634	--	--	--	--	1	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
31B. Fluoranthene (206-44-0)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
33B. Hexachlorobenzene (118-74-1)	X	X		< 0 00549	< 0 0791	--	--	--	--	1	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-1)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)	X	X		< 0 0022	< 0 0317	--	--	--	--	1	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
40B. Nitrobenzene (98-95-3)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)	X	X		< [redacted]	< [redacted]	--	--	--	--	1	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)	X	X		< 0 0044	< 0 0634	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]-7

OUTFALL NO 009

1 Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAK[illegible] *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. NO OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)	X	X		< 0.00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0	X	X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)	X	X		< 0.0044	< 0 0634	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)		X		< 0.000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)		X		< 0 000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)		X		< 0.000022	< 0.00032	--	--	--	--	1	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)		X		< 0 000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)		X		< 0.000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)		X		< 0.000217	< 0 00313	--	--	--	--	1	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)		X		< 0 000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)		X		< 0.000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)		X		< 0 000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)		X		< 0.000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)		X		< 0 000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)		X		< 0.000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)		X		< 0 000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8		X		< 0 000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
15P. Endrin Aldehyde (7421-93-4)		X		< 0.000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8		X		< 0 000005	< 0 00007	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PA. V-8

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)		X		< 0.000005	< 0.00007	--	--	--	--	1	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)		X		< 0.000217	< 0.00313	--	--	--	--	1	mg/L	kg/d	--	--	--

Additional Testing Results

OUTFALL NO 009

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Tl (dissolved)		X		< 0 0004	< 0 0058	--	--	--	--	1	mg/L	kg/d	--	--	--
Se (dissolved)		X		< 0 001	< 0.0144	--	--	--	--	1	mg/L	kg/d	--	--	--
Sb (dissolved)		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Pb (dissolved)		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Ni (dissolved)		X		0 000552	0 0080	--	--	--	--	1	mg/L	kg/d	--	--	--
Hg (dissolved)		X		0 000000533	0 000008	--	--	--	--	1	mg/L	kg/d	--	--	--
Cu (dissolved)		X		0 00107	0 0154	--	--	--	--	1	mg/L	kg/d	--	--	--
Cr (dissolved)		X		< 0.0003	< 0 0043	--	--	--	--	1	mg/L	kg/d	--	--	--
Cd (dissolved)		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
As (dissolved)		X		< 0 00083	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
Ag (dissolved)		X		< 0 00001	< 0 0001	--	--	--	--	1	mg/L	kg/d	--	--	--
Zn (dissolved)		X		0 00385	0 0555	--	--	--	--	1	mg/L	kg/d	--	--	--
Ba (dissolved)		X		0 0269	0 3877	--	--	--	--	1	mg/L	kg/d	--	--	--
Mn (dissolved)		X		0 111	1 5997	--	--	--	--	1	mg/L	kg/d	--	--	--
Fe (dissolved)		X		0 218	3 1417	--	--	--	--	1	mg/L	kg/d	--	--	--
TKN		x		< 0 2	< 2 8823	--	--	--	--	1	mg/L	kg/d	--	--	--
Total Hardness as $CaCO_3$		X		27 5	396 3	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorides as Cl		X		20.1	289 7	--	--	--	--	1	mg/L	kg/d	--	--	--
E Coli		X		< 1	--	--	--	--	--	1	MPN/100 ml	--	--	--	--
Enterrococci		X		< 1	--	--	--	--	--	1	MPN/100 ml	--	--	--	--
Sulfide (dissolved)		X		< 0 1	< 1 4412	--	--	--	--	1	mg/L	kg/d	--	--	--
Hydrogen Sulfide		X		< 0.1	< 1 4412	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +3 as Cr^{3+}		X		< 0 01	< 0 1441	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +6 as Cr^{6+}		X		< 0 003	< 0 0432	--	--	--	--	1	mg/L	kg/d	--	--	--
Nonylphenol		X		< 0 00272	< 0 0392	--	--	--	--	1	mg/L	kg/d	--	--	--
Kepone		X		< 0 00879	< 0 1267	--	--	--	--	1	mg/L	kg/d	--	--	--
Methoxychlor		X		< 0 000005	< 0 0001	--	--	--	--	1	mg/L	kg/d	--	--	--
Mirex		X		< 0 000005	< 0 0001	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorpyrifos		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Demeton		X		< 0 0004	< 0 0058	--	--	--	--	1	mg/L	kg/d	--	--	--
Diazinon		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Guthion		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Malathion		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
Parathion		X		< 0 0002	< 0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
TDS		X		89	1282.6	--	--	--	--	1	mg/L	kg/d	--	--	--
Nitrate as N		X		< 0 1	< 1.4412	--	--	--	--	1	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 013

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE No Discharge 2015-2017		VALUE --		VALUE --		--	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*if available*)	2 MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (if available)		d No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 013

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

CONTINUED FROM PAGE V-3

OUTFALL NO 013

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLU						d No. OF ANALYSES	4. UNITS (specify if blank)		5 INT (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG. VALUE (if available)			a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V. Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO. 013

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c LONG TERM AVG. VALUE (*if available*) (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V. Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A. 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A. 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO. 013

1 Pollutant and CAS NO (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B. Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B. Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B. 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B. 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 013

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opt*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B. 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B. Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B. Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 013

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P V-8

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION - PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 016

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand (*BOD*)	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand (*COD*)	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon (*TOC*)	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids (*TSS*)	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia (*as N*)	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 5 24		VALUE --		VALUE 4 37		3	MGD	--	VALUE --		--
g. Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge Complete one table for each outfall. See the instructions for additional details and requirements

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (if available)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO. 016

1. Pollutant and CAS NO. (If available)	MARK 'X'		3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a. Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG VALUE (if available)		d No. OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (as N)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (as SO_4) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (as S)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M. Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M. Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

CONTINUED FROM PAGE V-3

OUTFALL NO 016

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT. (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V. Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*if*)		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V. 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V. 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V. 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 016

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B. Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B. Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B. Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B. Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B. Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 016

1 Pollutant and CAS NO (*If available*)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*op.*		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-7

OUTFALL NO. 016

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3 EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG VALUE (if available)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM I V-8

EPA I D. NUMBER (copy from Item 1 of Form 1) 1891114

OUTFALL NO 016

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I.D. NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 020

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	< 0.2	< 0.841	--	--	--	--	1	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	20 3	85.328	--	--	--	--	1	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	8 9	37 410	--	--	--	--	1	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	< 1	< 4.203	--	--	< 1	< 1.53	12	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	0 14	0 588	--	--	--	--	1	mg/L	kg/d	--	--	--
f. Flow	VALUE 0 5040		VALUE --		VALUE 0 1834		72	MGD	--	VALUE --		--
g. Temperature (*winter*)	VALUE 23.7		VALUE --		VALUE --		1	°C		VALUE --		--
h. Temperature (*summer*)	VALUE 27.9		VALUE --		VALUE --		1	°C		VALUE --		--
i pH	MINIMUM 7.0	MAXIMUM 8.6	MINIMUM --	MAXIMUM --	[redacted]		72	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if available)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)	X		0 063	0.265	--	--	--	--	1	mg/L	kg/d	--	--	--
b Chlorine, Total Residual	X		< 0.1	< 0 4203	--	--	< 0.1	< 0 15	72	mg/L	kg/d	--	--	--
c Color	X		5 5	--	--	--	--	--	1	PCU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)	X		0.219	0.921	--	--	--	--	1	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*	X		0 68	2 858	--	--	--	--	1	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 020

1 Pollutant and CAS NO. (If available)	2 MARK 'X' a. Believed Present	2 MARK 'X' b Believed Absent	3. EFFLUENT a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b MAXIMUM 30 DAY VALUE (if available) (2) MASS	c LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c LONG TERM AVG. VALUE (if available) (2) MASS	d No OF ANALYSES	4 UNITS (specify if blank) a. CONCENTRATION	4 UNITS (specify if blank) b MASS	5. INTAKE (optional) a LONG TERM AVG VALUE (1) CONCENTRATION	5. INTAKE (optional) a LONG TERM AVG VALUE (2) MASS	5. INTAKE (optional) b NO. OF ANALYSES
GC/MS FRACTION														
g. Nitrogen, Total Organic (as N)	X		< 0 3	< 1 261	--	--	--	--	1	mg/L	kg/d	--	--	--
h Oil & Grease	X		< 5 0	< 21.02	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)	X		< 0 02	< 0 084	--	--	--	--	1	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha	X		< 1 16	--	--	--	--	--	1	pCi/L	--	--	--	--
(2) Beta	X		8 44	--	--	--	--	--	1	pCi/L	--	--	--	--
(3) Radium, Total	X		< 1 30	--	--	--	--	--	1	pCi/L	--	--	--	--
(4) Radium 226, Total	X		< 0 553	--	--	--	--	--	1	pCi/L	--	--	--	--
k. Sulfate (as SO_4) (14808-79-8)	X		37 1	155 94	--	--	--	--	1	mg/L	kg/d	--	--	--
l. Sulfide (as S)	X		< 0 1	< 0.42	--	--	--	--	1	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants	X		< 0.1	< 0.420	--	--	--	--	1	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)	X		0 0252	0.106	--	--	--	--	1	mg/L	kg/d	--	--	--
p. Barium Total (7440-39-3)	X		0 0612	0.257	--	--	--	--	1	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)	X		0 0552	0.232	--	--	--	--	1	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)	X		< 0.001	< 0 004	--	--	--	--	1	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)	X		0 0154	0 065	--	--	--	--	1	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)	X		8 75	36 779	--	--	--	--	1	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)	X		0 0298	0 125	--	--	--	--	1	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)	X		0 00277	0 012	--	--	--	--	1	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)	X		< 0 007	< 0.029	--	--	--	--	1	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)	X		< 0 003	< 0.013	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PA

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*If available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)	X	X		< 0 0002	< 0 001	--	--	--	--	1	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2	X	X		0 00137	0 006	--	--	--	--	1	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)	X	X		< 0 0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)	X	X		< 0.0002	< 0 001	--	--	--	--	1	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)	X	X		< 0.0003	< 0 001	--	--	--	--	1	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)	X	X		0 0003	0 001	--	--	--	--	1	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)	X	X		< 0 0002	< 0 001	--	--	--	--	1	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)	X	X		0 000000545	0 00000229	--	--	--	--	1	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)	X	X		< 0 000939	< 0 004	--	--	--	--	1	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)	X	X		< 0 001	< 0 004	--	--	--	--	1	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4	X	X		< 0 00001	< 0.000	--	--	--	--	1	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)	X	X		< 0 0004	< 0.002	--	--	--	--	1	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)	X	X		0 00846	0 036	--	--	--	--	1	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)	X	X		< 0 01	< 0 042	--	--	--	--	1	mg/L	kg/d	--	--	--
15M Phenols, Total	X	X		< 0 003	< 0 013	--	--	--	--	1	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS		Waived									

1. Pollutant and CAS NO *(if available)*	2. MARK 'X'			3. EFFLU						d No. OF ANALYSES	4. UNITS *(specify if blank)*		5. INT[illegible] *optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*			a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)	X	X		< 0 03	< 0.126	--	--	--	--	1	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)	X	X		< 0.0085	< 0.036	--	--	--	--	1	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required											
5V Bromoform (75-25-2)	X	X		< 0.002	< 0.008	--	--	--	--	1	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)	X	X		< 0 0025	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)	X	X		< 0.00175	< 0 007	--	--	--	--	1	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)	X	X		< 0 0035	< 0 015	--	--	--	--	1	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)	X	X		< 0.005	< 0.021	--	--	--	--	1	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)	X	X		< 0 0025	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
12V. Dichlorobromomethane (75-27-4)	X	X		< 0.002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required											
14V 1,1-Dichloroethane (75-34-3)	X	X		< 0.003	< 0 013	--	--	--	--	1	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)	X	X		< 0 0035	< 0 015	--	--	--	--	1	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)	X	X		< 0.0035	< 0 015	--	--	--	--	1	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)	X	X		< 0.005	< 0.021	--	--	--	--	1	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)	X	X		< 0.002	< 0.008	--	--	--	--	1	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)	X	X		< 0.004	< 0 017	--	--	--	--	1	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)	X	X		< 0.00475	< 0 020	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 4

OUTFALL NO 020

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)	X	X		< 0 005	< 0 021	--	--	--	--	1	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)	X	X		< 0 0015	< 0 006	--	--	--	--	1	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)	X	X		< 0.0025	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)	X	X		< 0 003	< 0 013	--	--	--	--	1	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)	X	X		< 0 003	< 0 013	--	--	--	--	1	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)	X	X		< 0 0025	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
30V. Trichlorofluoromethane (75-69-4)	X	X		< 0 004	< 0 017	--	--	--	--	1	mg/L	kg/d			
31V Vinyl Chloride (75-01-4)	X	X		< 0 0025	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	X	X		< 0 00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
2A. 2,4-Dichlorophenol (120-83-2)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)	X	X		< 0 00699	< 0 029	--	--	--	--	1	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)	X	X		< 0 0860	< 0 361	--	--	--	--	1	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)	X	X		< 0 0860	< 0.361	--	--	--	--	1	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)	X	X		< 0 00323	< 0.014	--	--	--	--	1	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)	X	X		< 0 00215	< 0.009	--	--	--	--	1	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5	X	X		< 0 0108	< 0.045	--	--	--	--	1	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)	X	X		< 0 00269	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 020

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)	X	X		< 0 0043	< 0 018	--	--	--	--	1	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)	X	X		< 0 0043	< 0 018	--	--	--	--	1	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)	X	X		< 0.00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)	X	X		< 0 0538	< 0 226	--	--	--	--	1	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)	X	X		< 0.0086	< 0 036	--	--	--	--	1	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
7B. 3,4-Benzofluoranthene (205-99-2)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)	X	X		< 0.00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
10B. Bis (2-Chloroethoxy) Methane (111-91-1)	X	X		< 0.00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)	X	X		< 0 00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)	X	X		< 0.00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)	X	X		< 0 00484	< 0 020	--	--	--	--	1	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)	X	X		< 0.00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)	X	X		< 0 0015	< 0 006	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 020

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT						d No OF ANALYSES	4. UNITS (specify if blank)		5. INTAKE (opti		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)			a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	X	X		< 0 002	< 0 008	--	--	--	--	1	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)	X	X		< 0 0043	< 0 018	--	--	--	--	1	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)	X	X		< 0 00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)	X	X		< 0 00215	< 0 009	--	--	--	--	1	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)	X	X		< 0 00269	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)	X	X		< 0 0043	< 0.018	--	--	--	--	1	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)	X	X		< 0 00108	< 0.005	--	--	--	--	1	mg/L	kg/d	--	--	--
30B. 1,2-Diphenylhydrazine (as *Azobenzene*) (122-66-7)	X	X		< 0 0086	< 0 036	--	--	--	--	1	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)	X	X		< 0 0043	< 0 018	--	--	--	--	1	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)	X	X		< 0 00269	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
34B. Hexachlorobutadiene (87-68-3)	X	X		< 0 00484	< 0 020	--	--	--	--	1	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-1)	X	X		< 0 00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X	X		< 0 00108	< 0 005	--	--	--	--	1	mg/L	kg/d	--	--	--
38B. Isophorone (78-59-1)	X	X		< 0 00269	< 0 011	--	--	--	--	1	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)	X	X		< 0.00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)	X	X		< 0 00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)	X	X		< 0.00323	< 0 014	--	--	--	--	1	mg/L	kg/d	--	--	--
42B N-Nitrosodi-N-Propylamine (621-64-7)	X	X		< 0 00376	< 0 016	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]/-7

OUTFALL NO 020

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAK. (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)	X	X		< 0.0086	< 0 036	--	--	--	--	1	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)	X	X		< 0.0086	< 0.036	--	--	--	--	1	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0	X	X		< 0 0086	< 0 036	--	--	--	--	1	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)	X	X		< 0.0043	< 0.018	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)		X		< 0.000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)		X		< 0 000005	< 0.000021	--	--	--	--	1	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)		X		< 0 000022	< 0 000092	--	--	--	--	1	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)		X		< 0 000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)		X		< 0.000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)		X		< 0 000217	< 0 000912	--	--	--	--	1	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)		X		< 0 000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)		X		< 0 000005	< 0.000021	--	--	--	--	1	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)		X		< 0.000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)		X		< 0 000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)		X		< 0.000005	< 0.000021	--	--	--	--	1	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)		X		< 0 000005	< 0.000021	--	--	--	--	1	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)		X		< 0.000005	< 0.000021	--	--	--	--	1	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8		X		< 0.000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
15P Endrin Aldehyde (7421-93-4)		X		< 0 000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8		X		< 0.000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM P.. .-8

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)	X	X		< 0 000005	< 0 000021	--	--	--	--	1	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)	X	X		< 0 000217	< 0.00091	--	--	--	--	1	mg/L	kg/d	--	--	--

OUTFALL NO 020

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*If available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Tl (dissolved)		X		< 0.0004	< 0.0017	--	--	--	--	1	mg/L	kg/d	--	--	--
Se (dissolved)		X		< 0.001	< 0.0042	--	--	--	--	1	mg/L	kg/d	--	--	--
Sb (dissolved)		X		< 0.0002	< 0.0008	--	--	--	--	1	mg/L	kg/d	--	--	--
Pb (dissolved)		X		< 0.0002	< 0.0008	--	--	--	--	1	mg/L	kg/d	--	--	--
Ni (dissolved)		X		0.000395	0.0017	--	--	--	--	1	mg/L	kg/d	--	--	--
Hg (dissolved)		X		< 0.0000005	< 0.000002	--	--	--	--	1	mg/L	kg/d	--	--	--
Cu (dissolved)		X		0.00246	0.0103	--	--	--	--	1	mg/L	kg/d	--	--	--
Cr (dissolved)		X		< 0.0003	< 0.0013	--	--	--	--	1	mg/L	kg/d	--	--	--
Cd (dissolved)		X		< 0.0002	< 0.0008	--	--	--	--	1	mg/L	kg/d	--	--	--
As (dissolved)		X		0.00129	0.0054	--	--	--	--	1	mg/L	kg/d	--	--	--
Ag (dissolved)		X		< 0.00001	< 0.00004	--	--	--	--	1	mg/L	kg/d	--	--	--
Zn (dissolved)		X		0.00132	0.0055	--	--	--	--	1	mg/L	kg/d	--	--	--
Total Hardness as $CaCO_3$		X		51.6	216.893	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorides as Cl		X		20.6	86.589	--	--	--	--	1	mg/L	kg/d	--	--	--
Nitrate as N		X		0.48	2.018	--	--	--	--	1	mg/L	kg/d	--	--	--
TKN		X		0.62	2.606	--	--	--	--	1	mg/L	kg/d	--	--	--
Sulfide (dissolved)		X		< 0.1	< 0.420	--	--	--	--	1	mg/L	kg/d	--	--	--
Hydrogen Sulfide		X		< 0.1	< 0.420	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +3 as Cr^{3+}		X		< 0.010	< 0.04203	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +6 as Cr^{6+}		X		< 0.030	< 0.12610	--	--	--	--	1	mg/L	kg/d	--	--	--
Nonylphenol		X		< 0.00272	< 0.011	--	--	--	--	1	mg/L	kg/d	--	--	--
Kepone		X		< 0.00215	< 0.009	--	--	--	--	1	mg/L	kg/d	--	--	--
Methoxychlor		X		< 0.000005	< 0.00002	--	--	--	--	1	mg/L	kg/d	--	--	--
Silvex		X		< 0.0001	< 0.00042	--	--	--	--	1	mg/L	kg/d	--	--	--
Mirex		X		< 0.000005	< 0.00002	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorpyrifos		X		< 0.0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
Demeton		X		< 0.0004	< 0.002	--	--	--	--	1	mg/L	kg/d	--	--	--
Diazinon		X		< 0.0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
Guthion		X		< 0.0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
Malathion		X		< 0.0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
Parathion		X		< 0.0002	< 0.001	--	--	--	--	1	mg/L	kg/d	--	--	--
Ba (dissolved)		X		0.0584	0.245	--	--	--	--	1	mg/L	kg/d	--	--	--
Mn (dissolved)		X		0.000583	0.002	--	--	--	--	1	mg/L	kg/d	--	--	--
Fe (dissolved)		X		< 0.01	< 0.042	--	--	--	--	1	mg/L	kg/d	--	--	--
E. Coli		X		1	--	--	--	--	--	1	MNP/100 ml	--	--	--	--
Enterrococci		X		1	--	--	--	--	--	1	MNP/100 ml	--	--	--	--
TDS		X		213	895.316	--	--	--	--	1	mg/L	kg/d	--	--	--
N-Nitroso diethylamine		X		< 0.00549	< 0.023	--	--	--	--	1	mg/L	kg/d	--	--	--
2,4-D		X		< 0.002	< 0.008	--	--	--	--	1	mg/L	kg/d	--	--	--
Radium 228		X		< 0.748	--	--	--	--	--	1	pCi/L	--	--	--	--
Total Uranium		X		< 0.26	--	--	--	--	--	1	ug/l	--	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS.

EPA I D. NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 021

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details

1 Pollutant	2. EFFLUENT						d No OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE No Discharge 2015-2017		VALUE --		VALUE --		--	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge Complete one table for each outfall. See the instructions for additional details and requirements.

1 Pollutant and CAS NO. *(If available)*	2.MARK 'X'		3. EFFLUENT						d No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (if available)			a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 021

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO 021

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5 INT. (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V. 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 021

1 Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG VALUE *(if available)* (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]V-5

OUTFALL NO 021

1. Pollutant and CAS NO (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B. Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B. Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B. Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B. Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B. 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B. 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA 6

OUTFALL NO 021

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3 EFFLUENT							4 UNITS (specify if blank)		5 INTAKE (opt		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B. 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (as Azobenzene) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (1,2,3-cd) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B. N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 021

1 Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAK *tional)*		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (u same format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 028

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (if available) (2) MASS	d No OF ANALYSES	3. UNITS (specify if blank) a. CONCENTRATION	b. MASS	4. INTAKE (optional) a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b. NO OF ANALYSES
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0 384		VALUE --		VALUE --		1	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements

1. Pollutant and CAS NO. *(if available)*	2.MARK 'X' b Believed Present	c. Believed Absent	3. EFFLUENT a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (if available) (2) MASS	d No OF ANALYSES	4. UNITS (specify if blank) a CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b. NO OF ANALYSES
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO. 028

1. Pollutant and CAS NO (If available)	MARK 'X'		3 EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (optional)		
	a. Believed Present	b. Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (as N)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (as SO_4) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide (as S)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU							4. UNITS *(specify if blank)*		5 INT. *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V. Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V. 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A. 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A. 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A. P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A. Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 028

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B. 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 028

1 Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B. Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B. Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 028

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b MAXIMUM 30 DAY VALUE (if available) (2) MASS	c LONG TERM AVG VALUE (if available) (1) CONCENTRATION	c LONG TERM AVG VALUE (if available) (2) MASS	d No. OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO OF ANALYSES
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

[redacted]

OUTFALL NO 101

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1 Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 2367.90		VALUE --		VALUE 1850.56		1096	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE 32		VALUE --		VALUE 23 7		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE 40 7		VALUE --		VALUE 34 8		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge Complete one table for each outfall. See the instructions for additional details and requirements.

1 Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if availale)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO. 101

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'		3 EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a. Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p. Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q. Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO. 101

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT. (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible] 4

OUTFALL NO 101

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE ([illegible])		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(If available)*		c. LONG TERM AVG. VALUE *(If available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]-5

OUTFALL NO 101

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B. Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B. Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B. Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 101

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5 INTAKE (opt		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B. Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAK *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d. No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I.D. NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 103

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT						d. No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	9 0	21 62	--	--	6.0	14 41	3	mg/L	kg/d	--	--	--
e. Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Flow	VALUE 0 288		VALUE --		VALUE 0 288		3	MGD	--	VALUE --		--
g. Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i. pH	MINIMUM 6 8	MAXIMUM 7 3	MINIMUM --	MAXIMUM --	[redacted]		3	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO 103

1. Pollutant and CAS NO (*If available*)	MARK 'X'		3 EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	4.0	9 61	--	--	1.3	3.19	3	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barrum Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*If available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT (*optional*)		
	a Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 103

1 Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE (		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V. Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A. 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A. Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 103

1 Pollutant and CAS NO (If available)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B. Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 103

1 Pollutant and CAS NO (*if available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B. Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO (*if available*)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P V-8

EPA I D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NO 103
1891114	

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS.

EPA I D. NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 104

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	7.6	18 3	--	--	--	--	1	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	14 6	35.1	--	--	--	--	1	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	5 7	13 69	--	--	--	--	1	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	3.0	7 21	--	--	1.7	4 0	3	mg/L	kg/d	--	--	--
e. Ammonia *(as N)*	21 40	51.4	--	--	--	--	1	mg/L	kg/d	--	--	--
f Flow	VALUE 0 288		VALUE --		VALUE 0.288		3	MGD	--	VALUE --		-- --
g. Temperature (*winter*)	VALUE 40.8		VALUE --		VALUE --		1	°C		VALUE --		-- --
h Temperature (*summer*)	VALUE 41.9		VALUE --		VALUE --		1	°C		VALUE --		-- --
i pH	Maximum 7 5	Minimum 6 5	Maximum --	Minimum --	[redacted]		3	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if availale)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)	X		1 42	10.86	--	--	--	--	1	mg/L	kg/d	--	--	--
b Chlorine, Total Residual	X		< 0.1	< 0 76	--	--	--	--	1	mg/L	kg/d	--	--	--
c Color	X		4.7	--	--	--	--	--	1	PCU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)	X		< 0.1	< 0.76	--	--	--	--	1	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*	X		3 1	23 7	--	--	--	--	1	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 104

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic *(as N)*	X		< 3 0	< 7 2	–	–	–	–	1	mg/L	kg/d	–	–	–
h Oil & Grease	X		5.0	12 0	–	–	1.67	4 01	3	mg/L	kg/d	–	–	–
i Phosphorus (as P), Total (7723-14-0)	X		1 58	3 795	–	–	–	–	1	mg/L	kg/d	–	–	–
j. Radioactivity														
(1) Alpha	X		< 1 12	–	–	–	–	–	1	pCi/L	–	–	–	–
(2) Beta	X		5 99	–	–	–	–	–	1	pCi/L	–	–	–	–
(3) Radium, Total	X		< 1 24	–	–	–	–	–	1	pCi/L	–	–	–	–
(4) Radium 226, Total	X		0.510	–	–	–	–	–	1	pCi/L	–	–	–	–
k Sulfate *(as SO_4)* (14808-79-8)	X		6 3	15 13	–	–	–	–	1	mg/L	kg/d	–	–	–
l Sulfide *(as S)*	X		< 0 1	< 0 24	–	–	–	–	1	mg/L	kg/d	–	–	–
m Sulfite (as SO_3) (14265-45-3)		X		–	–	–	–	–	–	mg/L	kg/d	–	–	–
n Surfactants	X		< 0 1	< 0 24	–	–	–	–	1	mg/L	kg/d	–	–	–
o Aluminum, Total (7429-90-5)	X		0 0452	0 11	–	–	–	–	1	mg/L	kg/d	–	–	–
p. Barium Total (7440-39-3)	X		0 0164	0 04	–	–	–	–	1	mg/L	kg/d	–	–	–
q Boron, Total (7440-42-8)	X		< 0 05	< 0 120	–	–	–	–	1	mg/L	kg/d	–	–	–
r. Cobalt, Total (7440-48-4)	X		< 0.001	< 0.002	–	–	–	–	1	mg/L	kg/d	–	–	–
s. Iron, Total (7439-89-6)	X		0 0925	0.222	–	–	–	–	1	mg/L	kg/d	–	–	–
t Magnesium, Total (7439-95-4)	X		2.32	5.572	–	–	–	–	1	mg/L	kg/d	–	–	–
u Molybdenum, Total (7439-98-7)	X		0 0472	0 113	–	–	–	–	1	mg/L	kg/d	–	–	–
v. Manganese, Total (7439-96-5)	X		0.0174	0.042	–	–	–	–	1	mg/L	kg/d	–	–	–
w Tin, Total (7440-31-5)	X		< 0 007	< 0 017	–	–	–	–	1	mg/L	kg/d	–	–	–
x. Titanium, Total (7440-32-6)	X		< 0 003	< 0 007	–	–	–	–	1	mg/L	kg/d	–	–	–

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG VALUE (*If available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)	X	X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2	X	X		< 0 00083	< 0 0020	--	--	--	--	1	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)	X	X		< 0.0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)	X	X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)	X	X		0 00058	0 0014	--	--	--	--	1	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)	X	X		0 0133	0.0319	--	--	--	--	1	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)	X	X		0.000273	0 0007	--	--	--	--	1	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)	X	X		0 000000591	0.00000142	--	--	--	--	1	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)	X	X		0 00122	0 0029	--	--	--	--	1	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)	X	X		< 0 001	< 0 0024	--	--	--	--	1	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4	X	X		< 0 00001	< 0 0000	--	--	--	--	1	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)	X	X		0 000672	0 0016	--	--	--	--	1	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)	X	X		0.00174	0.0042	--	--	--	--	1	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)	X	X		< 0 01	< 0 0240	--	--	--	--	1	mg/L	kg/d	--	--	--
15M Phenols, Total	X	X		< 0 03	< 0.0721	--	--	--	--	1	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS No Sample											

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)	X	X		< 0.03	< 0 0721	--	--	--	--	1	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)	X	X		< 0 0085	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required											
5V Bromoform (75-25-2)	X	X		< 0 002	< 0.0048	--	--	--	--	1	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)	X	X		< 0.0025	< 0.0060	--	--	--	--	1	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)	X	X		< 0.002	< 0.0048	--	--	--	--	1	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)	X	X		< 0 00175	< 0 0042	--	--	--	--	1	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)	X	X		< 0 0035	< 0 0084	--	--	--	--	1	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)	X	X		< 0.005	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)	X	X		< 0.0025	< 0 0060	--	--	--	--	1	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)	X	X		< 0.002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required											
14V. 1,1-Dichloroethane (75-34-3)	X	X		< 0 003	< 0 0072	--	--	--	--	1	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)	X	X		< 0.0035	< 0.0084	--	--	--	--	1	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)	X	X		< 0 0035	< 0 0084	--	--	--	--	1	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)	X	X		< 0.005	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)	X	X		< 0 004	< 0 0096	--	--	--	--	1	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)	X	X		< 0 00475	< 0 0114	--	--	--	--	1	mg/L	kg/d	--	--	--

OUTFALL NO 104

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (optional)		
	a Testing Required	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)	X	X		< 0 005	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)	X	X		< 0 0015	< 0 0036	--	--	--	--	1	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)	X	X		< 0.0025	< 0 0060	--	--	--	--	1	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)	X	X		< 0 003	< 0 0072	--	--	--	--	1	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)	X	X		< 0 003	< 0 0072	--	--	--	--	1	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)	X	X		< 0 0025	< 0 0060	--	--	--	--	1	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)	X	X		< 0 004	< 0.0096	--	--	--	--	1	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)	X	X		< 0 0025	< 0 0060	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)	X	X		< 0 00691	< 0 0166	--	--	--	--	1	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)	X	X		< 0 00851	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)	X	X		< 0 00851	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)	X	X		< 0 00213	< 0 0051	--	--	--	--	1	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5	X	X		< 0 0106	< 0 0255	--	--	--	--	1	mg/L	kg/d	--	--	--
10A. Phenol (108-95-2)	X	X		< 0 00266	< 0 0064	--	--	--	--	1	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 5

OUTFALL NO 104

1. Pollutant and CAS NO (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
3B. Anthracene (120-12-7)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)	X	X		< 0 0532	< 0 1278	--	--	--	--	1	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)	X	X		< 0 00851	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)	X	X		< 0.00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)	X	X		< 0 00479	< 0 0115	--	--	--	--	1	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
21B 1,3-Dichlorobenzene (541-73-1)	X	X		< 0 0015	< 0.0036	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 5

OUTFALL NO 104

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)	X	X		< 0 002	< 0 0048	--	--	--	--	1	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131 - 11-3)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)	X	X		< 0 00213	< 0 0051	--	--	--	--	1	mg/L	kg/d	--	--	--
27B. 2,4-Dinitrotoluene (121-14-2)	X	X		< 0.00266	< 0 0064	--	--	--	--	1	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	X	X		< 0 00851	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
31B. Fluoranthene (206-44-0)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)	X	X		< 0 00266	< 0 0064	--	--	--	--	1	mg/L	kg/d	--	--	--
34B. Hexachlorobutadiene (87-68-3)	X	X		< 0 00479	< 0 0115	--	--	--	--	1	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-	X	X		< 0 00106	< 0.0025	--	--	--	--	1	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-1)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)	X	X		< 0 00106	< 0 0025	--	--	--	--	1	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)	X	X		< 0 00266	< 0.0064	--	--	--	--	1	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)	X	X		< 0 00372	< 0.0089	--	--	--	--	1	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)	X	X		< 0 00319	< 0 0077	--	--	--	--	1	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)	X	X		< 0 00372	< 0 0089	--	--	--	--	1	mg/L	kg/d	--	--	--

OUTFALL NO 104

1. Pollutant and CAS NO. (*if available*)	2. MARK 'X'			3. EFFLUENT						4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)	X	X		< 0 00851	< 0.0204	--	--	--	--	1	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)	X	X		< 0 00851	< 0.0204	--	--	--	--	1	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0	X	X		< 0 00851	< 0 0204	--	--	--	--	1	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)	X	X		< 0 00426	< 0 0102	--	--	--	--	1	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)		X		< 0.000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)		X		< 0 000021	< 0.00005	--	--	--	--	1	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)		X		< 0 000206	< 0.00049	--	--	--	--	1	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)		X		< 0 000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)		X		< 0.000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)		X		< 0.000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)		X		< 0.000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)		X		< 0.000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8		X		< 0.000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
15P. Endrin Aldehyde (7421-93-4)		X		< 0 000005	< 0 00001	--	--	--	--	1	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8		X		< 0 000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--

CONTINUED FROM PA -8

EPA I.D. NUMBER (copy from Item 1 of Form 1) 1 91114

OUTFALL NO. 104

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)	X	X		< 0.000005	< 0.00001	--	--	--	--	1	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)	X	X		< 0.000206	< 0.00049	--	--	--	--	1	mg/L	kg/d	--	--	--

Additional Testing Results

OUTFALL NO 104

1 Pollutant and CAS NO (*If available*)	2 MARK 'X'			3 EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
Tl (dissolved)		X		0 000673	0 0016	--	--	--	--	1	mg/L	kg/d	--	--	--
Se (dissolved)		X		< 0 001	< 0 0024	--	--	--	--	1	mg/L	kg/d	--	--	--
Sb (dissolved)		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Pb (dissolved)		X		0 000206	0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Ni (dissolved)		X		0 00249	0 0060	--	--	--	--	1	mg/L	kg/d	--	--	--
Hg (dissolved)		X		0 000000799	0 0000019	--	--	--	--	1	mg/L	kg/d	--	--	--
Cu (dissolved)		X		0 0082	0 0197	--	--	--	--	1	mg/L	kg/d	--	--	--
Cr (dissolved)		X		0 000508	0 0012	--	--	--	--	1	mg/L	kg/d	--	--	--
Cd (dissolved)		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
As (dissolved)		X		< 0 00083	< 0 0020	--	--	--	--	1	mg/L	kg/d	--	--	--
Ag (dissolved)		X		< 0 00001	< 0 0000	--	--	--	--	1	mg/L	kg/d	--	--	--
Zn (dissolved)		X		0 00891	0 0214	--	--	--	--	1	mg/L	kg/d	--	--	--
Ba (dissolved)		X		0 0119	0 0286	--	--	--	--	1	mg/L	kg/d	--	--	--
Mn (dissolved)		X		0 00809	0 0194	--	--	--	--	1	mg/L	kg/d	--	--	--
Fe (dissolved)		X		0 0437	0 1050	--	--	--	--	1	mg/L	kg/d	--	--	--
TKN		x		24.4	58 6068	--	--	--	--	1	mg/L	kg/d	--	--	--
Total Hardness as $CaCO_3$		X		16 1	--	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorides as Cl		X		9 4	22 6	--	--	--	--	1	mg/L	kg/d	--	--	--
E Coli		X		< 1	--	--	--	--	--	1	MPN/100 ml	--	--	--	--
Enterrococci		X		2	--	--	--	--	--	1	MPN/100 ml	--	--	--	--
Sulfide (dissolved)		X		< 0 1	< 0 2402	--	--	--	--	1	mg/L	kg/d	--	--	--
Hydrogen Sulfide		X		< 0 1	< 0 2402	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +3 as Cr^{3+}		X		< 0 01	< 0 0240	--	--	--	--	1	mg/L	kg/d	--	--	--
Chromium +6 as Cr^{6+}		X		< 0 005	< 0 0120	--	--	--	--	1	mg/L	kg/d	--	--	--
Nonylphenol		X		< 0 00263	< 0,0063	--	--	--	--	1	mg/L	kg/d	--	--	--
Kepone		X		< 0 00213	< 0 0051	--	--	--	--	1	mg/L	kg/d	--	--	--
Methoxychlor		X		< 0 000005	< 0 0000	--	--	--	--	1	mg/L	kg/d	--	--	--
Mirex		X		< 0 000005	< 0,0000	--	--	--	--	1	mg/L	kg/d	--	--	--
Chlorpyrifos		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Demeton		X		< 0 0004	< 0 0010	--	--	--	--	1	mg/L	kg/d	--	--	--
Diazinon		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Guthion		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Malathion		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Parathion		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
n-Nitrosodiethylamine		X		< 0 00266	< 0 0064	--	--	--	--	1	mg/L	kg/d	--	--	--
TDS		X		105	252.2	--	--	--	--	1	mg/L	kg/d	--	--	--
Nitrate as N		X		0.66	1 5853	--	--	--	--	1	mg/L	kg/d	--	--	--
2,4-D		X		< 0 0002	< 0 0005	--	--	--	--	1	mg/L	kg/d	--	--	--
Silvex		X		< 0 0001	< 0 0002	--	--	--	--	1	mg/L	kg/d	--	--	--
Radium 228		X		< 0.770	--	--	--	--	--	1	pCi/L	--	--	--	--
Total Uranium		X		0 342	--	--	--	--	--	1	ug/l	--	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1) 110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 105

PART A --You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1 Pollutant	2. EFFLUENT						d No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0.0288		VALUE --		VALUE 0 0281		30	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i. pH	MINIMUM 6 2	MAXIMUM 8 1	MINIMUM --	MAXIMUM --	[redacted]		30	STANDARD UNITS		[redacted]		

PART B -- Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1 Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT						d. No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if availale)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUF

OUTFALL NO 105

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'		3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a. Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barrum Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q. Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you knew or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS		5 INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)		X		< 0.025	< 0 006	--	--	< 0 025	< 0 006	12	mg/L	kg/d	--	--	--
6M. Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)		X		< 1 0	< 0 240	--	--	< 1.0	< 0 234	12	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO 105

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLU							4. UNITS (specify if blank)		5. INT (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvmyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA 4

OUTFALL NO 105

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE ( )		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V. 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V. Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V. Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA 5

OUTFALL NO 105

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (o		
	a Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B. Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]6

OUTFALL NO 105

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*op*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B. 1,4-Drchlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B. 2,4-Dnitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B. 2,6-Dnitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B. Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B. Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAK (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)	—	—	X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-8

EPA I.D NUMBER (copy from Item 1 of Form 1) 891114

OUTFALL NO. 105

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d. No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I.D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 107

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details.

1. Pollutant	2. EFFLUENT						d No OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE No Discharge 2015-2017		VALUE --		VALUE --		--	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT						d No OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*If available*)		c LONG TERM AVG VALUE (If available)			a. CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 107

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(If available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(If available)* (2) MASS	c. LONG TERM AVG. VALUE *(If available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(If available)* (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M. Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M. Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

CONTINUED FROM PAGE V-3

OUTFALL NO 107

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLU							4. UNITS *(specify if blank)*		5. INT. *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(If available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolem (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachlorde (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V. 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 107

1 Pollutant and CAS NO (*If available*)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 107

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*op*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B. 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B. 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 107

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opt.*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzadine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinatrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*or Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2 MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b NO. OF ANALYSES
GC/MS FRACTION - PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (us ame format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO. 108

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	19 0	23 77	--	--	12 0	15 01	3	mg/L	kg/d	--	--	--
e. Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Flow	VALUE 0 15		VALUE --		VALUE 0.15		3	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i. pH	MINIMUM 7.2	MAXIMUM 7.4	MINIMUM --	MAXIMUM --	[redacted]		3	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge Complete one table for each outfall. See the instructions for additional details and requirements.

1 Pollutant and CAS NO. *(If available)*	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 108

1. Pollutant and CAS NO (*If available*)	MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a. Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	< 5.0	< 6.26	--	--	< 5 0	< 6 255	3	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO 108

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU							4 UNITS *(specify if blank)*		5. INT. *optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 108

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE (optional)		
	a Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c LONG TERM AVG. VALUE *(if available)* (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE (1) CONCENTRATION	a LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A. 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A. 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A. Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 108

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*op*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B. Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B. 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B. Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B. 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B. 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B. 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B. Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B. Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 108

1 Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (opt		
	a Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B. Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B. Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B. Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

EPA I.D. NUMBER (copy from Item 1 of Form 1) 891114

OUTFALL NO 108

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (If available)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS.

EPA I.D NUMBER (copy from Item 1 of Form 1)
110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 109

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT						d. No OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	< 1.0	< 1 14	--	--	< 1 0	< 1.16	2	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0.1368		VALUE --		VALUE 0 1386		2	MGD	--	VALUE --		--
g. Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM 6.5	MAXIMUM 7 8	MINIMUM --	MAXIMUM --	[redacted]		2	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT						d. No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if availale)			a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO. 109

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	< 5.0	< 5 70	--	--	< 5 0	< 5,780	2	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M. Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M. Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M. Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1. Pollutant and CAS NO. (*if available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT. (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(If available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(If available)* (2) MASS	c. LONG TERM AVG. VALUE *(If available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(If available)* (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V. 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V. Trichlorofluoromethene (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 109

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B. Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 109

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (*opt*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B. Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B. Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B. Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi-N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

EPA I.D NUMBER (copy from Item 1 of Form 1) 891114

OUTFALL NO. 109

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages SEE INSTRUCTIONS.

EPA I D. NUMBER (copy from Item 1 of Form 1): 110001891114

V. INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 110

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details

1. Pollutant	2. EFFLUENT						d No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	2 0	2 28	--	--	1 0	1.16	2	mg/L	kg/d	--	--	--
e. Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Flow	VALUE 0.1368		VALUE --		VALUE 0.1386		2	MGD	--	VALUE --		--
g. Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM 7.1	MAXIMUM 7.5	MINIMUM --	MAXIMUM --	[redacted]		2	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT						d No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)			a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO 110

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4 UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a. Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d. No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	< 5.0	< 5 70	--	--	< 5 0	< 5 780	2	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you knew or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M. Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M. Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M. Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxm (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO. 110

1. Pollutant and CAS NO. (*if available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5. INT. (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V. 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 110

1. Pollutant and CAS NO. *(If available)*	2 MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. NO OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE (1) CONCENTRATION	a. LONG TERM AVG VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V. Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A. Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO. 110

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (optional)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B. Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B. Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B. Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B. Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 110

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 110

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (If available)		c LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

EPA I D. NUMBER (copy from Item 1 of Form 1) 1 [illegible]891114

OUTFALL NO 110

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3 EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

[redacted]

OUTFALL NO 112

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b. NO OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	< 1 0	< 2 16	--	--	< 1.0	< 1 56	3	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0 2592		VALUE --		VALUE 0 1872		3	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM 6 5	MAXIMUM 7.5	MINIMUM --	MAXIMUM --	[redacted]		3	STANDARD UNITS		[redacted]		

PART B – Mark "X" In column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)		d No. OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO 112

1. Pollutant and CAS NO (*If available*)	MARK 'X'		3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	13 0	28 10	--	--	4 3	6 713	3	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M. Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M. Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO. 112

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU							4 UNITS *(specify if blank)*		5. INT* *optional)*		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V. 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 112

1. Pollutant and CAS NO. *(if available)*	2 MARK 'X'			3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V. 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 112

1 Pollutant and CAS NO (If available)	2 MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*opt*		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)			c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2)	MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS																
1B Acenaphthene (83-32-9)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
12B. Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--		--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 112

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opti*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzadine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B. Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-7

OUTFALL NO 112

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5 INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3 EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (if available) (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO. OF ANALYSES
GC/MS FRACTION - PESTICIDES (continued)															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages.
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 113

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG VALUE (*if available*) (2) MASS	d No. OF ANALYSES	3. UNITS (*specify if blank*) a CONCENTRATION	3. UNITS b MASS	4. INTAKE (*optional*) a. LONG TERM AVG VALUE (1) CONCENTRATION	4. INTAKE a. LONG TERM AVG VALUE (2) MASS	4. INTAKE b. NO OF ANALYSES
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	< 1.0	< 2.16	--	--	< 1.0	< 1 56	3	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0 2592		VALUE --		VALUE 0 1872		3	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i. pH	MINIMUM 6 5	MAXIMUM 7.5	MINIMUM --	MAXIMUM --	[redacted]		3	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X' b. Believed Present	2.MARK 'X' c Believed Absent	3. EFFLUENT a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c LONG TERM AVG VALUE (if available) (1) CONCENTRATION	c LONG TERM AVG VALUE (if available) (2) MASS	d No OF ANALYSES	4. UNITS (*specify if blank*) a. CONCENTRATION	4. UNITS b. MASS	5. INTAKE (*optional*) a. LONG TERM AVG. VALUE (1) CONCENTRATION	5. INTAKE a. LONG TERM AVG. VALUE (2) MASS	5. INTAKE b. NO. OF ANALYSES
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO. 113

1. Pollutant and CAS NO (*If available*)	MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	13.0	28 10	--	--	4 3	6 713	3	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p. Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q. Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M. Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M. Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU.							4. UNITS *(specify if blank)*		5. INTA *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*If available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*If available*) (2) MASS	c LONG TERM AVG. VALUE (*If available*) (1) CONCENTRATION	c LONG TERM AVG. VALUE (*If available*) (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE (1) CONCENTRATION	a LONG TERM AVG. VALUE (2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V. Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 113

1. Pollutant and CAS NO (If available)	2 MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (*opt.*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B. Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B. Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B. 4-Bromophenyl Phenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B. 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE 6

OUTFALL NO 113

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (optional)		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (as *Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B. Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 113

1 Pollutant and CAS NO. (If available)	2 MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c. LONG TERM AVG VALUE (if available) (1) CONCENTRATION	c. LONG TERM AVG VALUE (if available) (2) MASS	d No OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO OF ANALYSES
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P. 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P. β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA- -8

EPA I D NUMBER (copy from Item 1 of Form 1) 1 :91114 | OUTFALL NO 113

1. Pollutant and CAS NO. *(If available)*	2 MARK 'X'			3 EFFLUENT							4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

[redacted]

OUTFALL NO 114

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	< 1.0	< 0.0428	--	--	< 1 0	< 0 023769	2	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0 00513		VALUE --		VALUE 0.00285		2	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM 7 4	MAXIMUM 7 5	MINIMUM --	MAXIMUM --	[redacted]		2	STANDARD UNITS		[redacted]		

PART B -- Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements.

1 Pollutant and CAS NO (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if available)		d No. OF ANALYSES	a. CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO 114

1. Pollutant and CAS NO (*If available*)	MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic (*as N*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	16 0	0 68	--	--	7 0	0 166383	2	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k. Sulfate (*as SO_4*) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (*as S*)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m. Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o. Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p. Barrum Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q. Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1 Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS		5 INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M. Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M. Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M. Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLU							4. UNITS (*specify if blank*)		5 INT (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V. Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/l.	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA 4

OUTFALL NO 114

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE ( )		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V. Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A. 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A. 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]V-5

OUTFALL NO 114

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B. Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B. Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B. 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]-6

OUTFALL NO 114

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opt*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P V-7

OUTFALL NO 114

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAK *tional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

EPA I.D. NUMBER (copy from Item 1 of Form 1) 1891114

OUTFALL NO. 114

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P. PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P. PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I.D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 115

PART A –You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall See instructions for additional details.

1. Pollutant	2. EFFLUENT							3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	19.0	23 77	--	--	--	--	1	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Flow	VALUE 0 15		VALUE --		VALUE --		1	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM 7 3	MINIMUM --	MAXIMUM --	[redacted]		1	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if available)		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO. 115

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3 EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optiona*		
	a Believed Present	b Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*		d No. OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g. Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	< 5 0	< 6 26	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q. Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w. Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO. OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M. Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

CONTINUED FROM PAGE V-3

OUTFALL NO. 115

1. Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3. EFFLU							4 UNITS *(specify if blank)*		5 INT. *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE *(if available)* (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE *(if available)* (2) MASS	c. LONG TERM AVG. VALUE *(if available)* (1) CONCENTRATION	c. LONG TERM AVG. VALUE *(if available)* (2) MASS	d. No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b NO. OF ANALYSES
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V. Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO. 115

1. Pollutant and CAS NO (*if available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V. Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V. 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V. Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A. 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A. P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A. 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 115

1 Pollutant and CAS NO (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B. Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-Bromophenyl Phenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B. Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 115

1 Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B. Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 115

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3 EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P. Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P. Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM P. V-8

1. Pollutant and CAS NO (*If available*)	2 MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I.D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C)

[redacted]

OUTFALL NO. 116

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1 Pollutant	2. EFFLUENT						d No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)			a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 0 072		VALUE --		VALUE 0 072		6	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h. Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall. See the instructions for additional details and requirements

1. Pollutant and CAS NO. *(If available)*	2.MARK 'X'		3. EFFLUENT						d. No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (if available)			a. CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e. Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUED

OUTFALL NO 116

1. Pollutant and CAS NO. *(If available)*	MARK 'X'		3. EFFLUENT							4 UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a Believed Present	b. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate *(as SO_4)* (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide *(as S)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p. Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT						4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M. Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M. Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO 116

1 Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3 EFFLU							4. UNITS *(specify if blank)*		5 INT. *(optional)*		
	a Testmg Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V. 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V. 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V. Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO. 116

1 Pollutant and CAS NO (*If available*)	2 MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5 INTAKE (optional)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*If available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V. 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V. Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V. Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-5

OUTFALL NO 116

1. Pollutant and CAS NO (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (op		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B. Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B. 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B. 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B. Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B. 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 116

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3 EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opt*		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B. Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B. Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B. Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi-N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO. 116

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5 INTAK (*optional*)		
	a Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No. OF ANALYSES	a. CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P. β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P. 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P. 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P. α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P. Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NO 116
891114	

CONTINUED FROM P V-8

1. Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4. UNITS *(specify if blank)*		5 INTAKE *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG VALUE *(if available)*		d No. OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P. PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 117

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall See instructions for additional details

1 Pollutant	2. EFFLUENT						d. No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG. VALUE (*if available*)			a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f Flow	VALUE 1.15		VALUE --		VALUE 0 47		7	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i. pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge. Complete one table for each outfall See the instructions for additional details and requirements.

1. Pollutant and CAS NO. *(If available)*	2.MARK 'X'		3. EFFLUENT						d. No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (if available)			a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d. Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO. 117

1. Pollutant and CAS NO. (If available)	2. MARK 'X'		3. EFFLUENT							4. UNITS (specify if blank)		5. INTAKE (optional)		
	a Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (as N)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h. Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate (as SO_4) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l. Sulfide (as S)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n. Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r. Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s. Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x. Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAG

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements.

Part C.

1. Pollutant and CAS NO. (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (*optional*)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE (1) CONCENTRATION	a. MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (*if available*) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (*if available*) (2) MASS	c. LONG TERM AVG. VALUE (*if available*) (1) CONCENTRATION	c. LONG TERM AVG. VALUE (*if available*) (2) MASS	d. No. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE (1) CONCENTRATION	a. LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUI							4. UNITS (*specify if blank*)		5. INTA (*optional*)		
	a Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V. Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V. Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 117

1. Pollutant and CAS NO (*if available*)	2 MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5 INTAKE (optional)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS *(continued)*															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V. 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A. Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 117

1. Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*op*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B. Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B. 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B. 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PA[illegible]5

OUTFALL NO 117

1 Pollutant and CAS NO. (If available)	2. MARK 'X'			3. EFFLUENT							4 UNITS (specify if blank)		5. INTAKE (opt		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d No OF ANALYSES	a. CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B. 1,2-Diphenylhydrazine (as Azobenzene) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (1,2,3-cd) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B. N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi- N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 117

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5 INTAK[illegible]*tional*)		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B. Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P. Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P. α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P. Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-8

1. Pollutant and CAS NO. *(if available)*	2. MARK 'X'			3 EFFLUENT						d. No OF ANALYSES	4. UNITS *(specify if blank)*		5. INTAKE *(optional)*		
	a. Testing Required	b. Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVG. VALUE *(if available)*			a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES *(continued)*															
17P Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P. PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P. PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P. Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets (use same format) instead of completing these pages
SEE INSTRUCTIONS

EPA I D NUMBER (copy from Item 1 of Form 1)
110001891114

V INTAKE AND EFFLUENT CHARACTERISTICS (continued from page 3 of Form 2-C) [redacted] OUTFALL NO 118

PART A –You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details.

1 Pollutant	2. EFFLUENT						d. No. OF ANALYSES	3. UNITS (*specify if blank*)		4. INTAKE (*optional*)		
	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)			a. CONCENTRATION	b MASS	a LONG TERM AVG. VALUE		b NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Biological Oxygen Demand *(BOD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b Chemical Oxygen Demand *(COD)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c. Total Organic Carbon *(TOC)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
d. Total Suspended Solids *(TSS)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
e Ammonia *(as N)*	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Flow	VALUE No Discharge 2015-2017		VALUE --		VALUE --		--	MGD	--	VALUE --		--
g Temperature (*winter*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
h Temperature (*summer*)	VALUE --		VALUE --		VALUE --		--	°C		VALUE --		--
i pH	MINIMUM --	MAXIMUM --	MINIMUM --	MAXIMUM --	[redacted]		--	STANDARD UNITS		[redacted]		

PART B – Mark "X" in column 2-a for each pollutant you know or have reason to believe is present Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2a for any pollutant which is limited either directly, or indirectly but expressly, in an effluent limitations guideline, you must provide the results of at least one analysis for that pollutant. For other pollutants for which you mark column 2a, you must provide quantitative data or an explanation of their presence in your discharge Complete one table for each outfall. See the instructions for additional details and requirements.

1. Pollutant and CAS NO. (*If available*)	2.MARK 'X'		3. EFFLUENT						d No. OF ANALYSES	4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	b. Believed Present	c Believed Absent	a MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (if available)			a. CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a Bromide (24959-67-9)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
b. Chlorine, Total Residual		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
c Color		X	--	--	--	--	--	--	--	NTU	--	--	--	--
d Fecal Coliform		X	--	--	--	--	--	--	--	COL/100ml	--	--	--	--
e Fluoride (16984-48-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
f. Nitrate - Nitrite *(as N)*		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

ITEM V-B CONTINUE

OUTFALL NO. 118

1. Pollutant and CAS NO. (If available)	2. MARK 'X'		3 EFFLUENT							4 UNITS (specify if blank)		5 INTAKE (optional)		
	a Believed Present	b Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (if available)		c LONG TERM AVG VALUE (if available)		d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG VALUE		b NO OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION														
g Nitrogen, Total Organic (as N)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
h Oil & Grease		X	--	--	--	--	--	--	1	mg/L	kg/d	--	--	--
i. Phosphorus (as P), Total (7723-14-0)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
j. Radioactivity														
(1) Alpha		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(2) Beta		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(3) Radium, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
(4) Radium 226, Total		X	--	--	--	--	--	--	--	pCi/L	--	--	--	--
k Sulfate (as SO_4) (14808-79-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
l Sulfide (as S)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
m Sulfite (as SO_3) (14265-45-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
n Surfactants		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
o Aluminum, Total (7429-90-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
p. Barium Total (7440-39-3)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
q Boron, Total (7440-42-8)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
r Cobalt, Total (7440-48-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
s Iron, Total (7439-89-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
t. Magnesium, Total (7439-95-4)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
u. Molybdenum, Total (7439-98-7)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
v. Manganese, Total (7439-96-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
w Tin, Total (7440-31-5)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
x Titanium, Total (7440-32-6)		X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a (secondary industries, nonprocess wastewater outfalls, and nonrequired GC/MS fractions), mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe is absent. If you mark column 2a for any pollutant, you must provide the results of at least one analysis for that pollutant. If you mark column 2b for any pollutant, you must provide the results of at least one analysis for that pollutant if you know or have reason to believe it will be discharged in concentrations of 10 ppb or greater. If you mark column 2b for acrolein, acrylonitrile, 2,4 dinitrophenol, or 2-methyl-4, 6 dinitrophenol, you must provide the results of at least one analysis for each of these pollutants which you know or have reason to believe that you discharge in concentrations of 100 ppb or greater. Otherwise, for pollutants for which you mark column 2b, you must either submit at least one analysis or briefly describe the reasons the pollutant is expected to be discharged. Note that there are 7 pages to this part; please review each carefully. Complete one table (all 7 pages) for each outfall. See instructions for additional details and requirements

Part C.

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLUENT							4 UNITS		5 INTAKE *(optional)*		
	a Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(If available)*		c LONG TERM AVG. VALUE *(If available)*		d. No OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVG. VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M Antimony, Total (7440-36-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2M Arsenic, Total (7440-38-2			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3M. Beryllium, Total (7440-41-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4M Cadmium, Total (7440-43-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5M Chromium, Total (7440-47-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6M Copper, Total (7440-50-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7M Lead, Total (7439-92-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8M Mercury, Total (7439-97-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9M Nickel, Total (7440-02-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10M Selenium, Total (7782-49-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11M Silver, Total (7440-22-4			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12M Thallium, Total (7440-28-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13M Zinc, Total (7440-66-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14M Cyanide, Total (57-12-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15M Phenols, Total			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P Dioxin (1764-01-6)			X	DESCRIBE RESULTS --											

OUTFALL NO. 118

1 Pollutant and CAS NO. *(If available)*	2. MARK 'X'			3. EFFLU[illegible]							4. UNITS *(specify if blank)*		5. INT[illegible] *(optional)*		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c LONG TERM AVG. VALUE *(if available)*		d No OF ANALYSES	a CONCENTRATION	b. MASS	a LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2V. Acrylonitrile (107-13-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3V. Benzene (71-43-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4V. Bis (Chloromethyl) Ether (542-88-1)				Not Required		Not Required		Not Required							
5V. Bromoform (75-25-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6V. Carbon Tetrachloride (56-23-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7V Chlorobenzene (108-90-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8V. Chlorodibromomethane (124-48-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9V Chloroethane (75-00-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10V 2-Chloroethylvinyl Ether (110-75-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11V Chloroform (67-66-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12V. Dichlorobromomethane (75-27-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13V Dichlorodifluoromethane (75-71-8)				Not Required		Not Required		Not Required							
14V 1,1-Dichloroethane (75-34-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15V. 1,2-Dichloroethane (107-06-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16V. 1,1-Dichloroethylene (75-35-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17V. 1,2-Dichloropropane (78-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18V. 1,3-Dichloropropylene (542-75-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19V. Ethylbenzene (100-41-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20V Methyl Bromide (74-83-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21V. Methyl Chloride (74-87-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-4

OUTFALL NO 118

1. Pollutant and CAS NO (*if available*)	2 MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (optional)		
	a. Testing Required	b Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*If available*)		c. LONG TERM AVG. VALUE (*if available*)		d No. OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - VOLATILE COMPOUNDS (*continued*)															
22V Methylene Chloride (75-09-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23V 1,1,2,2-Tetrachloroethane (79-34-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24V Tetrachloroethylene (127-18-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25V Toluene (108-88-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26V 1,2-Trans-Dichloroethylene (156-60-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27V 1,1,1-Trichloroethane (71-55-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28V 1,1,2-Trichloroethane (79-00-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29V Trichloroethylene (79-01-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30V Trichlorofluoromethane (75-69-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31V Vinyl Chloride (75-01-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - ACID COMPOUNDS															
1A 2-Chlorophenol (95-57-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2A. 2,4-Dichlorophenol (120-83-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3A 2,4-Dimethylphenol (105-67-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4A 4,6-Dinitro-OCresol (534-52-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5A 2,4-Dinitrophenol (51-28-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6A 2-Nitrophenol (88-75-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7A 4-Nitrophenol (100-02-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8A P-Chloro-MCresol (59-50-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9A Pentachlorophenol (87-86-5			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10A Phenol (108-95-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11A. 2,4,6-Trichlorophenol (88-05-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

OUTFALL NO 118

1. Pollutant and CAS NO (If available)	2 MARK 'X'			3. EFFLUENT							4 UNITS (*specify if blank*)		5. INTAKE (*op*		
	a Testing Required	b Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE		b MAXIMUM 30 DAY VALUE (*if available*)		c LONG TERM AVG VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG. VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS															
1B Acenaphthene (83-32-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2B Acenaphtylene (208-96-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3B Anthracene (120-12-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4B Benzidine (92-87-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5B Benzo (a) Anthracene (56-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6B Benzo (a) Pyrene (50-32-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7B 3,4-Benzofluoranthene (205-99-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8B Benzo (ghi) Perylene (191-24-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9B. Benzo (k) Fluoranthene (207-08-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10B Bis (2-Chloroethoxy) Methane (111-91-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11B Bis (2-Chloroethyl) Ether (111-44-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12B Bis (2-Chloroisopropyl) Ether (102-80-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13B Bis (2-Ethylhexyl) Phthalate (117-81-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14B 4-BromophenylPhenyl Ether (101-55-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
15B Butyl Benzyl Phthalate (85-68-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16B 2-Chloronaphthalene (91-58-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
17B 4-Chlorophenyl Phenyl Ether (7005-72-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18B Chrysene (218-01-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19B Dibenzo (a,h) Anthracene (53-70-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20B 1,2-Dichlorobenzene (95-50-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21B 1,3-Di-chlorobenzene (541-73-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

CONTINUED FROM PAGE V-6

OUTFALL NO 118

1 Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*opt*		
	a Testing Required	b. Believed Present	c Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d No OF ANALYSES	a CONCENTRATION	b MASS	a. LONG TERM AVG VALUE		b NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
22B 1,4-Dichlorobenzene (106-46-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23B 3,3-Dichlorobenzidine (91-94-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24B. Diethyl Phthalate (84-66-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25B Dimethyl Phthalate (131-11-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
26B Di-N-Butyl Phthalate (84-74-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
27B. 2,4-Dinitrotoluene (121-14-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
28B 2,6-Dinitrotoluene (606-20-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
29B Di-N-Octyl Phthalate (117-84-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
30B 1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
31B Fluoranthene (206-44-0)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
32B Fluorene (86-73-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
33B Hexachlorobenzene (118-74-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
34B Hexachlorobutadiene (87-68-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
35B Hexachlorocyclopentadiene (77-47-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
36B Hexachloroethane (67-72-			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
37B Indeno (*1,2,3-cd*) Pyrene (193-39-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
38B Isophorone (78-59-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
39B Naphthalene (91-20-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
40B Nitrobenzene (98-95-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
41B N-Nitrosodimethylamine (62-75-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
42B N-Nitrosodi-N-Propylamine (621-64-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

1. Pollutant and CAS NO. (If available)	2 MARK 'X'			3 EFFLUENT							4. UNITS (specify if blank)		5 INTAKE (optional)		
	a. Testing Required	b. Believed Present	c. Believed Absent	a MAXIMUM DAY VALUE (1) CONCENTRATION	a MAXIMUM DAY VALUE (2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	b. MAXIMUM 30 DAY VALUE (if available) (2) MASS	c LONG TERM AVG. VALUE (if available) (1) CONCENTRATION	c LONG TERM AVG. VALUE (if available) (2) MASS	d No OF ANALYSES	a CONCENTRATION	b MASS	a LONG TERM AVG. VALUE (1) CONCENTRATION	a LONG TERM AVG. VALUE (2) MASS	b. NO OF ANALYSES
GC/MS FRACTION - BASE/NEUTRAL COMPOUNDS (continued)															
43B. N-Nitrosodiphenylamine (86-30-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
44B. Phenanthrene (85-01-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
45B Pyrene (129-00-0			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
46B. 1,2,4-Trichlorobenzene (120-82-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
GC/MS FRACTION - PESTICIDES															
1P Aldrin (309-00-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
2P α-BHC (319-84-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
3P β-BHC (319-85-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
4P. γ-BHC (58-89-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
5P. δ-BHC (319-86-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
6P Chlordane (57-74-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
7P 4,4'-DDT (50-29-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
8P 4,4'-DDE (72-55-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
9P 4,4'-DDD (72-54-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
10P. Dieldrin (60-57-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
11P α-Enosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
12P β-Endosulfan (115-29-7)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
13P Endosulfan Sulfate (1031-07-8)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
14P Endrin (72-20-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
Aldehyde (7421-93-4)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
16P Heptachlor (76-44-8			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

EPA I D NUMBER (copy from Item 1 of Form 1)	OUTFALL NO. 118
891114	

CONTINUED FROM P. V-8

1. Pollutant and CAS NO (*If available*)	2. MARK 'X'			3. EFFLUENT							4. UNITS (*specify if blank*)		5. INTAKE (*optional*)		
	a. Testing Required	b Believed Present	c. Believed Absent	a. MAXIMUM DAY VALUE		b. MAXIMUM 30 DAY VALUE (*if available*)		c. LONG TERM AVG. VALUE (*if available*)		d. No. OF ANALYSES	a CONCENTRATION	b. MASS	a. LONG TERM AVG VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION - PESTICIDES (*continued*)															
17P. Heptachlor Epoxide (1024-57-3)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
18P. PCB-1242 (53469-21-9)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
19P PCB-1254 (11097-69-1)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
20P PCB-1221 (11104-28-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
21P PCB-1232 (11131-16-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
22P PCB-1248 (12672-29-6)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
23P PCB-1260 (11096-82-5)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
24P. PCB-1016 (12674-11-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--
25P Toxaphene (8001-35-2)			X	--	--	--	--	--	--	--	mg/L	kg/d	--	--	--

EPA Form 2A

FACILITY NAME AND PERMIT NUMBER:
Dominion North Anna Power Station Units 1&2 STP VA0052451

Form Approved 1/14/99
OMB Number 2040-0086

FORM 2A NPDES

NPDES FORM 2A APPLICATION OVERVIEW

APPLICATION OVERVIEW

Form 2A has been developed in a modular format and consists of a "Basic Application Information" packet and a "Supplemental Application Information" packet. The Basic Application Information packet is divided into two parts. All applicants must complete Parts A and C. Applicants with a design flow greater than or equal to 0.1 mgd must also complete Part B. Some applicants must also complete the Supplemental Application Information packet. The following items explain which parts of Form 2A you must complete.

BASIC APPLICATION INFORMATION:

A. **Basic Application Information for all Applicants.** All applicants must complete questions A.1 through A.8. A treatment works that discharges effluent to surface waters of the United States must also answer questions A.9 through A.12.

B. **Additional Application Information for Applicants with a Design Flow ≥ 0.1 mgd.** All treatment works that have design flows greater than or equal to 0.1 million gallons per day must complete questions B.1 through B.6.

C. **Certification.** All applicants must complete Part C (Certification).

SUPPLEMENTAL APPLICATION INFORMATION:

D. **Expanded Effluent Testing Data.** A treatment works that discharges effluent to surface waters of the United States and meets one or more of the following criteria must complete Part D (Expanded Effluent Testing Data):

1. Has a design flow rate greater than or equal to 1 mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to provide the information.

E. **Toxicity Testing Data.** A treatment works that meets one or more of the following criteria must complete Part E (Toxicity Testing Data):

1. Has a design flow rate greater than or equal to 1 mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to submit results of toxicity testing.

F. **Industrial User Discharges and RCRA/CERCLA Wastes.** A treatment works that accepts process wastewater from any significant industrial users (SIUs) or receives RCRA or CERCLA wastes must complete Part F (Industrial User Discharges and RCRA/CERCLA Wastes). SIUs are defined as:

1. All industrial users subject to Categorical Pretreatment Standards under 40 Code of Federal Regulations (CFR) 403.6 and 40 CFR Chapter I, Subchapter N (see Instructions); and
2. Any other industrial user that:
   a. Discharges an average of 25,000 gallons per day or more of process wastewater to the treatment works (with certain exclusions); or
   b. Contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the treatment plant; or
   c. Is designated as an SIU by the control authority.

G. **Combined Sewer Systems.** A treatment works that has a combined sewer system must complete Part G (Combined Sewer Systems).

ALL APPLICANTS MUST COMPLETE PART C (CERTIFICATION)

BASIC APPLICATION INFORMATION

PART A. BASIC APPLICATION INFORMATION FOR ALL APPLICANTS:

All treatment works must complete questions A.1 through A.8 of this Basic Application Information packet.

A.1. Facility Information.

Facility name: Dominion Energy- North Anna Power Station

Mailing Address: 1022 Haley Drive
Louisa, Virginia 23117

Contact person: Randy Markey

Title: Environmental Compliance Coordinator

Telephone number: (540) 894-2856

Facility Address (not P.O. Box): 1022 Haley Drive
Louisa, Virginia 23117

A.2. Applicant Information. If the applicant is different from the above, provide the following.

Applicant name: Virginia Electric & Power Company

Mailing Address: 5000 Dominion Boulevard
Glen Allen, Virginia 23060

Contact person: Jason E. Williams

Title: Director, Environmental

Telephone number: (804) 273-2646

Is the applicant the owner or operator (or both) of the treatment works?

✓ owner ✓ operator

Indicate whether correspondence regarding this permit should be directed to the facility or the applicant.

✓ facility ✓ applicant

A.3. Existing Environmental Permits. Provide the permit number of any existing environmental permits that have been issued to the treatment works (include state-issued permits).

NPDES: VA0052451
PSD: –
UIC: –
Other: Air Permit 40726 (ID # 51-109-0025)
RCRA: VAD065376279 (Small Quantity Generator)
Other: VAR104462, ESCP06-2017

A.4. Collection System Information. Provide information on municipalities and areas served by the facility. Provide the name and population of each entity and, if known, provide information on the type of collection system (combined vs. separate) and its ownership (municipal, private, etc.).

Name	Population Served	Type of Collection System	Ownership
North Anna Power Station	950	Separate	Private
–	–	–	–
–	–	–	–

Total population served 950

A.5. Indian Country.

a. Is the treatment works located in Indian Country?

_____ Yes ✓ No

b. Does the treatment works discharge to a receiving water that is either in Indian Country or that is upstream from (and eventually flows through) Indian Country?

_____ Yes ✓ No

A.6. Flow. Indicate the design flow rate of the treatment plant (i.e., the wastewater flow rate that the plant was built to handle). Also provide the average daily flow rate and maximum daily flow rate for each of the last three years. Each year's data must be based on a 12-month time period with the 12th month of "this year" occurring no more than three months prior to this application submittal

a. Design flow rate 0.03 mgd

	Two Years Ago	Last Year	This Year	
b. Annual average daily flow rate	0.0052	0.0062	0.0054	mgd
c. Maximum daily flow rate	0.0192	0.0205	0.0225	mgd

A.7. Collection System. Indicate the type(s) of collection system(s) used by the treatment plant. Check all that apply. Also estimate the percent contribution (by miles) of each.

✓ Separate sanitary sewer	100 %
_____ Combined storm and sanitary sewer	_____ %

A.8. Discharges and Other Disposal Methods.

a. Does the treatment works discharge effluent to waters of the U.S.? _____ Yes ✓ No

If yes, list how many of each of the following types of discharge points the treatment works uses: This is an internal outfall

i. Discharges of treated effluent 1

ii. Discharges of untreated or partially treated effluent 0

iii. Combined sewer overflow points 0

iv. Constructed emergency overflows (prior to the headworks) 0

v. Other -- 0

b. Does the treatment works discharge effluent to basins, ponds, or other surface impoundments that do not have outlets for discharge to waters of the U.S.? _____ Yes ✓ No

If yes, provide the following for each surface impoundment.

Location: N/A

Annual average daily volume discharged to surface impoundment(s) N/A mgd

Is discharge _____ continuous or _____ intermittent?

c. Does the treatment works land-apply treated wastewater? _____ Yes ✓ No

If yes, provide the following for each land application site:

Location: N/A

Number of acres: N/A

Annual average daily volume applied to site: N/A Mgd

Is land application _____ continuous or _____ intermittent?

d. Does the treatment works discharge or transport treated or untreated wastewater to another treatment works? _____ Yes ✓ No

If yes, describe the mean(s) by which the wastewater from the treatment works is discharged or transported to the other treatment works (e.g., tank truck, pipe).

N/A

If transport is by a party other than the applicant, provide:

Transporter name: N/A

Mailing Address: –

Contact person: –

Title. –

Telephone number

For each treatment works that receives this discharge, provide the following:

Name: N/A

Mailing Address: –

Contact person –

Title: –

Telephone number:

If known, provide the NPDES permit number of the treatment works that receives this discharge. –

Provide the average daily flow rate from the treatment works into the receiving facility. – mgd

e. Does the treatment works discharge or dispose of its wastewater in a manner not included in A.8.a through A.8.d above (e.g., underground percolation, well injection)? ____ Yes ✓ No

If yes, provide the following for each disposal method:

Description of method (including location and size of site(s) if applicable):

N/A

Annual daily volume disposed of by this method. N/A

Is disposal through this method ____ continuous or ____ intermittent?

WASTEWATER DISCHARGES:

If you answered "yes" to question A.8.a, complete questions A.9 through A.12 **once for each outfall** (including bypass points) through which effluent is discharged. Do not include information on combined sewer overflows in this section. **If you answered "no" to question A.8.a**, go to Part B, "Additional Application Information for Applicants with a Design Flow Greater than or Equal to 0.1 mgd."

A.9. Description of Outfall.

a. Outfall number: 111 (Internal Outfall to 001)

b. Location: Louisa County, Virginia 23117
(City or town, if applicable) (Zip Code)
(County) (State)
38° 03' 46" -77° 47' 13.4"
(Latitude) (Longitude)

c. Distance from shore (if applicable): 0 ft

d. Depth below surface (if applicable): 0 ft

e. Average daily flow rate: 0.0056 mgd

f. Does this outfall have either an intermittent or a periodic discharge? ____ Yes ✓ No (go to A.9.g.)

If yes, provide the following information:

Number of times per year discharge occurs: N/A

Average duration of each discharge: N/A

Average flow per discharge: N/A mgd

Months in which discharge occurs: N/A

g. Is outfall equipped with a diffuser? ____ Yes ✓ No

A.10. Description of Receiving Waters.

a. Name of receiving water: NAPS Discharge Canal and Waste Heat Treatment Facility to Lake Anna

b. Name of watershed (if known): North Anna River

United States Soil Conservation Service 14-digit watershed code (if known). N/A

c. Name of State Management/River Basin (if known): York River

United States Geological Survey 8-digit hydrologic cataloging unit code (if known) N/A

d Critical low flow of receiving stream (if applicable):
acute N/A cfs chronic N/A cfs

e. Total hardness of receiving stream at critical low flow (if applicable): N/A mg/l of $CaCO_3$

A.11. Description of Treatment.

a What levels of treatment are provided? Check all that apply.

✓ Primary ✓ Secondary

____ Advanced ____ Other. Describe: –

b. Indicate the following removal rates (as applicable):

Design BOD_5 removal or Design $CBOD_5$ removal	85	%
Design SS removal	85	%
Design P removal	N/A	%
Design N removal	N/A	%
Other –	–	%

c. What type of disinfection is used for the effluent from this outfall? If disinfection varies by season, please describe.

Chlorination

If disinfection is by chlorination, is dechlorination used for this outfall? ____ Yes ✓ No

d. Does the treatment plant have post aeration? ____ Yes ✓ No

A.12. Effluent Testing Information. All Applicants that discharge to waters of the US must provide effluent testing data for the following parameters. Provide the indicated effluent testing required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. At a minimum, effluent testing data must be based on at least three samples and must be no more than four and one-half years apart.

Outfall number. 111 (Internal)

PARAMETER	MAXIMUM DAILY VALUE		AVERAGE DAILY VALUE		
	Value	Units	Value	Units	Number of Samples
pH (Minimum)	6.2	s.u.			
pH (Maximum)	7.5	s.u.			
Flow Rate	0.0225	MGD	0.0056	MGD	1096
Temperature (Winter)	21.4	degrees C	–	degrees C	1
Temperature (Summer)	24.5	degrees C	24.3	degrees C	2

* For pH please report a minimum and a maximum daily value

POLLUTANT		MAXIMUM DAILY DISCHARGE		AVERAGE DAILY DISCHARGE			ANALYTICAL METHOD	ML / MDL
		Conc.	Units	Conc.	Units	Number of Samples		
CONVENTIONAL AND NONCONVENTIONAL COMPOUNDS.								
BIOCHEMICAL OXYGEN DEMAND (Report one)	BOD-5	24	mg/L	8.3	mg/L	36	SM 5210B	2 mg/L
	CBOD-5	–	–	–	–	–	–	–
FECAL COLIFORM		2	MPN	0.6*	MPN	3	9221E	2 MPN/100 mL
TOTAL SUSPENDED SOLIDS (TSS)		30	mg/L	10.7	mg/L	36	SM 2540D	1 mg/L

END OF PART A.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

*Calculated

BASIC APPLICATION INFORMATION

N/A

PART B. ADDITIONAL APPLICATION INFORMATION FOR APPLICANTS WITH A DESIGN FLOW GREATER THAN OR EQUAL TO 0.1 MGD (100,000 gallons per day).

All applicants with a design flow rate ≥ 0.1 mgd must answer questions B.1 through B.6. All others go to Part C (Certification).

B.1. Inflow and Infiltration. Estimate the average number of gallons per day that flow into the treatment works from inflow and/or infiltration.

_____ – gpd

Briefly explain any steps underway or planned to minimize inflow and infiltration.

–

B.2. Topographic Map. Attach to this application a topographic map of the area extending at least one mile beyond facility property boundaries. This map must show the outline of the facility and the following information. (You may submit more than one map if one map does not show the entire area.)

a. The area surrounding the treatment plant, including all unit processes.

b. The major pipes or other structures through which wastewater enters the treatment works and the pipes or other structures through which treated wastewater is discharged from the treatment plant. Include outfalls from bypass piping, if applicable.

c. Each well where wastewater from the treatment plant is injected underground.

d. Wells, springs, other surface water bodies, and drinking water wells that are: 1) within 1/4 mile of the property boundaries of the treatment works, and 2) listed in public record or otherwise known to the applicant

e. Any areas where the sewage sludge produced by the treatment works is stored, treated, or disposed.

f. If the treatment works receives waste that is classified as hazardous under the Resource Conservation and Recovery Act (RCRA) by truck, rail, or special pipe, show on the map where that hazardous waste enters the treatment works and where it is treated, stored, and/or disposed.

B.3. Process Flow Diagram or Schematic. Provide a diagram showing the processes of the treatment plant, including all bypass piping and all backup power sources or redundancy in the system. Also provide a water balance showing all treatment units, including disinfection (e.g, chlorination and dechlorination). The water balance must show daily average flow rates at influent and discharge points and approximate daily flow rates between treatment units. Include a brief narrative description of the diagram.

B.4. Operation/Maintenance Performed by Contractor(s).

Are any operational or maintenance aspects (related to wastewater treatment and effluent quality) of the treatment works the responsibility of a contractor? ____Yes ____No

If yes, list the name, address, telephone number, and status of each contractor and describe the contractor's responsibilities (attach additional pages if necessary).

Name: –

Mailing Address: –

Telephone Number: _____

Responsibilities of Contractor: –

B.5. Scheduled Improvements and Schedules of Implementation. Provide information on any uncompleted implementation schedule or uncompleted plans for improvements that will affect the wastewater treatment, effluent quality, or design capacity of the treatment works If the treatment works has several different implementation schedules or is planning several improvements, submit separate responses to question B.5 for each. (If none, go to question B.6.)

a. List the outfall number (assigned in question A 9) for each outfall that is covered by this implementation schedule.

–

b. Indicate whether the planned improvements or implementation schedule are required by local, State, or Federal agencies.

____Yes ____No

c If the answer to B 5 b is "Yes," briefly describe, including new maximum daily inflow rate (if applicable).

–

d. Provide dates imposed by any compliance schedule or any actual dates of completion for the implementation steps listed below, as applicable. For improvements planned independently of local, State, or Federal agencies, indicate planned or actual completion dates, as applicable. Indicate dates as accurately as possible.

	Schedule	Actual Completion
Implementation Stage	MM / DD / YYYY	MM / DD / YYYY
– Begin construction	___/___/_____	___/___/_____
– End construction	___/___/_____	___/___/_____
– Begin discharge	___/___/_____	___/___/_____
– Attain operational level	___/___/_____	___/___/_____

e. Have appropriate permits/clearances concerning other Federal/State requirements been obtained? ____Yes ____No

Describe briefly: –

N/A **B.6. EFFLUENT TESTING DATA (GREATER THAN 0.1 MGD ONLY).**

Applicants that discharge to waters of the US must provide effluent testing data for the following parameters. Provide the indicated effluent testing required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. At a minimum, effluent testing data must be based on at least three pollutant scans and must be no more than four and one-half years old.

Outfall Number:_____

POLLUTANT	MAXIMUM DAILY DISCHARGE		AVERAGE DAILY DISCHARGE			ANALYTICAL METHOD	ML / MDL
	Conc.	Units	Conc.	Units	Number of Samples		
CONVENTIONAL AND NONCONVENTIONAL COMPOUNDS.							
AMMONIA (as N)							
CHLORINE (TOTAL RESIDUAL, TRC)							
DISSOLVED OXYGEN							
TOTAL KJELDAHL NITROGEN (TKN)							
NITRATE PLUS NITRITE NITROGEN							
OIL and GREASE							
PHOSPHORUS (Total)							
TOTAL DISSOLVED SOLIDS (TDS)							
OTHER							

END OF PART B.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

FACILITY NAME AND PERMIT NUMBER:

Dominion North Anna Power Station Units 1&2 STP VA0052451

Form Approved 1/14/99
OMB Number 2040-0086

BASIC APPLICATION INFORMATION

PART C. CERTIFICATION

All applicants must complete the Certification Section. Refer to instructions to determine who is an officer for the purposes of this certification. All applicants must complete all applicable sections of Form 2A, as explained in the Application Overview. Indicate below which parts of Form 2A you have completed and are submitting. By signing this certification statement, applicants confirm that they have reviewed Form 2A and have completed all sections that apply to the facility for which this application is submitted.

Indicate which parts of Form 2A you have completed and are submitting:

✓ Basic Application Information packet

Supplemental Application Information packet.

_____ Part D (Expanded Effluent Testing Data)

_____ Part E (Toxicity Testing: Biomonitoring Data)

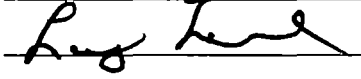
_____ Part F (Industrial User Discharges and RCRA/CERCLA Wastes)

_____ Part G (Combined Sewer Systems)

ALL APPLICANTS MUST COMPLETE 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 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.

Name and official title: Larry Lane, Site Vice President

Signature: 

Telephone number: (540) 894-2101

Date signed: 10-15-18

Upon request of the permitting authority, you must submit any other information necessary to assess wastewater treatment practices at the treatment works or identify appropriate permitting requirements.

SEND COMPLETED FORMS TO:

EPA Form 2F

Please print or type in the unshaded areas	EPA ID Number *(copy from Item I of Form 1)* **110001891114**	Form Approved. OMB No. 2040-0086 Approval expires 5-31-92

Form **2F** NPDES

United States Environmental Protection Agency
Washington, DC 20460

Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity

Paperwork Reduction Act Notice

Public reporting burden for this application is estimated to average 28.6 hours per application, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate, any other aspect of this collection of information or suggestions for improving this form, including suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M St., SW, Washington, DC 20460, or Director, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

I. Outfall Location

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. Outfall Number *(list)*	B. Latitude			C. Longitude			D. Receiving Water *(name)*
014	38	03	42.7	-77	47	28.6	Lake Anna
022	38	03	52.5	-77	47	52.8	Lake Anna
024	38	03	55.2	-77	47	38.4	Lake Anna
025	38	03	16.5	-77	47	27.2	Waste Heat Treatment Facility to Lake Anna
027	38	03	11.6	-77	47	21.7	Waste Heat Treatment Facility to Lake Anna

II. Improvements

A. Are you now required by any Federal, State, or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

1. Identification of Conditions, Agreements, Etc.	2. Affected Outfalls		3. Brief Description of Project	4. Final Compliance Date	
	number	source of discharge		a. req.	b. proj.
N/A					

B. You may attach additional sheets describing any additional water pollution (or other environmental projects which may affect your discharges) you now have under way or which you plan. Indicate whether each program is now under way or planned, and indicate your actual or planned schedules for construction.

III. Site Drainage Map

See **Attachment E.**

Continued from the Front

IV. Narrative Description of Pollutant Sources

A. For each outfall, provide an estimate of the area (include units) of impervious surfaces (including paved areas and building roofs) drained to the outfall, and an estimate of the total surface area drained by the outfall.

Outfall Number	Area of Impervious Surface (provide units)	Total Area Drained (provide units)	Outfall Number	Area of Impervious Surface (provide units)	Total Area Drained (provide units)
014	3.7 acres	4.3 acres	024	0.08 acre	6.1 acres
022	7.1 acres	57.5 acres	025	4 acres	58.6 acres
			027	1.3 acres	7.5 acres

B. Provide a narrative description of significant materials that are currently or in the past three years have been treated, stored or disposed in a manner to allow exposure to storm water; method of treatment, storage, or disposal; past and present materials management practices employed to minimize contact by these materials with storm water runoff; materials loading and access areas; and the location, manner, and frequency in which pesticides, herbicides, soil conditioners, and fertilizers are applied.

See Sections 4, 5, and 6 of the SWPPP in **Attachment F**.

C. For each outfall, provide the location and a description of existing structural and nonstructural control measures to reduce pollutants in storm water runoff; and a description of the treatment the storm water receives, including the schedule and type of maintenance for control and treatment measures and the ultimate disposal of any solid or fluid wastes other than by discharge.

Outfall Number	Treatment	List Codes from Table 2F-1
All outfalls	See Sections 4, 5, and 6 of the SWPPP in **Attachment F**.	1-O (Outfall 025) 4-A (all outfalls)

. Non Stormwater Discharges

A. I certify under penalty of law that the outfall(s) covered by this application have been tested or evaluated for the presence of non-stormwater discharges, and that all non-stormwater discharges from these outfall(s) are identified in either an accompanying Form 2C or Form 2E application for the outfall.

Name of Official Title *(type or print)*	Signature	Date Signed
Larry Lane, Site Vice President		10-15-18

B. Provide a description of the method used, the date of any testing, and the onsite drainage points that were directly observed during a test.

A dry weather evaluation was performed on the permitted storm water outfalls on 08/16/ 2018 at 2:30 p.m. The last qualifying rain event (according to Weather Sentry) occurred on 08/14/2018, which had a total rainfall of 0.10 inches.
The observations were as follows:
Outfall 014: No discharge.
Outfall 022: Continuous discharge (previously identified as groundwater discharge).
Outfall 024: No discharge.
Outfall 025: No discharge.
Outfall 027: A small trickle was discharging coming from the retention pond that is immediately upstream of the outfall.

VI. Significant Leaks or Spills

Provide existing information regarding the history of significant leaks or spills of toxic or hazardous pollutants at the facility in the last three years, including the approximate date and location of the spill or leak, and the type and amount of material released.

None.

 Continued on Page 3

EPA ID Number *(copy from Item I of Form 1)*
110001891114

II. Discharge Information

A,B,C, & D: See instruction before proceeding. Complete one set of tables for each outfall. Annotate the outfall number in the space provided. Tables VII-A, VII-B, and VII-C are included on separate sheets numbered VII-1 and VII-2.

E. Potential discharges not covered by analysis - is any toxic pollutant listed in table 2F-2, 2F-3, or 2F-4, a substance or a component of a substance which you currently use or manufacture as an intermediate or final product or byproduct?

X Yes *(list all such pollutants below)* ☐ No *(go to Section IX)*

As radioactive releases at this facility are regulated by the Nuclear Regulatory Commission (NRC), they have not been listed here.
See **Attachment C** for a list of other potential discharges not covered by analysis.

VIII. Biological Toxicity Testing Data

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ Yes *(list all such pollutants below)* ☒ No *(go to Section IX)*

IX. Contact analysis Information

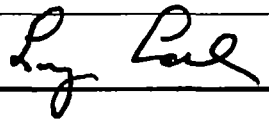
Were any of the analysis reported in item VII performed by a contact laboratory or consulting firm?

☒ Yes *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ No *(go to Section X)*

A. Name	B. Address	C. Area Code & Phone No.	D. Pollutants Analyzed
Air Water & Soil Laboratories, Inc.	**1941 Reymet Road Richmond, VA 23237**	**(804) 358-8295**	**Total metals, Dissolved metals, Ammonia, Chloride, Total Nitrogen, Nitrate-Nitrite, TKN, Total Phosphorus, BOD, COD, TSS, Oil & Grease, TPH, Hardness**
Pace Analytical Services Inc.	**9800Kincey Avenue Huntersville, NC 28078**	**(704)875-9092**	**Total Mercury, Dissolved Mercury**

X. 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.

A. Name & Official Title *(type or print)*	B. Area Code and Phone No.
Larry Lane, Site Vice President	540-894-2101
C. Signature 	D. Date Signed 10-15-18

Outfall 022

EPA ID Number *(copy from Item I of Form 1)*
110001891114

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Oil & Grease	<5 mg/L	N/A	N/A	N/A	1	N/A
Biological Oxygen Demand (BOD5)	<0.2 mg/L	N/A	N/A	N/A	1	N/A
Chemical Oxygen Demand (COD)	13.6 mg/L	N/A	N/A	N/A	1	General Site Runoff
Total Suspended Solids (TSS)	3.4 mg/L	N/A	N/A	N/A	1	General Site Runoff
Total Organic Nitrogen	0.4 mg/L	N/A	N/A	N/A	1	General Site Runoff
Total Phosphorus	0.05 mg/L	N/A	N/A	N/A	1	General Site Runoff
pH	Minimum 7.9 S.U.	Maximum 7.9 S.U.	N/A	N/A	1	General Site Runoff

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Chlorine, Total Residual	<0.1 mg/L	N/A	N/A	N/A	1	N/A
Chromium	0.000893 mg/l	N/A	N/A	N/A	1	General Site Runoff
Free Available Chlorine	N/A – as TRC <0.1 mg/l	N/A	N/A	N/A	1	N/A
Temperature (summer)	23.7°C	N/A	N/A	N/A	1	N/A
Zinc	0.0335 mg/l	N/A	N/A	N/A	1	General Site Runoff

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Aluminum	0.266 mg/l	N/A	N/A	N/A	1	General Site Runoff
Ammonia as N	<0.1 mg/l	N/A	N/A	N/A	1	N/A
Antimony	0.000736 mg/l	N/A	N/A	N/A	1	General Site Runoff
Arsenic	0.00159 mg/l	N/A	N/A	N/A	1	General Site Runoff
Barium	0.0143 mg/l	N/A	N/A	N/A	1	General Site Runoff
Beryllium	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Boron	<0.05 mg/l	N/A	N/A	N/A	1	N/A
Cadmium	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Calcium	8.21 mg/l	N/A	N/A	N/A	1	General Site Runoff
Chloride	2.7 mg/l	N/A	N/A	N/A	1	General Site Runoff
Chromium	0.000893 mg/l	N/A	N/A	N/A	1	General Site Runoff
Cobalt	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Copper	0.00355 mg/l	N/A	N/A	N/A	1	General Site Runoff
Hardness as CaCO3	25.2 mg/l	N/A	N/A	N/A	1	General Site Runoff
Iron	0.468 mg/l	N/A	N/A	N/A	1	General Site Runoff
Lead	0.000463 mg/l	N/A	N/A	N/A	1	General Site Runoff
Magnesium	1.14 mg/l	N/A	N/A	N/A	1	General Site Runoff

Manganese	0.0358 mg/l	N/A	N/A	N/A	1	General Site Runoff
Molybdenum	0.00242 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nickel	0.000439 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nitrate+Nitrite as N	0.83 mg/l	N/A	N/A	N/A	1	General Site Runoff
Selenium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Silver	0.0000107 mg/l	N/A	N/A	N/A	1	General Site Runoff
Thallium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Tin	<0.007 mg/l	N/A	N/A	N/A	1	N/A
Titanium	0.01 mg/l	N/A	N/A	N/A	1	General Site Runoff
TKN as N	0.40 mg/l	N/A	N/A	N/A	1	General Site Runoff
TPH-Semi-Volatiles (DRO)	<0.549 mg/l	N/A	N/A	N/A	1	N/A
TPH-Volatiles (GRO)	<0.05 mg/l	N/A	N/A	N/A	1	N/A
TSS	3.43 mg/l	N/A	N/A	N/A	1	General Site Runoff
Vanadium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Zinc	0.0335 mg/l	N/A	N/A	N/A	1	General Site Runoff
Aluminum, Dissolved	0.0819 mg/l	N/A	N/A	N/A	1	General Site Runoff
Antimony, Dissolved	0.000753 mg/l	N/A	N/A	N/A	1	General Site Runoff
Arsenic, Dissolved	0.00144 mg/l	N/A	N/A	N/A	1	General Site Runoff
Barium, Dissolved	0.0128 mg/l	N/A	N/A	N/A	1	General Site Runoff
Beryllium, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Boron, Dissolved	<0.05 mg/l	N/A	N/A	N/A	1	N/A
Cadmium, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Dissolved	<0.0040 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Hexavalent, Dissolved	<0.003 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Trivalent, Dissolved	<0.00400 mg/l	N/A	N/A	N/A	1	N/A
Cobalt, Dissolved	<0.001 mg/l	N/A	N/A	N/A	1	N/A General Site Runoff
Copper, Dissolved	0.00287 mg/l	N/A	N/A	N/A	1	General Site Runoff
Iron, Dissolved	0.193 mg/l	N/A	N/A	N/A	1	General Site Runoff
Lead, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Magnesium, Dissolved	1.06 mg/l	N/A	N/A	N/A	1	General Site Runoff
Manganese, Dissolved	0.0309 mg/l	N/A	N/A	N/A	1	General Site Runoff
Molybdenum, Dissolved	0.00305 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nickel, Dissolved	<0.00028 mg/l	N/A	N/A	N/A	1	N/A
Selenium, Dissolved	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Silver, Dissolved	<0.00001 mg/l	N/A	N/A	N/A	1	N/A
Thallium, Dissolved	<0.0004 mg/l	N/A	N/A	N/A	1	N/A
Tin, Dissolved	<0.007 mg/l	N/A	N/A	N/A	1	N/A
Titanium, Dissolved	0.0031 mg/l	N/A	N/A	N/A	1	General Site Runoff
Vanadium, Dissolved	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Zinc, Dissolved	0.0251 mg/l	N/A	N/A	N/A	1	General Site Runoff
Mercury	4.66 ng/l	N/A	N/A	N/A	1	General Site Runoff
Mercury, Dissolved	3.29 ng/l	N/A	N/A	N/A	1	General Site Runoff

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event *(in minutes)*	3. Total rainfall during storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5 Total flow from rain event *(gallons or specify units)*
--	--	--	--	--

7. Provide a description of the method of flow measurement or estimate.

--

II. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Oil & Grease	<5 mg/L	N/A	N/A	N/A	1	
Biological Oxygen Demand (BOD5)	3.5 mg/L	N/A	N/A	N/A	1	General Site Runoff
Chemical Oxygen Demand (COD)	10.6 mg/L	N/A	N/A	N/A	1	General Site Runoff
Total Suspended Solids (TSS)	< 1 mg/L	N/A	N/A	N/A	1	N/A
Total Organic Nitrogen	0.4 mg/l	N/A	N/A	N/A	1	General Site Runoff
Total Phosphorus	0.053 mg/l	N/A	N/A	N/A	1	General Site Runoff
pH	Minimum 7.12 S.U.	Maximum 7.12 S.U.	N/A	N/A	1	N/A

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Chlorine, Total Residual	<0.1 mg/l	N/A	N/A	N/A	1	N/A
Chromium	<0.0003 mg/l	N/A	N/A	N/A	1	N/A
Free Available Chlorine	N/A – as TRC <0.1 mg/l	N/A	N/A	N/A	1	N/A
Temperature (summer)	24 °C	N/A	N/A	N/A	1	N/A
Zinc	0.0437 mg/l	N/A	N/A	N/A	1	General Site Runoff

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall

Pollutant And CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite	Grab Sample Taken During First 30 Minutes	Flow-weighted Composite		
Aluminum	0.136 mg/l	N/A	N/A	N/A	1	General Site Runoff
Ammonia as N	<0.10 mg/l	N/A	N/A	N/A	1	N/A
Antimony	0.00106 mg/l	N/A	N/A	N/A	1	General Site Runoff
Arsenic	<0.00083 mg/l	N/A	N/A	N/A	1	N/A
Barium	0.0111 mg/l	N/A	N/A	N/A	1	General Site Runoff
Beryllium	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Boron	<0.05 mg/l	N/A	N/A	N/A	1	N/A
Cadmium	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Calcium	18.8 mg/l	N/A	N/A	N/A	1	General Site Runoff
Chloride	19 mg/l	N/A	N/A	N/A	1	General Site Runoff
Chromium	<0.0003 mg/l	N/A	N/A	N/A	1	N/A
Cobalt	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Copper	0.00338 mg/l	N/A	N/A	N/A	1	General Site Runoff
Hardness as CaCO3	55.0 mg/l	N/A	N/A	N/A	1	General Site Runoff
Iron	0.155 mg/l	N/A	N/A	N/A	1	General Site Runoff
Lead	<0.0002 mg/l	N/A	N/A	N/A	1	N/A

Magnesium	1.97 mg/l	N/A	N/A	N/A	1	General Site Runoff
Manganese	0.0175 mg/l	N/A	N/A	N/A	1	General Site Runoff
Molybdenum	0.0377 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nickel	0.00095 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nitrate-Nitrite as N	0.36 mg/l	N/A	N/A	N/A	1	General Site Runoff
Selenium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Silver	0.0000165 mg/l	N/A	N/A	N/A	1	General Site Runoff
Thallium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Tin	<0.007 mg/l	N/A	N/A	N/A	1	N/A
Titanium	0.0076 mg/l	N/A	N/A	N/A	1	General Site Runoff
TKN as N	0.40 mg/l	N/A	N/A	N/A	1	General Site Runoff
TPH-Semi-Volatiles (DRO)	<0.549 mg/l	N/A	N/A	N/A	1	N/A
TPH-Volatiles (GRO)	<0.05 mg/l	N/A	N/A	N/A	1	N/A
TSS	<1.00	N/A	N/A	N/A	1	N/A
Vanadium	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Zinc	0.0437 mg/l	N/A	N/A	N/A	1	General Site Runoff
Aluminum, Dissolved	<0.019 mg/l	N/A	N/A	N/A	1	N/A
Antimony, Dissolved	0.00124 mg/l	N/A	N/A	N/A	1	General Site Runoff
Arsenic, Dissolved	<0.00083 mg/l	N/A	N/A	N/A	1	N/A
Barium, Dissolved	0.0123 mg/l	N/A	N/A	N/A	1	General Site Runoff
Beryllium, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Boron, Dissolved	<0.05 mg/l	N/A	N/A	N/A	1	N/A
Cadmium, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Dissolved	<0.0040 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Hexavalent, Dissolved	<0.003 mg/l	N/A	N/A	N/A	1	N/A
Chromium, Trivalent, Dissolved	<0.00400 mg/l	N/A	N/A	N/A	1	N/A
Cobalt, Dissolved	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Copper, Dissolved	0.00339 mg/l	N/A	N/A	N/A	1	General Site Runoff
Iron, Dissolved	0.0424 mg/l	N/A	N/A	N/A	1	General Site Runoff
Lead, Dissolved	<0.0002 mg/l	N/A	N/A	N/A	1	N/A
Magnesium, Dissolved	1.82 mg/l	N/A	N/A	N/A	1	General Site Runoff
Manganese, Dissolved	0.0175 mg/l	N/A	N/A	N/A	1	General Site Runoff
Molybdenum, Dissolved	0.0429 mg/l	N/A	N/A	N/A	1	General Site Runoff
Nickel, Dissolved	0.00102 mg/l	N/A	N/A	N/A	1	General Site Runoff
Selenium, Dissolved	<0.001 mg/l	N/A	N/A	N/A	1	N/A
Silver, Dissolved	<0.00001 mg/l	N/A	N/A	N/A	1	N/A
Thallium, Dissolved	<0.0004 mg/l	N/A	N/A	N/A	1	N/A
Tin, Dissolved	<0.007 mg/l	N/A	N/A	N/A	1	N/A
Titanium, Dissolved	0.0034 mg/l	N/A	N/A	N/A	1	General Site Runoff
Vanadium, Dissolved	0.00162 mg/l	N/A	N/A	N/A	1	General Site Runoff
Zinc, Dissolved	0.0459 mg/l	N/A	N/A	N/A	1	General Site Runoff
Mercury	6.25 ng/l	N/A	N/A	N/A	1	General Site Runoff
Mercury, Dissolved	4.21 ng/l	N/A	N/A	N/A	1	General Site Runoff

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.				
1. Date of Storm Event	2. Duration of Storm Event *(in minutes)*	3. Total rainfall during storm event *(in inches)*	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Total flow from rain event *(gallons or specify units)*
--	--	--	--	--
7. Provide a description of the method of flow measurement or estimate.				
--				

Continued from the Front

Dominion Resources Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
dom.com

Certified Mail
Return Receipt Requested

May 2, 2017

Ms. Susan Mackert
Department of Environmental Quality
Northern Regional Office
13901 Crown Court,
Woodbridge, VA 22193

RE: Dominion-North Anna Power Station
VPDES Permit # VA0052451 Outfall 027 Form 2F Section VII

Dear Ms. Mackert:

Dominion is submitting the analytical results for the North Anna Power Station Outfall 027 Form 2F Section VII as required by Part I.G.23 of VPDES permit #VA0052451. The data included on the attached Form 2F were generated using grab samples collected from Outfall 027 in accordance with Part I.F.1.a.2 on March 27, 2017.

Should you require additional information, please contact Herbert Chriscoe at (804) 273-2484 or via email herbert.f.chriscoe@dom.com.

Sincerely,

Jason E. Williams
Manager, Generation Environmental Services

Enclosures

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.

Name: Daniel G. Stoddard

Title: SVP & CNO Dominion Nuclear

Phone: 804-273-4390

Signature: Dan Stoddard

Date: 5/31/17

OUTFALL 027

EPA ID Number *(copy from Item 1 of Form 1)*
110001891114

Form Approved. OMB No. 2040-0086
Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant And CAS Number *(if available)*	Maximum Values *(mg/L)*		Average Values *(mg/L)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil & Grease	5.1	N/A	N/A	N/A	1	General Site Runoff
Biological Oxygen Demand (BOD5)	3.3	N/A	N/A	N/A	1	General Site Runoff
Chemical Oxygen Demand (COD)	12.1	N/A	N/A	N/A	1	General Site Runoff
Total Suspended Solids (TSS)	2.6	N/A	N/A	N/A	1	General Site Runoff
Total Nitrogen	0.74	N/A	N/A	N/A	1	General Site Runoff
Total Phosphorus	0.186	N/A	N/A	N/A	1	General Site Runoff
pH	Minimum 6.8	Maximum 6.8	Minimum N/A	Maximum N/A	1	General Site Runoff

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant And CAS Number *(if available)*	**Maximum Values** *(mg/L unless otherwise noted)*		**Average Values** *(mg/L unless otherwise noted)*		**Number Of Storm Events Sampled**	**Sources of Pollutants**
	Grab Sample Taken During First 30 Minutes	**Flow-weighted Composite**	**Grab Sample Taken During First 30 Minutes**	**Flow-weighted Composite**		
Flow (MGD)	0.03	N/A	N/A	N/A	1	General Site Runoff
pH	See Part A	--	--	--	--	--
Total Residual Chlorine	<0.1	N/A	N/A	N/A	1	N/A
Total Nitrogen	See Part A	--	--	--	--	--
Total Kjeldahl Nitrogen	0.74	N/A	N/A	N/A	1	General Site Runoff
Nitrate + Nitrite	<0.02	N/A	N/A	N/A	1	N/A
Total Phosphorus	See Part A	--	--	--	--	--
Oil And Grease	See Part A	--	--	--	--	--
Total Suspended Solids	See Part A	--	--	--	--	--
Free Available Chlorine	<0.1	N/A	N/A	N/A	1	N/A
Total Chromium	0.000519	N/A	N/A	N/A	1	General Site Runoff
Total Zinc	0.0416	N/A	N/A	N/A	1	General Site Runoff
Biological Oxygen Demand (BOD5)	See Part A	--	--	--	--	--
E. Coli (MPN)	<1	N/A	N/A	N/A	1	N/A

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant And CAS Number *(if available)*	Maximum Values *(mg/L unless otherwise noted)*		Average Values *(mg/L unless otherwise noted)*		Number Of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
1,1,1-Trichloroethane	<0.001	N/A	N/A	N/A	1	N/A
1,1,2,2-Tetrachloroethane	<0.0015	N/A	N/A	N/A	1	N/A
1,1,2-Trichloroethane	<0.001	N/A	N/A	N/A	1	N/A
1,1-Dichloroethane	<0.001	N/A	N/A	N/A	1	N/A
1,1-Dichloroethylene	<0.001	N/A	N/A	N/A	1	N/A
1,2,4-Trichlorobenzene	<0.00213	N/A	N/A	N/A	1	N/A
1,2-Dichlorobenzene	<0.001	N/A	N/A	N/A	1	N/A
1,2-Dichloroethane	<0.0015	N/A	N/A	N/A	1	N/A
1,2-Dichloropropane	<0.0015	N/A	N/A	N/A	1	N/A
1,2-Diphenylhydrazine	<0.00851	N/A	N/A	N/A	1	N/A
1,3-Dichlorobenzene	<0.001	N/A	N/A	N/A	1	N/A
1,3-Dichloropropene, Total	<0.001	N/A	N/A	N/A	1	N/A
1,4-Dichlorobenzene	<0.001	N/A	N/A	N/A	1	N/A
2,2'-Oxybis (1-chloropropane)	<0.00106	N/A	N/A	N/A	1	N/A
2,4,6-Trichlorophenol	<0.00106	N/A	N/A	N/A	1	N/A
2,4-Dichlorophenol	<0.00106	N/A	N/A	N/A	1	N/A
2,4-Dimethylphenol	<0.00053	N/A	N/A	N/A	1	N/A
2,4-Dinitrophenol	<0.00053	N/A	N/A	N/A	1	N/A
2,4-Dinitrotoluene	<0.00106	N/A	N/A	N/A	1	N/A
2,6-Dinitrotoluene	<0.00106	N/A	N/A	N/A	1	N/A
2-Chloroethyl vinyl ether	<0.005	N/A	N/A	N/A	1	N/A
2-Chloronaphthalene	<0.00106	N/A	N/A	N/A	1	N/A
2-Chlorophenol	<0.00106	N/A	N/A	N/A	1	N/A
2-Nitrophenol	<0.00106	N/A	N/A	N/A	1	N/A
3,3'-Dichlorobenzidine	<0.00426	N/A	N/A	N/A	1	N/A
4,4'-DDD	<0.000005	N/A	N/A	N/A	1	N/A
4,4'-DDE	<0.000005	N/A	N/A	N/A	1	N/A
4,4'-DDT	<0.000005	N/A	N/A	N/A	1	N/A
4,6-Dinitro-2-methylphenol	<0.00106	N/A	N/A	N/A	1	N/A
4-Bromophenyl phenyl ether	<0.00106	N/A	N/A	N/A	1	N/A
4-Chlorophenyl phenyl ether	<0.00106	N/A	N/A	N/A	1	N/A
4-Nitrophenol	<0.00106	N/A	N/A	N/A	1	N/A
Acenaphthene	<0.00106	N/A	N/A	N/A	1	N/A
Acenaphthylene	<0.00106	N/A	N/A	N/A	1	N/A
Acrolein	<0.0255	N/A	N/A	N/A	1	N/A
Acrylonitrile	<0.0085	N/A	N/A	N/A	1	N/A
Aldrin	<0.000005	N/A	N/A	N/A	1	N/A
alpha-BHC	<0.000005	N/A	N/A	N/A	1	N/A
Aluminum	0.129	N/A	N/A	N/A	1	General Site Runoff
Ammonia as N	<0.10	N/A	N/A	N/A	1	N/A
Anthracene	<0.00106	N/A	N/A	N/A	1	N/A
Antimony	0.000207	N/A	N/A	N/A	1	General Site Runoff
Arsenic	0.000898	N/A	N/A	N/A	1	General Site Runoff
Barium	0.0374	N/A	N/A	N/A	1	General Site Runoff
Benzene	<0.001	N/A	N/A	N/A	1	N/A
Benzidine	<0.0532	N/A	N/A	N/A	1	N/A
Benzo (a) anthracene	<0.00851	N/A	N/A	N/A	1	N/A
Benzo (a) pyrene	<0.00106	N/A	N/A	N/A	1	N/A
Benzo (b) fluoranthene	<0.00106	N/A	N/A	N/A	1	N/A
Benzo (g,h,i) perylene	<0.00106	N/A	N/A	N/A	1	N/A
Benzo (k) fluoranthene	<0.00106	N/A	N/A	N/A	1	N/A
Beryllium	<0.0002	N/A	N/A	N/A	1	N/A
beta-BHC	<0.000005	N/A	N/A	N/A	1	N/A

bis (2-Chloroethoxy) methane	<0.00106	N/A	N/A	N/A	1	N/A
bis (2-Chloroethyl) ether	<0.00106	N/A	N/A	N/A	1	N/A
bis (2-Ethylhexyl) phthalate	<0.00106	N/A	N/A	N/A	1	N/A
Boron	<0.0500	N/A	N/A	N/A	1	N/A
Bromide	<1.00	N/A	N/A	N/A	1	N/A
Bromodichloromethane	<0.001	N/A	N/A	N/A	1	N/A
Bromoform	<0.0015	N/A	N/A	N/A	1	N/A
Bromomethane	<0.001	N/A	N/A	N/A	1	N/A
Butyl benzyl phthalate	<0.00106	N/A	N/A	N/A	1	N/A
Cadmium	<0.0002	N/A	N/A	N/A	1	N/A
Carbon tetrachloride	<0.001	N/A	N/A	N/A	1	N/A
Chlordane	<0.000208	N/A	N/A	N/A	1	N/A
Chlorobenzene	<0.0005	N/A	N/A	N/A	1	N/A
Chloroethane	<0.001	N/A	N/A	N/A	1	N/A
Chloroform	<0.001	N/A	N/A	N/A	1	N/A
Chloromethane	<0.0015	N/A	N/A	N/A	1	N/A
Chrysene	<0.00106	N/A	N/A	N/A	1	N/A
cis-1,3-Dichloropropene	<0.001	N/A	N/A	N/A	1	N/A
Cobalt	<0.001	N/A	N/A	N/A	1	N/A
Color, PCU	25.5	N/A	N/A	N/A	1	General Site Runoff
Copper	0.00277	N/A	N/A	N/A	1	General Site Runoff
Cyanide	<0.010	N/A	N/A	N/A	1	N/A
delta-BHC	<0.000005	N/A	N/A	N/A	1	N/A
Dibenz (a,h) anthracene	<0.00106	N/A	N/A	N/A	1	N/A
Dibromochloromethane	<0.001	N/A	N/A	N/A	1	N/A
Dieldrin	<0.000005	N/A	N/A	N/A	1	N/A
Diethyl phthalate	<0.00106	N/A	N/A	N/A	1	N/A
Dimethyl phthalate	<0.00106	N/A	N/A	N/A	1	N/A
Di-n-butyl phthalate	<0.00213	N/A	N/A	N/A	1	N/A
Di-n-octyl phthalate	<0.00106	N/A	N/A	N/A	1	N/A
Endosulfan I	<0.000005	N/A	N/A	N/A	1	N/A
Endosulfan II	<0.000005	N/A	N/A	N/A	1	N/A
Endosulfan sulfate	<0.000005	N/A	N/A	N/A	1	N/A
Endrin	<0.000005	N/A	N/A	N/A	1	N/A
Endrin aldehyde	<0.000005	N/A	N/A	N/A	1	N/A
Ethylbenzene	<0.0005	N/A	N/A	N/A	1	N/A
Fecal Coliform, MPN/100mL	<2	N/A	N/A	N/A	1	N/A
Fluoranthene	<0.00106	N/A	N/A	N/A	1	N/A
Fluorene	<0.00106	N/A	N/A	N/A	1	N/A
Fluoride	<0.1	N/A	N/A	N/A	1	N/A
gamma-BHC (Lindane)	<0.000005	N/A	N/A	N/A	1	N/A
Heptachlor	<0.000005	N/A	N/A	N/A	1	N/A
Heptachlor epoxide	<0.000005	N/A	N/A	N/A	1	N/A
Hexachlorobenzene	<0.00266	N/A	N/A	N/A	1	N/A
Hexachlorobutadiene	<0.00106	N/A	N/A	N/A	1	N/A
Hexachlorocyclopentadiene	<0.00106	N/A	N/A	N/A	1	N/A
Hexachloroethane	<0.00106	N/A	N/A	N/A	1	N/A
Hydrogen Sulfide	<3	N/A	N/A	N/A	1	N/A
Indeno (1,2,3-cd) pyrene	<0.00106	N/A	N/A	N/A	1	N/A
Iron	0.549	N/A	N/A	N/A	1	General Site Runoff
Isophorone	<0.00106	N/A	N/A	N/A	1	N/A
Kepone	<0.00213	N/A	N/A	N/A	1	N/A
Lead	0.000281	N/A	N/A	N/A	1	General Site Runoff
Magnesium	1.5	N/A	N/A	N/A	1	General Site Runoff
Manganese	0.0835	N/A	N/A	N/A	1	General Site Runoff
Mercury	<0.0001	N/A	N/A	N/A	1	N/A
Methoxychlor	<0.000005	N/A	N/A	N/A	1	N/A
Methylene chloride	<0.005	N/A	N/A	N/A	1	N/A
Molybdenum	0.0039	N/A	N/A	N/A	1	General Site Runoff
Naphthalene	<0.00851	N/A	N/A	N/A	1	N/A
Nickel	0.000737	N/A	N/A	N/A	1	General Site Runoff
Nitrobenzene	<0.00851	N/A	N/A	N/A	1	N/A
Nitrogen, Organic	0.74	N/A	N/A	N/A	1	General Site Runoff
n-Nitrosodimethylamine	<0.00213	N/A	N/A	N/A	1	N/A
n-Nitrosodi-n-propylamine	<0.00213	N/A	N/A	N/A	1	N/A

n-Nitrosodiphenylamine	<0.00851	N/A	N/A	N/A	1	N/A
o-Cresol	<0.00851	N/A	N/A	N/A	1	N/A
Oil and Grease	5.1	N/A	N/A	N/A	1	General Site Runoff
PCB as Aroclor 1016	<0.00003	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1221	<0.0002	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1232	<0.00002	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1242	<0.00004	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1248	<0.00005	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1254	<0.00004	N/A	N/A	N/A	1	N/A
PCB as Aroclor 1260	<0.00004	N/A	N/A	N/A	1	N/A
p-Chloro-m-cresol	<0.00851	N/A	N/A	N/A	1	N/A
p-Cresol	<0.00106	N/A	N/A	N/A	1	N/A
Pentachlorophenol	<0.0106	N/A	N/A	N/A	1	N/A
Phenanthrene	<0.00851	N/A	N/A	N/A	1	N/A
Phenol	<0.00851	N/A	N/A	N/A	1	N/A
Pyrene	<0.00851	N/A	N/A	N/A	1	N/A
Selenium	<0.001	N/A	N/A	N/A	1	N/A
Silver	<0.00001	N/A	N/A	N/A	1	N/A
Sulfate	10.8	N/A	N/A	N/A	1	General Site Runoff
Sulfide	<3	N/A	N/A	N/A	1	N/A
TDS	676	N/A	N/A	N/A	1	General Site Runoff
Tetrachloroethylene (PCE)	<0.001	N/A	N/A	N/A	1	N/A
Thallium	<0.0004	N/A	N/A	N/A	1	N/A
Tin	<0.007	N/A	N/A	N/A	1	N/A
Titanium	0.008	N/A	N/A	N/A	1	General Site Runoff
Toluene	<0.001	N/A	N/A	N/A	1	N/A
Total Recoverable Phenolics	<0.05	N/A	N/A	N/A	1	N/A
Toxaphene	<0.000208	N/A	N/A	N/A	1	N/A
trans-1,2-Dichloroethylene	<0.001	N/A	N/A	N/A	1	N/A
trans-1,3-Dichloropropene	<0.001	N/A	N/A	N/A	1	N/A
Trichloroethylene	<0.001	N/A	N/A	N/A	1	N/A
Vanadium	0.00213	N/A	N/A	N/A	1	N/A
Vinyl chloride	<0.001	N/A	N/A	N/A	1	N/A
2,4,5-TP	<0.0002	N/A	N/A	N/A	1	N/A
2,4-D	<0.0002	N/A	N/A	N/A	1	N/A
Guthion	<0.001	N/A	N/A	N/A	1	N/A
Chloropyrifos	<0.0002	N/A	N/A	N/A	1	N/A
Parathion	<0.001	N/A	N/A	N/A	1	N/A
Malathion	<0.001	N/A	N/A	N/A	1	N/A
Diazinon	<0.001	N/A	N/A	N/A	1	N/A
Gross Alpha (pCi/L)	<2.83	N/A	N/A	N/A	1	N/A
Gross Beta (pCi/L)	2.19	N/A	N/A	N/A	1	General Site Runoff
Radium 226 (pCi/L)	<0.669	N/A	N/A	N/A	1	N/A
Radium 228 (pCi/L)	<1.4	N/A	N/A	N/A	1	N/A
Strontium 90 (pCi/L)	<1.14	N/A	N/A	N/A	1	N/A
Tritium (pCi/L)	<284	N/A	N/A	N/A	1	N/A
Total Uranium	<0.000193	N/A	N/A	N/A	1	N/A
Total Radium (pCi/L)	<2.07	N/A	N/A	N/A	1	N/A
MBAS-Surfactants	<0.100	N/A	N/A	N/A	1	N/A
Asbestos (MF/L)	<1.78	N/A	N/A	N/A	1	N/A

Part D – Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

OUTFALL	1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during event (gallons/minute)	6. Total flow from rain event (gallons)
027	03/27/2017	95	0.18	225	4.20	30,060

The storm event was sampled in accordance with the VPDES VA0052451 Part I.F.1.a.2.

7. Provide a description of the method of flow measurement or estimate

The rain data was obtained from Weather Sentry Online.

Flow estimates are based on the size of drainage area and the impervious surface for Outfall 027.

$$\frac{\text{Inches of Rain} \times \text{Drainage Area (sq. inches)}}{231 \text{ (conversion to gallons/cu. inch)}} = \text{Total gallons} \times \text{Drainage Area's runoff coefficient} = \frac{\text{Total gallons discharged(gal)}}{\text{Duration of Event(min)}} = \text{Flow rate(gal/min)}$$

VPDES Permit Application Addendum

VPDES Permit Application Addendum

1. **Entity to whom the permit is to be issued:** Virginia Electric and Power Company
Who will be legally responsible for the wastewater treatment facilities and compliance with the permit? This may or may not be the facility or property owner.

2. **Is this facility located within city or town boundaries?** Yes ☐ No ☑

3. **Provide the tax map parcel number for the land where the discharge is located.** Unknown (1)

4. **For the facility to be covered by this permit, how many acres will be disturbed during the next five years due to new construction activities?** None

5. **What is the design average effluent flow of this facility?** 3225.6 (2) MGD
For industrial facilities, provide the max. 30-day average production level, include units:
2440.52 MGD (3)

In addition to the design flow or production level, should the permit be written with limits for any other discharge flow tiers or production levels? Yes ☐ No ☑

If "Yes", please identify the other flow tiers (in MGD) or production levels:

—

Please consider the following questions for both the flow tiers and the production levels (if applicable): Do you plan to expand operations during the next five years? Is your facility's design flow considerably greater than your current flow?

6. **Nature of operations generating wastewater:**

Generation of electricity with steam produced by the fission of nuclear materials; domestic wastewater

<1 % of flow from domestic connections/sources

Number of private residences to be served by the treatment None (zero)

>99 % of flow from non-domestic connections/sources

7. **Mode of discharge:** ☑ Continuous ☐ Intermittent ☐ Seasonal
Describe frequency and duration of intermittent or seasonal discharges:

—

8. **Identify the characteristics of the receiving stream at the point just above the facility's discharge point:**

___ Permanent stream, never dry

___ Intermittent stream, usually flowing, sometimes dry

___ Ephemeral stream, wet-weather flow, often dry

___ Effluent-dependent stream, usually or always dry without effluent

X Lake or pond at or below the discharge point

___ Other: ___

9. **Approval Date(s):**

O & M Manual (4) **Sludge/Solids Management Plan** May 8, 2014 (5)

Have there been any changes in your operations or procedures since the above approval dates? Yes ☑ No ☐

10. **Privately Owned Treatment Works**

If this application is for a privately owned treatment works serving, or designed to serve, 50 or more residences, you must include with your application notification from the State Corporation Commission that you are incorporated in the Commonwealth and verification from the SCC that you are in compliance with all regulations and relevant orders of the State Corporation Commission. Incorporated also includes Limited Liability Companies (LLCs), Limited Partnerships (LPs) and certificates of authority.

11. **Consent to receive electronic mail**

The Department of Environmental Quality (DEQ) may deliver permits and certifications (this includes permit issuances, reissuances, modifications, revocation and reissuances, terminations and denials) to recipients, including applicants or permittees, by electronically certified mail where the recipients notify DEQ of their consent to receive mail electronically (§ 10.1-1183). Check *only one* of the following to consent to or decline receipt of electronic mail from DEQ as follows:

☑ Applicant or permittee agrees to receive by electronic mail the permit that may be issued for the proposed pollutant management activity, and to certify receipt of such electronic mail when requested by the DEQ.

If yes, provide email: jason.e.williams@dominionenergy.com

☐ Applicant or permittee declines to receive by electronic mail the permit that may be issued for the proposed pollutant management activity.

12. **Financial Assurance/Closure**

Not Applicable

The Financial Assurance Regulation, 9VAC25-650 applies to all privately owned sewerage systems that treat sewage generated by private residences and discharge more than 1,000 gallons per day and less than 40,000 gallons per day. A private residence is defined as any building, buildings or part of a building owned by a private entity which serves as a permanent residence where sewage is generated. It does not apply to hotels, motels, seasonal camps and industrial facilities that do not serve as permanent residences. The regulation requires that a closure plan, a cost estimate and a financial assurance mechanism be in place. If financial assurance/cost estimate/closure plan requirement is applicable to this facility please review the following:

For reissuances (existing facilities):

The Financial Assurance Regulation 9VAC25-650 also requires that the permittee review the closure plan and cost estimate at the end of the VPDES permit term and that the permittee submit the plan, the cost estimate and a written summary of their review, and of any modifications to the plan, concurrently with

this application for permit reissuance. If the permittee's review of the closure plan and cost estimate result in changes to the cost estimate greater than that which would result from the required annual inflationary adjustment per the permit's special condition and 9VAC25-650-30 B, the resulting increase to the existing financial assurance mechanism should be made.

Review and update if necessary, the closure plan, cost estimate and financial assurance mechanism per the last annual inflationary adjustment or today if changed from last annual inflationary adjustment. Send to the DEQ Office of Financial Responsibility at the address below via tracked mail.

For issuances (new facilities or facilities not built):

Include the closure plan, cost estimate and financial assurance mechanism with this application to the following address via UPS, FEDEX or USPS tracked mail:

Department of Environmental Quality
Office of Financial Responsibility and Waste Programs
P.O. Box 1105
Richmond, VA 23218

You may use the attached suggested wording for closure plan permanent facility closure, 24 month contract operation and closure plan third party implementation agreement. Also include the signed application for closure plan approval. Questions about these financial assurance and closure requirements may be directed to Suzanne Taylor at (804) 698-4146.

NOTES

(1)Virginia Electric and Power Company and Old Dominion Electric Cooperative own, and Virginia Electric and Power Company controls, all of the land within the North Anna Power Station (NAPS) boundary, both above and beneath the water surface, including those portions of Lake Anna and the waste heat treatment facility that lie within the site boundary. [The NAPS boundary is equivalent to the Exclusion Area Boundary as approved by the Nuclear Regulatory Commission.] The NAPS property comprises 1803 acres, approximately 760 acres of which are covered by water. Virginia Power and Old Dominion electric Cooperative also own all the land outside the NAPS boundary that forms Lake Anna, up to the expected high-water mark (i.e. elevation 255 ft above mean sea level). The NAPS site and all supporting facilities, including Lake Anna and the waste heat treatment facility, the earthen dam that forms Lake Anna, dikes railroad spur, and roads constitute approximately 18,643 acres. Virginia Power also owns and operates the North Anna Hydroelectric Project, an 855- kilowatt capacity hydroelectric power plant at the base of the dam that forms Lake Anna.
(2) Maximum 30-day maximum flow from Outfall 001 based on data generated January 2015 - December 2017.
(3) Maximum 30-day average flow from Outfall 001 based on data generated January 2015 - December 2017.
(4) The O&M manual was revised on October 23, 2017. Permit Condition G.1 does not require submittal of the O&M manual for review and approval unless requested by the DEQ.
(5) The Sludge Management Plan (Sludge Form) was submitted with the previous permit reissuance application and was approved when the permit was issued on May 8, 2014.

VPDES Sludge Application

VPDES SEWAGE SLUDGE PERMIT APPLICATION FORM

SCREENING INFORMATION

This application is divided into four sections. Section A pertains to all applicants. The applicability of Sections B, C and D depends on your facility's sewage sludge use or disposal practices. The information provided on this page will help you determine which sections to fill out.

1. All applicants must complete Section A (General Information).

2. Does this facility generate sewage sludge? _X_ Yes _____ No

   Does this facility derive a material from sewage sludge? _____ Yes _X_ No

   If you answered "Yes" to either, complete Section B (Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge).

3. Does this facility apply sewage sludge to the land? _____ Yes _X_ No

   Is sewage sludge from this facility applied to the land? Yes _X_ _____ No

   If you answer "No" to all above, skip Section C.

   If you answered "Yes" to either, answer the following three questions:

   a. Does the sewage sludge from this facility meet the ceiling concentrations, pollutant concentrations, Class A pathogen reduction requirements and one of the vector attraction reduction requirements 1-8, as identified in the instructions?
      _____ Yes _X_ No

   b. Is sewage sludge from this facility placed in a bag or other container for sale or give-away for application to the land?
      _____ Yes _X_ No

   c. Is sewage sludge from this facility sent to another facility for treatment or blending? _X_ Yes _____ No

   If you answered "No" to all three, complete Section C (Land Application Of Bulk Sewage Sludge).

   If you answered "Yes" to a, b or c, skip Section C.

4. Do you own or operate a surface disposal site? _____ Yes _X_ No

   If "Yes", complete Section D (Surface Disposal).

SECTION A. GENERAL INFORMATION

All applicants must complete this section.

1. **Facility Information.**
   a. Facility name: Dominion Energy – North Anna Power Station
   b. Contact person: Randy Markey
      Title: Environmental Compliance Coordinator
      Phone: (540) 894-2856
   c. Mailing address:
      Street or P.O. Box: 1022 Haley Drive
      City or Town: Mineral State: Virginia Zip: 23117
   d. Facility location:
      Street or Route #: 1022 Haley Drive
      County: Louisa
      City or Town: Mineral State: Virginia Zip: 23117
   e. Is this facility a Class I sludge management facility? _____ Yes _X_ No
   f. Facility design flow rate: Units 1&2 STP= 0.03 mgd
   g. Total population served: Units 1&2= 950
   h. Indicate the type of facility:
      _____ Publicly owned treatment works (POTW)
      _X_ Privately owned treatment works
      _____ Federally owned treatment works
      _____ Blending or treatment operation
      _____ Surface disposal site
      _____ Other (describe):

2. **Applicant Information.** If the applicant is different from the above, provide the following:
   a. Applicant name: Virginia Electric and Power Company
   b. Mailing address:
      Street or P.O. Box: 5000 Dominion Boulevard
      City or Town: Glen Allen State: Virginia Zip: 23060
   c. Contact person: Jason E. Williams
      Title: Director, Environmental
      Phone: (804) 273-2646
   d. Is the applicant the owner or operator (or both) of this facility?
      _X_ owner _X_ operator
   e. Should correspondence regarding this permit be directed to the facility or the applicant?
      ____ facility _X_ applicant

3. **Permit Information.**
   a. Facility's VPDES permit number (if applicable): VA0052451
   b. List on this form or an attachment, all other federal, state or local permits or construction approvals received or applied for that regulate this facility's sewage sludge management practices:

Permit Number:	Type of Permit:
N/A	N/A

4. **Indian Country.** Does any generation, treatment, storage, application to land or disposal of sewage sludge from this facility occur in Indian Country? _____ Yes _X_ No If "Yes", describe:

5. **Topographic Map.** Provide a topographic map or maps (or other appropriate maps if a topographic map is unavailable) that shows the following information. Maps should include the area one mile beyond all property boundaries of the facility:
   a. Location of all sewage sludge management facilities, including locations where sewage sludge is generated, stored, treated, or disposed.
   b. Location of all wells, springs, and other surface water bodies listed in public records or otherwise known to the applicant within 1/4 mile of the property boundaries. **Attachment A**

6. **Line Drawing.** Provide a line drawing and/or a narrative description that identifies all sewage sludge processes that will be employed during the term of the permit including all processes used for collecting, dewatering, storing, or treating sewage sludge, the destination(s) of all liquids and solids leaving each unit, and all methods used for pathogen reduction and vector attraction reduction. **Attachment B**

7. **Contractor Information.** Are any operational or maintenance aspects of this facility related to sewage sludge generation, treatment, use or disposal the responsibility of a contractor? _X_ Yes _____ No

   If "Yes", provide the following for each contractor (attach additional pages if necessary).

   Name: Hauler – Stamie E. Lyttle Co., Inc. (Benjamin Chapin – Manager Service Deptartment)

   Mailing address:

   Street or P.O. Box: 2210 East Belt Blvd., P.O. Box 24205

   City or Town: Richmond State: Virginia Zip: 23224

   Phone: (804) 232-6774

   Contractor's Federal, State or Local Permit Number(s) applicable to this facility's sewage sludge:

   VDH (Chesterfield County) Permit Numbers:

   17-120-0001H, 14-120-0009H, 13-120-0003H, 04-120-0006H, and 96-120-0001H6

   If the contractor is responsible for the use and/or disposal of the sewage sludge, provide a description of the service to be provided to the applicant and the respective obligations of the applicant and the contractor(s). N/A

8. **Pollutant Concentrations.** Using the table below or a separate attachment, provide sewage sludge monitoring data for the pollutants which limits in sewage sludge have been established in 9 VAC 25-31-10 et seq. for this facility's expected use or disposal practices. All data must be based on three or more samples taken at least one month apart and must be no more than four and one-half years old. **See Note below.**

POLLUTANT	CONCENTRATION (mg/kg dry weight)	SAMPLE DATE	ANALYTICAL METHOD	DETECTION LEVEL FOR ANALYSIS
Arsenic				
Cadmium				
Chromium				
Copper				
Lead				
Mercury				
Molybdenum				
Nickel				
Selenium				
Zinc				

See Table 1 below for a summary of the City of Richmond's sludge data from January 2014 – July 2018.

NOTE: As provided for in the VPDES Sewage Sludge Permit Application Form Instructions, no sewage sludge monitoring data has been reported because no sewage sludge permit limitations or monitoring requirements have been established in the North Anna Power Station VPDES permit. In a previous application, DEQ has requested sewage sludge data be included from the City of Richmond's WWTP as the majority of the sanitary waste sludge generated at North Anna are processed by the City. For this reason, a summary of the City of Richmond's sludge data from January 2014 – July 2018 is included here.

Table 1. City of Richmond Sludge Data from Discharge Monitoring Report (DMR)

DMR Date	As (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Mo (mg/kg)	Ni (mg/kg)	Cu (mg/kg)	Zn (mg/kg)	Se (mg/kg)	Cd (mg/kg)
Jan-14	7.2	78.7	0.7	10.4	24.8	368	877	4	8
Mar-14	4	44.8	0.5	5	12.2	163	503	4	3
May-14	22.5	107	0.8	10.7	23.9	321	896	4	4
Jul-14	4	48.5	0.6	5.4	13.8	168	461	4	4
Sep-14	4	62	0.7	13.2	28	351	838	4	7
Nov-14	4	60	0.7	17.1	29	408	1060	4	8
Mar-15	24.2	52	0.44	11.3	20.5	322	827	4	8.29
May-15	10.2	45.9	2.01	12.3	19.4	293	765	4	8.84
Aug-15	4	25.5	0.7	5.1	7.6	108	314	4	2.2
Jan-15	22	49.7	1.1	12	19.4	355	777	4	1.2
Sep-15	7.6	55.2	1.1	16.9	66.3	317	874	4	6.7
Dec-15	6.5	61.7	0.2	9.8	16.7	294	75.1	4	3.4
Jan-16	4	72.3	0.6	10.9	24	330	954	4	8.7
Mar-16	4.4	54.7	0.65	5.3	12.9	210	524	4	9.78
May-16	4	84.9	1.02	8.75	18.2	306	869	4	12.4
Jul-16	4	114	0.776	11	22.7	312	899	4	7.58
Sep-16	6.1	88.4	0.65	12.7	20.8	353	924	4	14.3
Nov-16	4	21.1	0.19	4.88	6.14	101	289	4	2.66
Feb-17	4	21.3	0.144	4.99	7.8	113	306	4	2
Mar-17	4	30.9	0.166	6.26	12.4	174	452	4	7.91
May-17	3.71	25.7	0.233	4.16	6.82	105	296	3.71	2.81
Jul-17	4	24.1	0.172	4.75	6.4	27.3	291	4	2.19
Sep-17	4	32.9	0.336	10.6	10.1	197	566	4	3.99
Nov-17	4	53.1	0.91	13.1	19	369	1440	4	8.28
Jan-18	4	54.5	0.691	14.4	20.4	392	1360	4	8.23
Mar-18	4	59.6	0.616	12.7	21.3	324	922	4	7.69
May-18	4	71.5	0.577	5.02	18.1	336	888	4	13.9
Jul-18	5.7	70.6	0.31	8.37	9.04	260	789	8.37	6

9.Certification. Read and submit the following certification statement with this application. Refer to the instructions to determine who is an officer for purposes of this certification. Indicate which parts of the application you have completed and are submitting:

__X__ Section A (General Information)

__X__ Section B (Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge)

_____ Section C (Land Application of Bulk Sewage Sludge) **Not Applicable**

_____ Section D (Surface Disposal) **Not Applicable**

"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 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."

Name and official title: Larry Lane, Site Vice President

Signature: _____

Date Signed: 10-15-18

Telephone number (540) 894-2101

Upon request of the department, you must submit any other information necessary to assess sewage sludge use or disposal practices at your facility or identify appropriate permitting requirements.

SECTION B. GENERATION OF SEWAGE SLUDGE OR PREPARATION OF A MATERIAL DERIVED FROM SEWAGE SLUDGE

Complete this section if your facility generates sewage sludge or derives a material from sewage sludge

1. **Amount Generated On Site.**
Total dry metric tons per 365-day period generated at your facility: < 1 dry metric tons

N/A 2. **Amount Received from Off Site.** If your facility receives sewage sludge from another facility for treatment, use or disposal, provide the following information for each facility from which sewage sludge is received. If you receive sewage sludge from more than one facility, attach additional pages as necessary.

a. Facility name: –

b. Contact Person: –

Title: –

Phone: (–) –

c. Mailing address:

Street or P.O. Box: –

City or Town: – State: – Zip: –

d. Facility location–

(not P.O. Box)

e. Total dry metric tons per 365-day period received from this facility: – dry metric tons

f. Describe, on this form or on another sheet of paper, any treatment processes known to occur at the off-site facility, including blending activities and treatment to reduce pathogens or vector attraction characteristics:

–

–

3. **Treatment Provided at Your Facility.**

a. Which class of pathogen reduction is achieved for the sewage sludge at your facility?
_____ Class A _____ Class B _X_ Neither or unknown

b. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce pathogens in sewage sludge: Low-level radioactive wastes are dried on the sludge drying beds and incinerated off-site

c. Which vector attraction reduction option is met for the sewage sludge at your facility?

_____ Option 1 (Minimum 38 percent reduction in volatile solids)

_____ Option 2 (Anaerobic process, with bench-scale demonstration)

_____ Option 3 (Aerobic process, with bench-scale demonstration)

_____ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)

_____ Option 5 (Aerobic processes plus raised temperature)

_____ Option 6 (Raise pH to 12 and retain at 11.5)

_____ Option 7 (75 percent solids with no unstabilized solids)

_____ Option 8 (90 percent solids with unstabilized solids)

_X_ None or unknown

d. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce vector attraction properties of sewage sludge: None

e. Describe, on this form or another sheet of paper, any other sewage sludge treatment activities, including blending, not identified in a - d above: None

N/A **4. Preparation of Sewage Sludge Meeting Ceiling and Pollutant Concentrations, Class A Pathogen Requirements and One of Vector Attraction Reduction Options 1-8 (EQ Sludge).**

(If sewage sludge from your facility does not meet all of these criteria, skip Question 4.)

a. Total dry metric tons per 365-day period of sewage sludge subject to this section that is applied to the land:

_____ dry metric tons

b. Is sewage sludge subject to this section placed in bags or other containers for sale or give-away?

_____ Yes _____ No

N/A **5. Sale or Give-Away In a Bag or Other Container for Application to the Land.**

(Complete this question if you place sewage sludge in a bag or other container for sale or give-away prior to land application. Skip this question if sewage sludge is covered in Question 4.)

a. Total dry metric tons per 365-day period of sewage sludge placed in a bag or other container at your facility for sale or give-away for application to the land: _____ dry metric tons

b. Attach, with this application, a copy of all labels or notices that accompany the sewage sludge being sold or given away in a bag or other container for application to the land.

6. Shipment Off Site for Treatment or Blending.

(Complete this question if sewage sludge from your facility is sent to another facility that provides treatment or blending. This question does not apply to sewage sludge sent directly to a land application or surface disposal site. Skip this question if the sewage sludge is covered in Questions 4 or 5. If you send sewage sludge to more than one facility, attach additional sheets as necessary.)

a. Receiving facility name: City of Richmond WWTP

b. Facility contact: Clair L. Watson

Title: Plant Manager

Phone: (804) 646- 8903

c. Mailing address:

Street or P.O. Box: 1400 Brander Street

City or Town: Richmond State: Virginia Zip: 23224

d. Total dry metric tons per 365-day period of sewage sludge provided to receiving facility: ≤1 dry metric tons

e. List, on this form or an attachment, the receiving facility's VPDES permit number as well as the numbers of all other federal, state or local permits that regulate the receiving facility's sewage sludge use or disposal practices:

Permit Number:	Type of Permit:
VA0063177	VPDES
_____	_____

f. Does the receiving facility provide additional treatment to reduce pathogens in sewage sludge from your facility?

X Yes _____ No

Which class of pathogen reduction is achieved for the sewage sludge at the receiving facility?

_____ Class A X Class B _____ Neither or unknown

Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce pathogens in sewage sludge: Sludge thickening, anaerobic digestion, dewatering, land application

g. Does the receiving facility provide additional treatment to reduce vector attraction characteristics of the sewage sludge? X Yes _____ No

Which vector attraction reduction option is met for the sewage sludge at the receiving facility?

X Option 1 (Minimum 38 percent reduction in volatile solids)

_____Option 2 (Anaerobic process, with bench-scale demonstration)

_____ Option 3 (Aerobic process, with bench-scale demonstration)

_____ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)

_____ Option 5 (Aerobic processes plus raised temperature)

_____ Option 6 (Raise pH to 12 and retain at 11.5)

_____ Option 7 (75 percent solids with no unstabilized solids)

_____ Option 8 (90 percent solids with unstabilized solids)

_____ None unknown

Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce vector attraction properties of sewage sludge: N/A

h. Does the receiving facility provide any additional treatment or blending not identified in f or g above? _____ Yes _X_ No

If "Yes", describe, on this form or another sheet of paper, the treatment processes not identified in f or g above:

i. If you answered "Yes" to f, g or h above, attach a copy of any information you provide to the receiving facility to comply with the "notice and necessary information" requirement of 9 VAC 25-31-530.G. N/A

j Does the receiving facility place sewage sludge from your facility in a bag or other container for sale or give-away for application to the land? _____ Yes _X_ No

If "Yes", provide a copy of all labels or notices that accompany the product being sold or given away.

k. Will the sewage sludge be transported to the receiving facility in a truck-mounted watertight tank normally used for such purposes? _X_ Yes _____ No. If "No", provide description and specification on the vehicle used to transport the sewage sludge to the receiving facility.

Show the haul route(s) on a location map or briefly describe the haul route below and indicate the days of the week and the times of the day sewage sludge will be transported.

See attached map and haul route. Sludge will be hauled on an as need basis during normal business hours, Monday – Friday

N/A **7. Land Application of Bulk Sewage Sludge.**

(Complete Question 7.a if sewage sludge from your facility is applied to the land, unless the sewage sludge is covered in Questions 4, 5 or 6. Complete Question 7.b, c & d only if you are responsible for land application of sewage sludge.)

a. Total dry metric tons per 365-day period of sewage sludge applied to all land application sites:

_____ dry metric tons

b. Do you identify all land application sites in Section C of this application? _____ Yes _____ No

If "No", submit a copy of the Land Application Plan (LAP) with this application (LAP should be prepared in accordance with the instructions).

c. Are any land application sites located in States other than Virginia? _____ Yes _____ No

If "Yes", describe, on this form or on another sheet of paper, how you notify the permitting authority for the States where the land application sites are located. Provide a copy of the notification.

d. Attach a copy of any information you provide to the owner or lease holder of the land application sites to comply with the "notice and necessary" information requirement of 9 VAC 25-31-530 F and/or H (Examples may be obtained in Appendix IV).

N/A **8. Surface Disposal.**

(Complete Question 8 if sewage sludge from your facility is placed on a surface disposal site.)

a. Total dry metric tons per 365-day period of sewage sludge from your facility placed on all surface disposal sites: _____ dry metric tons

b. Do you own or operate all surface disposal sites to which you send sewage sludge for disposal?
_____ Yes _____ No

If "No", answer questions c - g for each surface disposal site that you do not own or operate. If you send sewage sludge to more than one surface disposal site, attach additional pages as necessary.

c. Site name or number:

_____

d. Contact person:

_____

Title:

_____

Phone: (_____) _____

Contact is: _____ Site Owner _____ Site operator

e. Mailing address:

Street or P.O. Box:

_____

City or Town: _____ State: _____ Zip: _____

f. Total dry metric tons per 365-day period of sewage sludge from your facility placed on this surface disposal site: _____ dry metric tons

g. List, on this form or an attachment, the surface disposal site VPDES permit number as well as the numbers of all other federal, state or local permits that regulate the sewage sludge use or disposal practices at the surface disposal site:

Permit Number:	Type of Permit:
_____	_____
_____	_____

9. Incineration.

(Complete Question 9 if sewage sludge from your facility is fired in a sewage sludge incinerator.)

a. Total dry metric tons per 365-day period of sewage sludge from your facility fired in a sewage sludge incinerator: <1* dry metric tons *Low-level radioactive waste only

b. Do you own or operate all sewage sludge incinerators in which sewage sludge from your facility is fired?
_____ Yes _X_ No

If "No", answer questions c - g for each sewage sludge incinerator that you do not own or operate. If you send sewage sludge to more than one sewage sludge incinerator, attach additional pages as necessary.

c. Incinerator name or number: Duratek Services, Inc.

d. Contact person: Dennis Hennen

Title: Account Manager

Phone: (865) 220-1632

Contact is: _X_ Incinerator Owner _X_ Incinerator Operator

e. Mailing address:

Street or P.O. Box: 1560 Bear Creek Road, PO Box 2530

City or Town: Oak Ridge State: TN Zip: 37830

f. Total dry metric tons per 365-day period of sewage sludge from your facility fired in this sewage sludge incinerator: <1* dry metric tons *Low-level radioactive waste only

g. List on this form or an attachment the numbers of all other federal, state or local permits that regulate the

firing of sewage sludge at this incinerator:

Permit Number:	Type of Permit:
450482	Conditional Major Operating Permit (TN Division of Air Pollution)
TNR051628	NPDES Permit for Storm Water discharges Associated with Industrial Activity
Permit Number:	Type of Permit:
TND 98-215-7570	Hazardous Waste Generator
071299 851 014H	Hazardous Materials Certification of Registration (DOT)
TN-8004	Tracking system Permit (Illinois Department of Nuclear Safety)
T-TNO12-L05	Radioactive Waste Delivery License

N/A **10. Disposal in a Municipal Solid Waste Landfill.**

(Complete Question 10 if sewage sludge from your facility is placed on a municipal solid waste landfill. Provide the following information for each municipal solid waste landfill on which sewage sludge from your facility is placed. If sewage sludge is placed on more than one municipal solid waste landfill, attach additional pages as necessary.)

a. Landfill name:

_____

b. Contact person: _____

Title: _____

Phone: (_____) _____

Contact is: _____ Landfill Owner _____ Landfill Operator

c. Mailing address:

Street or P.O. Box:

_____

City or Town: _____ State: _____ Zip: _____

d. Landfill location.

Street or Route #: _____

County: _____

City or Town: _____ State: _____ Zip: _____

e. Total dry metric tons per 365-day period of sewage sludge placed in this municipal solid waste landfill:

_____ dry metric tons

f. List, on this form or an attachment, the numbers of all federal, state or local permits that regulate the operation of this municipal solid waste landfill:

Permit Number:	Type of Permit:
_____	_____

g. Does sewage sludge meet applicable requirements in the Virginia Solid Waste Management Regulation, 9 VAC 20-80-10 et seq., concerning the quality of materials disposed in a municipal solid waste landfill? _____ Yes _____ No

h. Does the municipal solid waste landfill comply with all applicable criteria set forth in the Virginia Solid Waste Management Regulation, 9 VAC 20-80-10 et seq.? _____ Yes _____ No

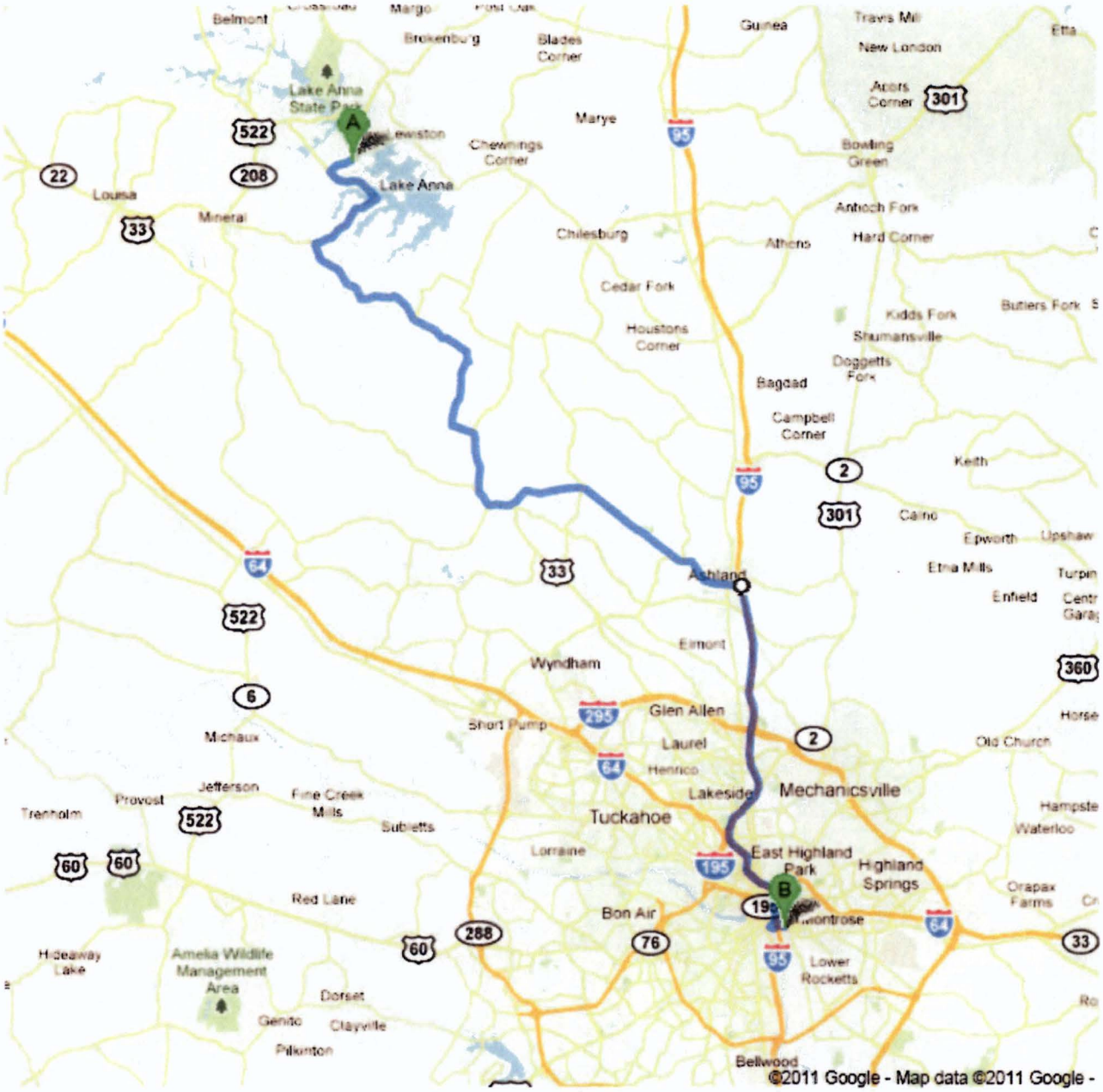
i. Will the vehicle bed or other container used to transport sewage sludge to the municipal solid waste landfill be watertight and covered? _____ Yes _____ No

Show the haul route(s) on a location map or briefly describe the route below and indicate the days of the week and time of the day sewage sludge will be transported.

_____

Pages 10 – 16 were not included as they are "Not Applicable"

FACILITY NAME: North Anna Power Station **VPDES PERMIT NUMBER: VA0052451**



A 1022 Haley Dr, Bumpass, VA 23024

1.	Head **southwest** on **Haley Dr/State Route 700** toward **Kentucky Springs Rd/State Route 652** About 3 mins	go 1.2 mi total 1.2 mi
2.	Take the 2nd left onto **Kentucky Springs Rd/State Route 652** About 5 mins	go 2.8 mi total 3.9 mi
3.	Turn right onto **Elk Creek Rd/State Route 614** About 6 mins	go 3.9 mi total 7.8 mi
4.	Sharp left onto **Fredericks Hall Rd/State Route 618** Continue to follow State Route 618 About 14 mins	go 9.8 mi total 17.6 mi
5.	Turn right onto **State Route 680/Woodsons Mill Rd** About 1 min	go 0.5 mi total 18.1 mi
6.	Turn right onto **Shiloh Church Rd/State Route 680** About 5 mins	go 3.4 mi total 21.5 mi
7.	Slight left onto **Old Ridge Rd/State Route 631** About 2 mins	go 1.1 mi total 22.6 mi
8.	Turn right onto **Beaver Dam Rd/State Route 715** About 4 mins	go 2.9 mi total 25.6 mi
9.	Turn left onto **US-33 E/Mountain Rd** About 4 mins	go 1.9 mi total 27.5 mi
10.	Continue onto **VA-54 E/W Patrick Henry Rd** Continue to follow VA-54 E About 19 mins	go 12.9 mi total 40.4 mi
11.	Merge onto **I-95 S** via the ramp to **Richmond** About 21 mins	go 18.4 mi total 58.8 mi
12.	Take exit **73** for **Maury St** toward **Commerce Rd** About 1 min	go 0.5 mi total 59.3 mi
13.	Turn right onto **Maury St** About 1 min	go 0.3 mi total 59.6 mi
14.	Continue onto **Brander St** Destination will be on the right About 1 min	go 0.5 mi total 60.1 mi

B 1400 Brander St, Richmond, VA 23224

Oula K Shehab-Dandan (Services - 6)

From: Laura M Zuranski (Services - 6)
Sent: Monday, September 24, 2018 9:54 AM
To: Oula K Shehab-Dandan (Services - 6)
Subject: FW: North Anna Acceptance letter
Attachments: Stamie Lyttle Permit 2016.pdf; Hauled waste acknowledgement letter.docx; City Hauled Waste Manifest 2018.doc

Follow Up Flag: Follow up
Flag Status: Flagged

Oula –

Please see below re: North Anna sludge application.

Thanks,
Laura

From: Bell, James R. - DPU [mailto:James.Bell@Richmondgov.com]
Sent: Monday, September 24, 2018 9:43 AM
To: Laura M Zuranski (Services - 6)
Cc: Whitehurst, Eric - DPU; Ezzineelamghari, Noureddine - DPU
Subject: [External] North Anna Acceptance letter

Hi Laura,

Noureddine forwarded your request to me. I will check with my boss, but I don't think there will be any such letter. Certainly not since I've been here (2011).

.s far as I know, the authorization to discharge here comes from the general authorization granted to haulers by their waste hauler permit. Stamie Lyttle has been the only hauler to bring us NA water. On the manifest form, the driver certifies that the waste is as described which in your case is septic from North Anna. As far as we are concerned, it is no different than the septic form a residential home, motel, or other business not connected to a central waste water system.

I have attached a copy of Lyttle's permit; manifest sheet; and the requirements for dumping that we have all drivers acknowledge and sign prior to discharging, for your information. If you have questions please let me know. JR

J.R. Bell, Jr.
Environmental Technician II
804-646-8434 (office phone)
804-646-8118 (fax)

CITY OF RICHMOND
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WASTEWATER TREATMENT

CERTIFIED MAIL
RETURNED RECEIPT REQUESTED

August 01, 2016

Mr. Ben Chapin, General Manager
2210 Belt Blvd
Richmond, Virginia 23224

RE: Septage Waste Hauler Discharge Permit

Dear Mr. Chapin :

The City's Pretreatment Staff has reviewed and processed your application, dated July 21, 2016 for a Septage Waste Hauler Discharge Permit. The information submitted satisfactorily meets the requirements specified in Sections 28-773 thru Sections 28-774 of the Richmond City Code.

The enclosed permit, ***# 1846 covers*** the hauled Septage waste discharge from vehicles owned and/or operated by **Stamie E. Lyttle Company** and discharged into the approved City Of Richmond disposal site designated in the permit. All discharges, actions, and reports relating thereto shall be in accordance with the permit application, the terms and conditions of this permit and The City of Richmond Sewer Use ordinance.

The pumping station is an automated screening and flow measuring device that requires a Card/key and confidential code to activate the unit and access the City's treatment system. If your vehicle is able to utilize this facility, it shall be necessary for you to contact this office to arrange to receive your Card/key(s) and personal identification number(s) (PIN) so that you may utilize the disposal site. Furthermore, each driver must be trained in the proper procedures to activate the unit. **Please call (804) 646-8930 or (804) 646-8434 to make these arrangements.**

If you wish to appeal or challenge any conditions imposed in this permit, a petition shall be filed for modification or reissuance of this permit within 30 days of your receipt. This is in accordance with the requirements of City of Richmond Wastewater Discharge Rules and Regulations, established and adopted pursuant to Section 28-26 of the Richmond City Code. Failure to petition for reconsideration of the permit within the allotted time is deemed a waiver by the permitted hauler of his right to challenge the terms of this permit.

Sincerely,

Eric Whitehurst, Environmental Compliance Officer
City of Richmond
DPU – Wastewater
1400 Brander Street
Richmond, Virginia 23224

Re-Issued this 1st Day of August 2016

TABLE OF CONTENTS

SEPTAGE HAULER DISCHARGE PERMIT 1

PART I: DISCHARGE LOCATION & REQUIREMENTS 2

PART II: VEHICLE OPERATION AND EQUIPMENT 2

PART III: SPECIFIC LIMITATIONS 3

PART IV: MONITORING AND RECORDS 5

PART V: STANDARD CONDITIONS 5

PART VI: SPECIAL CONDITIONS 7

APPENDIX A: CITY OF RICHMOND HAULED WASTE MANIFEST

CITY OF RICHMOND
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WASTEWATER TREATMENT

Permit No. *1846*

SEPTAGE HAULER DISCHARGE PERMIT

In accordance with the Provisions of City of Richmond, Department of Public Utilities, Industrial Wastewater Discharge Rules and Regulations, and applicable provisions of federal, state and local laws or regulations

STAMIE E. LYTTLE COMPANY
P.O.BOX 24272
2210 Belt Blvd.
Richmond, Virginia 23224

Is hereby authorized to discharge hauled wastewater into the City of Richmond sewer system located at the Brander Street Pumping Station south of the Maury Street exit off Interstate 95, in accordance with the conditions and requirements specified in this permit and **Richmond City Code Section 28-779 thru Sec.28-806** Compliance with this permit does not relieve the permitted hauler of its obligation to comply with any or all applicable pretreatment regulations, standards, or requirements under Local, State, and Federal laws, including any such regulations, standards, requirements, or laws that may become effective during the term of this permit.

The attached City of Richmond, Department of Public Utilities, Wastewater Discharge Rules and Regulations are considered a part of this permit. This permit is issued based on the disclosure data submitted by the Permitted hauler and received by the City of Richmond, Department of Public Utilities, on and in conformance with data submitted to the Environmental Compliance Officer of the Department of Public Utilities in support of the application, all of which are filed with, and considered as part of this document.

Noncompliance with any term or condition of this permit shall constitute a violation of the City of Richmond's sewer use ordinance.

This permit shall become effective on **September 1, 2016** and shall expire at midnight on **August 31, 2021.** If the permitted hauler wishes to continue to discharge after the expiration date of this permit, an application must be filed for a renewal permit a minimum of 90 days prior to the expiration date, or before **May 30, 2021.**

Authorized By: _____
Eric Whitehurst, Environmental Compliance Officer

Re-Issued this on August 1, 2016

cc: VA DEQ Piedmont Regional Coordinator

1400 BRANDER STREET • RICHMOND, VA 23224-2399 • 804.646.8720 • FAX 804.646.0081 • WWW.RICHMONDGOV.COM

PART I: DISCHARGE LOCATION & REQUIREMENTS

A. The discharge of all hauled waste must be performed at the following designated area: **Septage Receiving Station-Located at the Brander St Pumping Station south of the Maury Street Exit (73) off I-95N or I-95S.** Discharge to the City of Richmond sewer system at any other location is prohibited. The permitted hauler must provide prior notice to the City of Richmond of the intent to discharge and the actual discharge must be performed during supervision by plant personnel. In all cases, discharge may only be performed at this site Monday through Friday 8:00 a.m. to 4:00 pm. This may be subject to change with minimal notice forwarded to the Permitted hauler.

B. Hauled wastes are subject to sampling by the City of Richmond. The hauler may also be required to suspend the discharging of wastes until the analysis is complete. The City of Richmond reserves the right to refuse permission to dump any load.

PART II: VEHICLE OPERATION AND EQUIPMENT

A. This permit authorizes the permitted hauler to discharge waste into the City's Treatment System utilizing the vehicles identified herein.

1. Make of Vehicle: Sterling Model: 9500LT Year: 2001 Color: White Tank: White License No.: TU-21-017 VIN: 2F2HA2AS31AJ40606 Tank Capacity: 4000 Gallons: 4000

2. Make of Vehicle: Sterling Model: 9500 Year: 2005 Color: Red Tank: White License No.: TW 88-771 VIN: 2F2HA2DEX5AN70967 Tank Capacity: 4000 Gallons: 4000

3. Make of Vehicle: Ford Model: LU8000 Year: 1996 Color: White Tank: White License No.: TX211101 VIN: 1FDXR82E2TVA10737 Tank Capacity: 2500 Gallons: 2500

4. Make of Vehicle: International Model: LN8000 Year: 2007 Color: White Tank: White License No.: TX211102 VIN: 1HTMMAAN47H385955 Tank Capacity: 2500 Gallons: 2500

B. At all times, the Permitted hauler shall maintain in good working order and operate as efficiently as possible, the vehicle and all equipment used by the Permitted hauler necessary to achieve compliance with the terms and conditions herein.

C. The Permitted hauler shall report every occurrence when the vehicle(s) hauls any waste(s) prohibited by this Permit. A certification statement indicating these vehicles have been cleaned, prior to hauling Septage, shall be submitted to the City's Environmental Compliance Officer. The certification shall contain the following information and the signatory statement below:

1. Indicate the material which was hauled in the vehicle; and

2. The name, address and phone number of the person or company which conducted the cleaning; and

3. The location, date and time the vehicle was cleaned and the date and time the vehicle was used to haul Septage.

"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."

PART III: SPECIFIC LIMITATIONS

A. Any commercial or industrial waste that may cause pass through of pollutants or interfere with the wastewater treatment plant operations or that violates federal, state, or local restrictions shall not be discharged to the wastewater treatment plant.

B. Any waste transported from an industry subject to categorical pretreatment standards must meet the applicable Federal, State and local pretreatment standards and requirements including categorical standards developed for the waste generator's industrial category. Authorization by the City of Richmond prior to pumping must be obtained for the hauling of categorical wastes.

C. The permitted hauler is prohibited from discharging the following wastes:

- Any material with a pH lower than 5.0 or higher than 12.5;
- Any material which may solidify or become viscous at temperatures between thirty-two (32°F) degrees and one hundred forty (140°F) degrees Fahrenheit (0 degrees and 60 degrees Centigrade);
- Any waste containing any gasoline, benzene, naphtha, fuel oil or other flammable or explosive liquids, solids or gases;
- Waste with a temperature higher than 104°F (40°C);
- Any waste containing any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar plastics, wood, manure, or any other solids or viscous substances capable of causing obstructions of other interferences with proper operation of the sewer system;
- Any waste containing any pollutant, including oxygen demanding pollutants (BOD etc.) at a flow rate and/or concentration which will cause a pass through of pollutants to occur or an interference with the City of Richmond wastewater treatment facility's operations or sludge use and/or disposal practices;
- Any material considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA).
- ***Concentrated loads of FOG (Fats, Oils and Grease) substances including sludge. FOG liquids must be mixed with sewage before the City will accept the discharge. The mix may not contain FOG substances in excess of 50% of the total truck load by volume.***

D. **The following limits will be applied at the trucks' discharge point for any non-domestic discharges (Revised Local Limits July 2014)**

Parameter	Max. Concentration	Unit
Arsenic	4.45	mg/l
Cadmium	0.04	mg/l
Chromium	4.17	mg/l
Copper	3.19	mg/l
Cyanide	1.00	mg/l
Lead	0.45	mg/l
Mercury	0.0034	mg/l
Molybdenum	Monitoring Requirements	mg/l
Nickel	2.01	mg/l
Selenium	Monitoring Requirements	mg/l
Silver	1.74	mg/l
Zinc	1.53	mg/l
Oil & Grease (Petroleum)	100	mg/l
Oil & Grease (Animal/Vegetable)	300	mg/l
Btex	2.13	mg/l
Total Petroleum Hydrocarbon	Monitoring Requirements	mg/l
pH	5.0-12.5	s.u.

E. Each vehicle transporting waste in the City of Richmond must maintain a current Sewage Handling Permit issued by the Department of Health. A copy of this permit must be submitted to the City's Environmental Compliance Officer PRIOR TO DISCHARGING ANY WASTE TO THE CITY'S TREATMENT SYSTEM.

F. Any changes to the information submitted on the Permitted hauler's application must be reported to the City's Environmental Compliance Officer a minimum of 10 days prior to initiating the change or within 10 days of becoming aware of the change.

G. The Permitted hauler is responsible for the clean-up of any spills at the discharge site attributable to the process of discharging hauled waste.

PART IV: MONITORING AND RECORDS

A. All wastes must be accompanied by a completed waste manifest form. The form shall contain information regarding the wastes from and the signature of each waste generator. The hauler shall also sign the form, indicating that he has accepted no wastes other than those listed. The manifest must be reviewed by a City of Richmond Control Authority representative prior to discharge. Failure to accurately record every load, falsification of data, or failure to transmit the form to the plant operator prior to discharge may result in revocation of this permit or a fine per offense.

B. The Permitted hauler shall provide at the request of the City, samples and measurements of all hauled wastes which are to be discharged to the City's Treatment System. Samples and measurements required herein shall be taken by such methods so as to be representative of the volume and nature of the load and to ensure compliance with applicable pretreatment standards.

C. The Permitted hauler shall retain all records of all monitoring information, waste manifest forms, copies of all reports required by this permit and records of all data pertaining to hauled waste discharged for a period of at least three years. This period may be extended by request of the City at any time. All records shall be available for inspection by the City.

PART V: STANDARD CONDITIONS

A. Right of Entry: The permitted hauler shall allow the staff of the City of Richmond, and/or their authorized representative(s), upon the presentation of credentials:

1. To enter upon the permitted hauler's premises where a real or potential discharge is located or in which records are required to be kept under the terms and conditions of this permit; and

2. At reasonable times, to have access to and copy records required to be kept under the terms and conditions of this permit;

3. To inspect any monitoring equipment or monitoring method, practices or operations regulated or required in this permit;

4. To sample any discharge of pollutants as authorized by City Ordinance(s) provided that EPA and OSHA approved appropriate sampling and safety protocols are followed;

5. To inspect any production, manufacturing, fabricating, or storage area where pollutants, regulated by this permit, could originate, be stored, or be discharged to the City treatment system.

B. Duty to Provide Information: The permitted hauler shall furnish to the City of Richmond Wastewater Department within ten (10) days, any information which the City of Richmond Wastewater Department may request to determine whether cause exist for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permitted hauler shall also, upon request, furnish to the City of Richmond Wastewater Department within ten (10) days copies of any record required to be kept by this permit. Information submitted to the City as confidential will be treated in accordance with 40 CFR Part 2.

The permitted hauler shall give notice to the City of any change in the number or type of vehicles used to dispose of waste into the City's treatment system, prior to initiating any pumping activities with the vehicle(s). This shall include any new, replacement, leased and/or subcontracted vehicles. Furthermore, the permitted hauler shall provide the City with written verification of the acquisition of a State Health Department Sewage Handling Permit for each vehicle.

C. Property Rights: The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any violation of Federal, State, or local laws or regulations.

D. Dilution: The permitted hauler shall not increase the use of potable or process water or, in any way; attempt to dilute an effluent as a partial or complete substitute for adequate treatment to achieve compliance with the limitations contained in this permit.

E. Falsifying Information: Knowingly making any false statement or any report or other document required by this permit or knowingly rendering any monitoring device or method inaccurate is a crime and may result in the imposition of criminal sanctions and/or civil penalties.

F. Permit Termination: This permit may be terminated for the following reasons:

1. Falsifying self-monitoring reports.
2. Tampering with monitoring equipment.
3. Refusing to allow timely access to the facility premises and records.
4. Failure to meet effluent limitations.
5. Failure to pay fines.
6. Failure to pay wastewater charges.
7. Failure to meet compliance schedules.

G. Permit Modification: This permit may be modified, or alternatively, revoked and reissued, for good causes including, but not limited to, the following:

1. To incorporate any new or revised Federal, State, or local pretreatment standards or requirements.

2. Material and substantial alterations or additions to the discharger's operation processes, or discharge volume or character which were not considered in drafting the effective permit.

3. A change in any condition in either the industrial user or the City of Richmond Wastewater Treatment Plant that requires either a temporary or permanent reduction or elimination of the authorized discharge.

4. Information indicating that the permitted discharge poses a threat to the Richmond wastewater collection and treatment systems, City personnel or the receiving waters.

5. Violation of any term(s) or condition(s) of this permit.

6. Misrepresentation or failure to disclose fully all relevant facts in the permit application or in any required reporting.

7. To correct typographical or other errors in the permit.

8. To reflect transfer of the facility ownership and/or operation to a new owner/operator.

9. Upon request of the permitted hauler, provided such request does not create a violation of any applicable requirements, standards, laws, or rules and regulations.

The filing of a request by the permitted hauler for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

PART VI: SPECIAL CONDITIONS

A. The permitted hauler must carry liability insurance and provide satisfactory evidence of it to the City of Richmond upon requests, in such amounts and form as determined by the City of Richmond. Such insurance shall afford compensation for taking corrective action and for bodily injury, and for property damage to third persons caused by accidental releases.

Appendix A

City of Richmond
Hauled Waste Manifest

CITY OF RICHMOND

DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WASTEWATER TREATMENT

HAULED WASTE MANIFEST

1. Hauler Information

Hauler Company: _____ **Permit #:** _____

Address: _____ **City:** _____

State: _____ **Zip:** _____ **Telephone:** _____

Truck #:_____**License Plate #:**_____ **Card#**_____ **Tank Capacity (gals):**_____

2. Description of Waste: **Septic Tank:** _____**Sewage Holding Tank:** _____**Chemical/Portable Toilet:** _____**Landfill Leachate:** _____**Grit/debris from Storm water Systems:** _____**Grit from WW Collection Systems:** _____**Grease Traps:** _____ **Other Specify:** _____

Waste Generator Information				
Business /Resident Name	ADDRESS	Contact Person	Phone Number	Total Gallons

3. CERTIFICATION: *I hereby certify that all wastes being disposed of under this manifest are accurately identified in Section 2 of this manifest. I also certify that no wastes being disposed of or constituents thereof are listed as a RCRA hazardous waste or qualify as having characteristics of a hazardous waste as defined by 40 CFR 261 and that the foregoing is true and correct to the best of my knowledge and belief.*

Printed Name of Driver _____

Signature of Driver_____ **Date**_____ **Time**_____

4. Receipt Information: **Date** _____ **Time**_____**Card #**_____**Gallons**_____

5. Pretreatment Represenatitive_____**Date**_____**Time**_____

City of Richmond Hauled Waste Requirements

Septic Receiving Station Hours

Monday through Friday	8:00 a.m. - 4:00 p.m.*
Saturday and Sunday	Closed
Holidays	Closed

*Septic receiving station operation times are subject to change. For City sponsored events, hours may be extended, upon request.

Septic Receiving Station Rate

The current rate per gallon for discharging septic waste at the City of Richmond Wastewater Treatment Plant's septic receiving station is: $0.110 per gallon.

The minimum charge for discharging a waste load less than 600 gallons at the City of Richmond Wastewater Treatment Plant's septic receiving station is: $66.00

Septic Receiving Station Rules

All hauled waste drivers are required to acknowledge by signature, receipt and understanding of these rules.

Any commercial or industrial waste that may cause pass through of pollutants or interfere with the wastewater treatment plant operations or that violates federal, state, or local restrictions shall not be discharged to the wastewater treatment plant.

Violation of any of these rules or terms specifically referenced in the hauled waste permit mayresults in termination of service and/or further enforcement action under the Code of the City of Richmond's Sewer Use Ordinance.

ay waste transported from an industry subject to categorical pretreatment standards must meet the applicable Federal, State and local pretreatment standards and requirements including categorical standards developed for the waste generator's industrial category. Authorization by the City of Richmond prior to pumping must be obtained for the hauling of categorical wastes.

Each vehicle transporting waste in the City of Richmond must maintain a current Sewage Handling Permit issued by the Department of Health.

The discharge of all hauled waste must be performed at the following designated area: Septic Receiving Station which is located at the Brander Street Pumping Station south of the Maury Street Exit off of Interstate 95. Discharge to the City of Richmond sewer system at any other location is prohibited.

At all times, the permitted hauler shall maintain in good working order and operate as efficiently as possible, the vehicle and all equipment used by the Permitted hauler necessary to achieve compliance with the terms and conditions of their discharge permit.

Only those waste haulers who are currently permitted and approved by the City of Richmond may utilize the septic receiving station.

Each waste hauler is responsible for understanding and implementing all permit requirements specified in their discharge permit.

Use of the septic receiving station must only occur during operation hours listed above.

The approval of an authorized City of Richmond employee is required prior to each discharge at the septic receiving station.

Signed waste manifests certifying that the hauled load is in compliance with local limits must be provided for all septic loads which are to be discharged to the septic receiving station.

ne permitted hauler shall provide at the request of the City, samples and measurements of all hauled wastes which are to be discharged to the City's Treatment System. Samples and measurements required herein shall be taken by such methods so as to be representative of the volume and nature of the load and to ensure compliance with applicable pretreatment standards.

The City of Richmond reserves the right to deny waste haulers the use of the septic receiving based on septic load characterization and/or infraction of permit requirements.

Illicit or illegal discharge to the septic receiving station is strictly prohibited and subject to enforcement actions.

Each waste hauler is responsible for understanding and implementing all safety procedures required by the City of Richmond while performing discharge activities. Additionally, the permitted hauler must carry liability insurance and provide satisfactory evidence of it to the City of Richmond upon requests, in such amounts and form as determined by the City of Richmond. Such insurance shall afford compensation for taking corrective action and for bodily injury, and for property damage to third persons caused by accidental releases.

The Permitted hauler is responsible for the clean-up of any spills at the discharge site attributable to the process of discharging hauled waste.

Septic receiving access cards issued by the City of Richmond are free and are non-transferable. They must only be utilized by the hauler to which the card was originally issued. Replacement cards currently cost $13.00.

SEPTAGE HAULER DISCHARGE PERMIT HIGHLIGHTS

PART I: DISCHARGE LOCATION & REQUIREMENTS

A. The discharge of all hauled waste must be performed at the following designated area: **Septage Receiving Station-Located at the Brander St Pumping Station south of the Maury Street Exit off 95.** Discharge to the City of Richmond sewer system at any other location is prohibited. The permitted hauler must provide prior notice to the City of Richmond of the intent to discharge and the actual discharge must be performed during supervision by plant personnel. In all cases, discharge may only be performed at this site Monday through Friday 8:00 a.m. to 4:00 p.m. This may be subject to change with minimal notice forwarded to the Permitted hauler.

B. Hauled wastes are subject to sampling by the City of Richmond. The hauler may also be required to suspend the discharging of wastes until the analysis is complete. The City of Richmond reserves the right to refuse permission to dump any load.

PART III: SPECIFIC LIMITATIONS

G. The Permitted hauler is responsible for the clean-up of any spills at the discharge site attributable to the process of discharging hauled waste.

PART V: STANDARD CONDITIONS

G. Permit Modification: This permit may be modified, or alternatively, revoked and reissued, for good causes including, but not limited to, the following:

3. A change in any condition in either the industrial user or the City of Richmond Wastewater Treatment Plant that requires either a temporary or permanent reduction or elimination of the authorized discharge.

4. Information indicating that the permitted discharge poses a threat to the Richmond wastewater collection and treatment systems, City personnel or the receiving waters.

5. Violation of any term(s) or condition(s) of this permit.

ACKNOWLEDGEMENT:

Printed Name:_____

Signature: _____ **DATE:**_____

Public Notice Authorization

PUBLIC NOTICE BILLING INFORMATION

I hereby authorize the Department of Environmental Quality to have the cost of publishing a public notice billed to the Agent/Department shown below. The public notice will be published once a week for two consecutive weeks in accordance with 9VAC25-31-290.C.2.

Agent/Department to be billed: Mr. Jason Williams
Director –Environmental

Owner: Dominion Energy Services, Inc.

Applicant's Address: 5000 Dominion Boulevard

Glen Allen, VA 23060

Agent's Telephone Number: 804-273-2646

Authorizing Agent: Jason Williams 10/15/2018
Signature

VPDES Permit No.: VA0052451
Facility Name: Dominion – North Anna

Please return to:

Susan Mackert
VA-DEQ, NRO
13901 Crown Court
Woodbridge, VA 22193-1453
Fax: (703) 583-3821

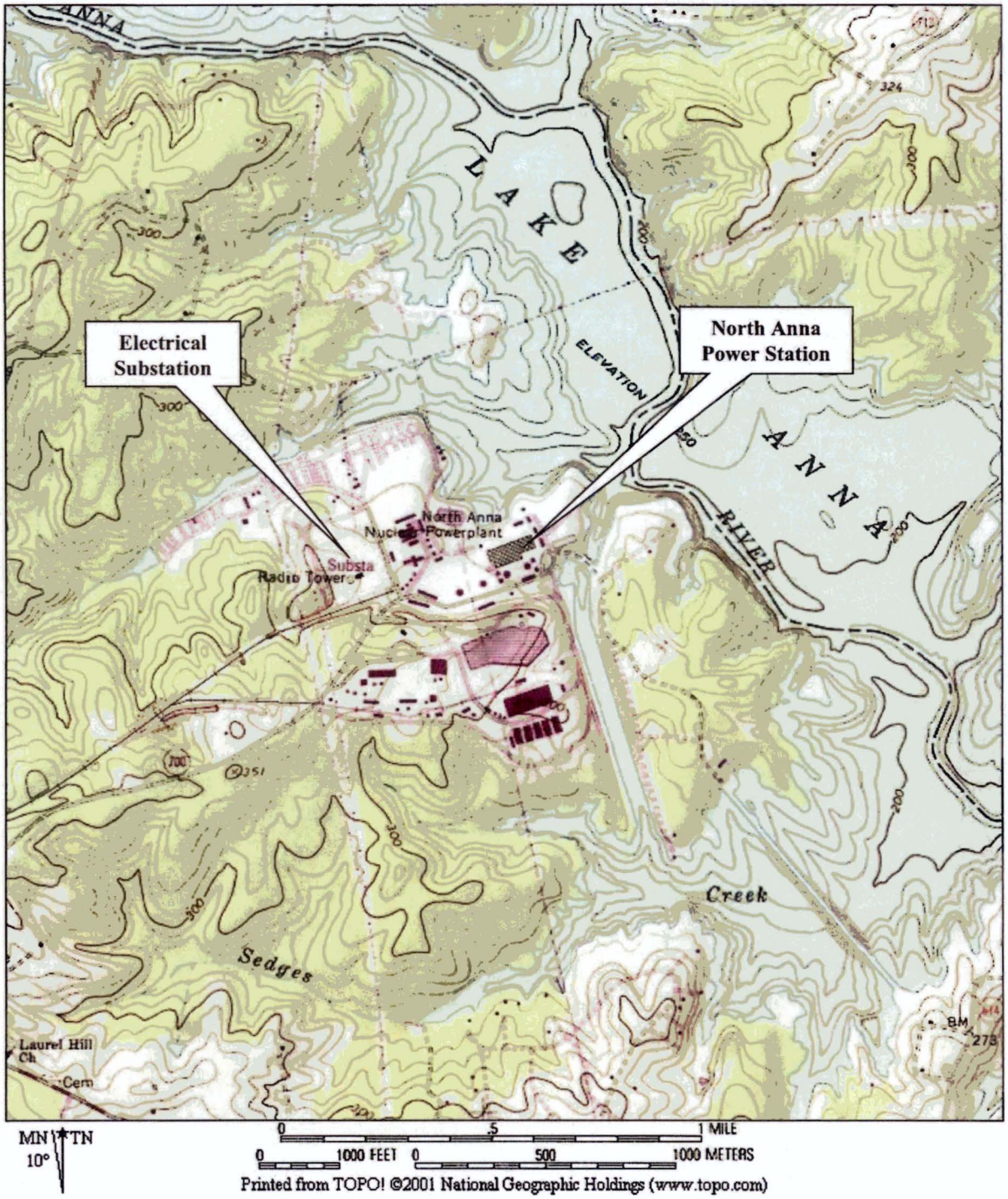
Permit Billing Information

VPDES/VPA Permit Billing Information Form
for Annual Maintenance Fee

Facility Name:	Dominion Energy- North Anna Power Station
Permit Number:	VA0052451
Owner Name:	Virginia Electric and Power Company
Owner Address:	5000 Dominion Boulevard
	Glen Allen, VA 23060
	–
Billing Contact Name:	Mr. Jason E. Williams
Title:	Director, Environmental
Phone Number:	(804) 273-2646
E-Mail Address:	jason.e.williams@dominionenergy.com

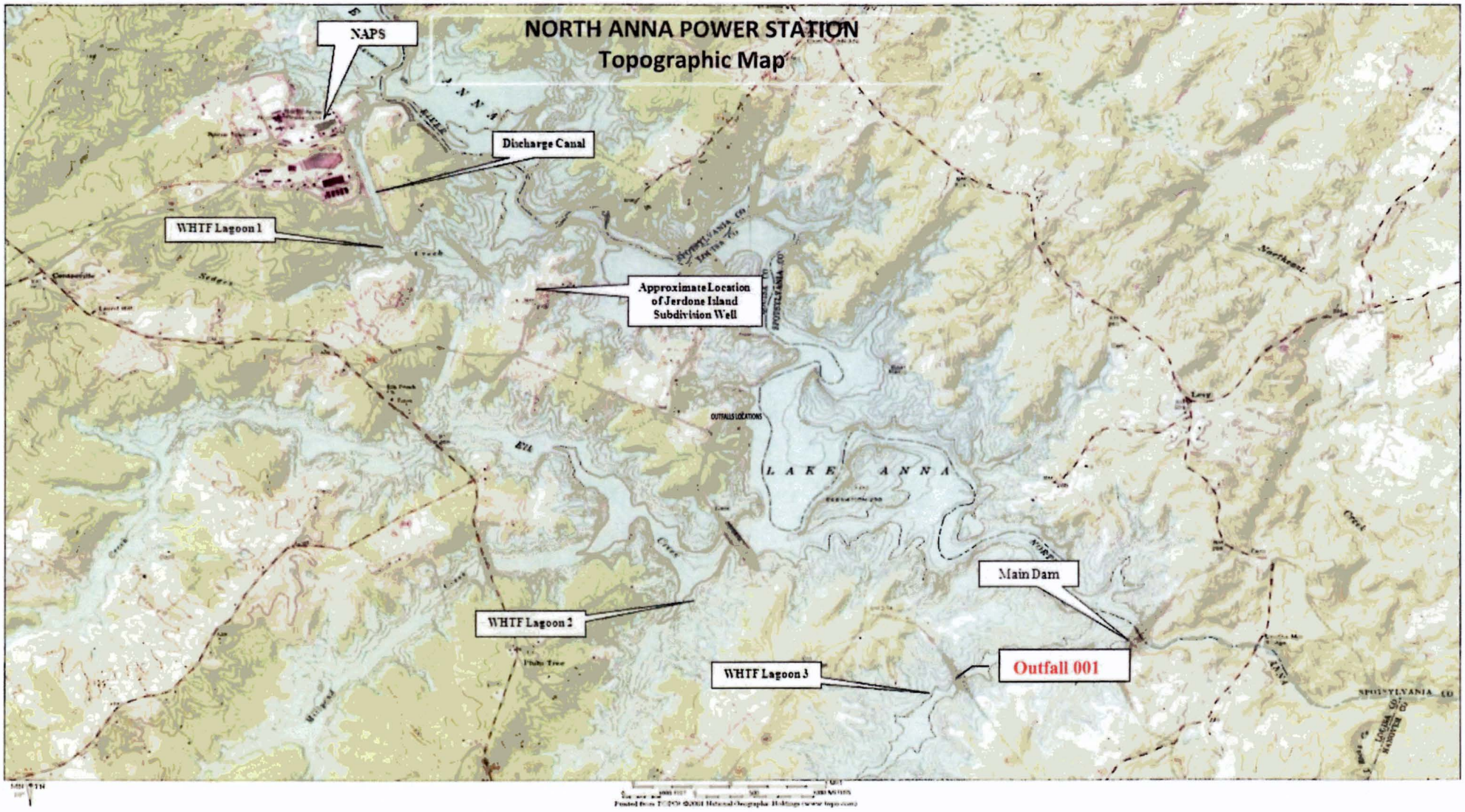
Attachment A

Site Maps

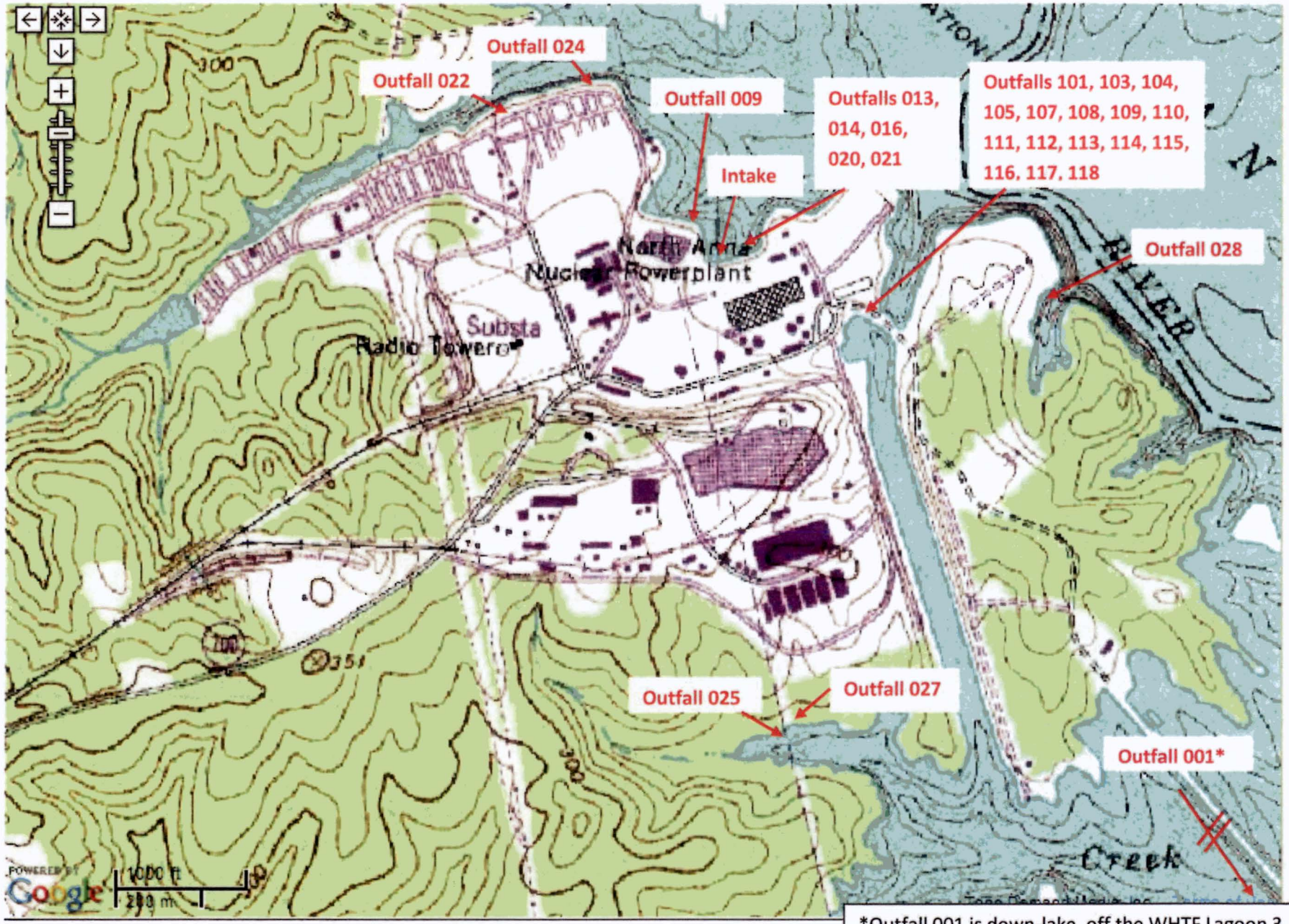


Source: USGS Lake Anna West, VA Quad, 1983 TOPO! ©2000 National Geographic Holdings

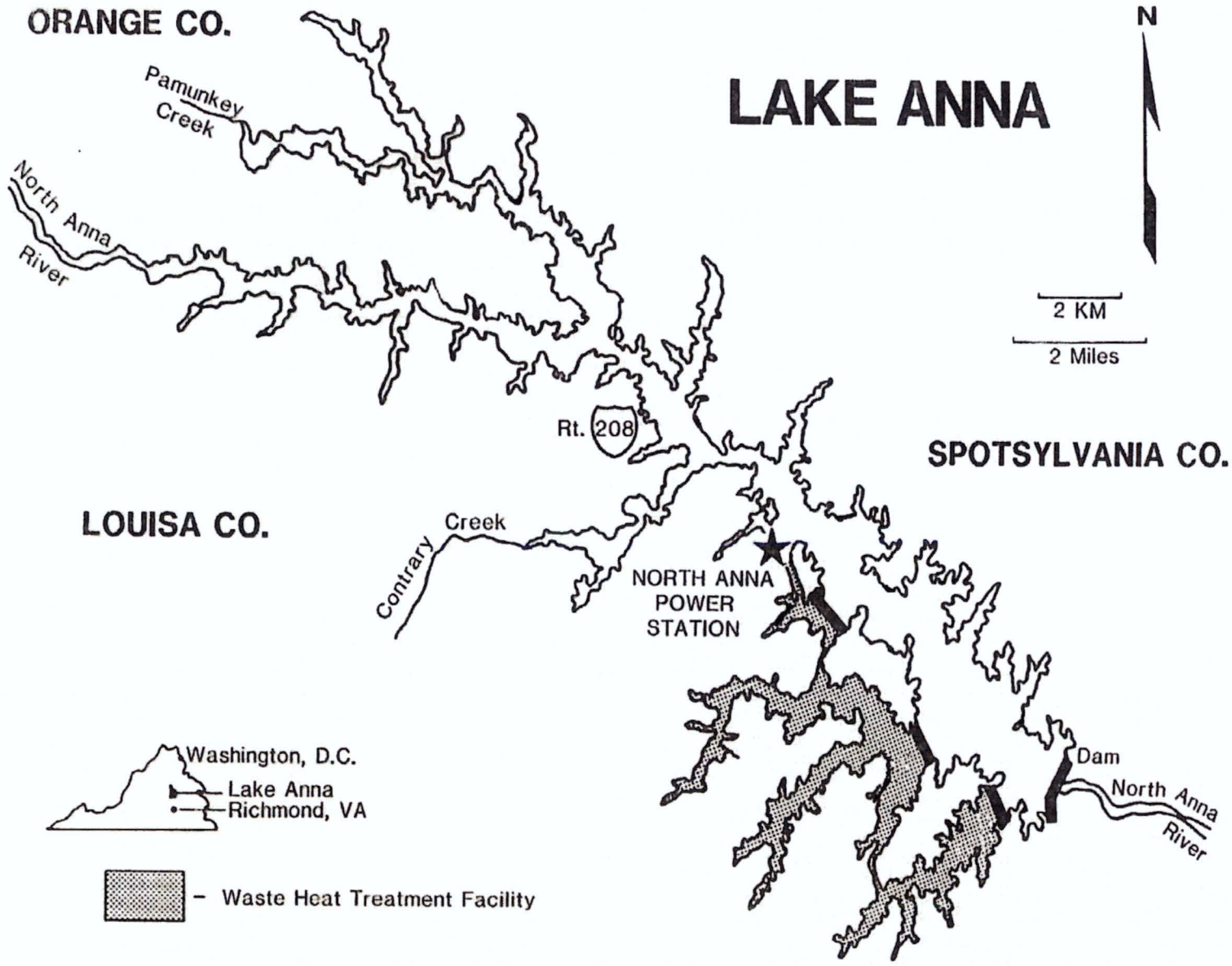
Figure I.1-2		Dominion Generation North Anna Power Station Mineral, Virginia
USGS 7.5' Quadrangle Map		
Date: *April 2005*	URS Project No.: *11655856*	
Drawn by: *RAW*	Approved by: *RAW*	URS CORPORATION 5540 FALMOUTH ST., SUITE 201 RICHMOND, VA 23230
Scale: *1" = 2,000'*	File name: *SITE VICINITY MAP*	


NORTH ANNA POWER STATION
Topographic Map
NAPS
Discharge Canal
WHTF Lagoon 1
Approximate Location of Jerdone Island Subdivision Well
OUTFALLS LOCATIONS
LAKE ANNA
Main Dam
WHTF Lagoon 2
WHTF Lagoon 3
Outfall 001

NORTH ANNA POWER STATION
OUTFALLS LOCATIONS



*Outfall 001 is down-lake, off the WHTF Lagoon 3 dam as depicted on the topographic map included in this Attachment.


ORANGE CO.
LAKE ANNA
N
Pamunkey Creek
North Anna River
2 KM
2 Miles
Rt. 208
SPOTSYLVANIA CO.
LOUISA CO.
Contrary Creek
NORTH ANNA POWER STATION
Dam
North Anna River
Washington, D.C.
Lake Anna
Richmond, VA
– Waste Heat Treatment Facility

THE OUTFALLS MOST LIKELY TO RECEIVE THE FOLLOWING NON-STORMWATER DISCHARGES ARE ITENTIFIED BELOW IN PARENTHESES:

- DISCHARGES FROM FIRE FIGHTING ACTIVITIES (OUTFALLS 014, 022, 024, 025, AND 027).
- FIRE HYDRANT FLUSHING (OUTFALLS 014, 022, 024, 025, AND 027).
- POTABLE WATER INCLUDING WATER LINE FLUSHINGS (OUTFALLS 014, 022, 024, 025, AND 027).
- UNCONTAMINATED AIR CONDITIONING OR COMPRESSOR CONDENSATE (OUTFALLS 014, 024, 025, AND 027).
- IRRIGATION DRAINAGE (OUTFALLS 022, 024, 025, AND 027).
- LANDSCAPE WATERING PROVIDED ALL PESTICIDES, HERBICIDES, AND FERTILIZER HAVE BEEN APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS (OUTFALLS 022, 024, 025, AND 027).
- PAVEMENT WASH WATER WHERE NO DETERGENTS ARE USED AND NO SPILLS OR LEAKS OF TOXIC OR HAZARDOUS MATERIALS HAVE OCCURRED (UNLESS ALL SPILLED MATERIALS HAVE BEEN REMOVED (OUTFALLS 014, 024, 025, AND 027).
- ROUTINE EXTERNAL BUILDING WASH DOWN WHICH DOES NOT USE DETERGENTS (OUTFALLS 014, 024, 025, AND 027).
- UNCONTAMINATED GROUND WATER OR SPRING WATER (OUTFALLS 014, 022, 024, 025, AND 027).
- FOUNDATION OR FOOTING DRAINS WHERE FLOW) ARE NOT CONTAMINATED WITH PROCESS MATERIALS SUCH AS SOLVENTS (OUTFALLS 014, 022, 024, 025, AND 027).
- INCIDENTAL WINDBLOWN MIST FROM COOLING TOWERS THAT COLLECTS FROM ROOFTOPS OR ADJACENT PORTIONS OF THE FACILITY, BUT NOT INTENTIONAL DISCHARGE FROM THE COOLING TOWER (E.G. PIPED COOLING TOWER BLOWDOWN OR DRAINS). THE COOLING TOWER MIST STUDY IS INCLUDED IN THIS PLAN AS APPENDIX G (OUTFALLS 014 AND 024).

CHEMICAL / MATERIAL STORAGE		
STORAGE TANK TYPE	STORAGE CAPACITY (VOLUME)	STRUCTURAL BMPs
SODIUM HYPOCHLORITE MAP KEY (50)	330 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.
ACTI-BROM 1318 MAP KEY (51)	400 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.
SAND MAP KEY (52)	VARIES	STORED UNDER ROOF WITH THREE WALLS AND A TARP OVER THE FRONT. UNLOADED IN FRONT OF THE BAY VIA DUMP-TRUCK. OFFLOAD RESIDUE IS SWEPT INTO THE PILE. IN 20XX, STATION BEGAN USING THE NEW STORAGE BUILDING WHICH IS COMPLETELY ENCLOSED AND INCLUDES A RETENTION POND.
SALT MAP KEY (52)	VARIES	STORED UNDER ROOF WITH THREE WALLS AND A TARP OVER THE FRONT. UNLOADED IN FRONT OF THE BAY VIA DUMP-TRUCK. OFFLOAD RESIDUE IS SWEPT INTO THE PILE. IN 20XX, STATION BEGAN USING THE NEW STORAGE BUILDING WHICH IS COMPLETELY ENCLOSED AND INCLUDES A RETENTION POND.
LAYDOWN AREA MAP KEY (53)	VARIES	GRADED FLAT.
ROLL OFF CONTAINERS (GENERAL REFUSE, DRY WASTES & SCRAP METAL) MAP KEY (54)	VARIOUS SIZE CONTAINERS	SMALLER "TRASH CANS" ARE EQUIPPED WITH LIDS. LARGER DUMPSTERS ARE STRATEGICALLY POSITIONED IN AREAS THAT MINIMIZE SHEET-FLOW TRANSPORT TO STORMWATER CONVEYANCES.
3D TRASAR 3DT46 MAP KEY (55)	275 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.

CHEMICAL CONTAINING EQUIPMENT		
STORAGE TANK TYPE	STORAGE CAPACITY (VOLUME)	STRUCTURAL BMPs
BEARING COOLING TOWERS: - EVAC - BIOXIDE - ACTI-BROM 1318 - SODIUM HYPOCHLORITE - 3D TRASAR 3DT46 MAP KEY (56)	25,000 GPM	CATCHMENT STRUCTURE

STORM WATER ONLY OUTFALLS
014
022
024
025
027

SLS = SEWAGE LIFT STATION

CHEMICAL & MATERIAL UNLOADING & TRANSFER FACILITIES		
UNLOADING / TRANSFER FACILITY NAME, NUMBER	SPILL POTENTIAL (VOLUME)	STRUCTURAL BMPs SECONDARY CONTAINMENT (GALLONS)
H-130 BIOCIDE MAP KEY (55)	200 GALLON TANKER TRUCK LOADS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. CATCH PANS ARE USED UNDER LINE CONNECTIONS.
3D TRASAR 3DT177 (CORROSION INHIBITOR) MAP KEY (55)	55 GALLONS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. TRANSFERS ARE CONDUCTED IN SECONDARY CONTAINMENT OF THE SERVICE WATER CHEMICAL ADDITION BUILDING (SWCAB). ALL DRAINS INSIDE THE SWCAB ARE COLLECTED IN A SUMP WHICH IS PERIODICALLY PUMPED TO THE SERVICE WATER RESERVOIR.
3D TRASAR 3DT180 (CORROSION INHIBITOR) MAP KEY (55)	55 GALLONS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. TRANSFERS ARE CONDUCTED IN SECONDARY CONTAINMENT OF THE SERVICE WATER CHEMICAL ADDITION BUILDING (SWCAB). ALL DRAINS INSIDE THE SWCAB ARE COLLECTED IN A SUMP WHICH IS PERIODICALLY PUMPED TO THE SERVICE WATER RESERVOIR.
PORTABLE RESTROOMS MAP KEY (56)	VARIOUS	STORED IN AREAS THAT ARE AWAY FROM STORM DRAIN INLETS. THE DRIVERS RECEIVE SPILL RESPONSE BRIEFING VIA STATION PROCEDURE MA-AA-1001 SUPPLEMENTAL PERSONNEL.
DYNACOOL 1383 MAP KEY (57)	55 GALLONS	CHEMICAL TRANSFER OPERATIONS ARE PERFORMED BY CHEMISTRY DEPT. PERSONNEL. THE CHEMICAL IS TRANSFERRED TO 300 GALLON TOTES WHICH ARE LOCATED IN COVERED SUMPS NEXT TO THE UNIT CONTAINMENT BUILDINGS OR IN THE DIESEL BUILDING BASEMENT.

REPORTABLE SPILL LOCATION		
	DATE	SOURCE
A	02/10/09	BEARING COOLING TOWER
B	08/23/11	BEARING COOLING TOWER
C	08/23/11	TRANSFORMER
D	08/25/11	UNIT 2 MAIN GENERATOR
E	10/14/11	BEARING COOLING TOWER
F	2/15/12	TRAINING BUILDING'S SEWAGE SUMP
G	12/14/16	2NB FUEL OIL LINE LEAK

NOTES:
1. IMPERVIOUS SURFACES INCLUDE PAVED ROADS, PARKING LOTS, CONCRETE DITCHES, METAL STRUCTURES, AND BUILDING ROOFTOPS.

SYMBOLS AND LEGEND:
- DRAINAGE PATH
- WETLAND AREA
- BUILDING
- ROADWAY
- OIL/WATER SEPARATOR
- STORMWATER RETENTION POND
- STORMWATER DROP INLET W/ BLOCK AND GRAVEL PROTECTION

Dominion

NUCLEAR ENGINEERING
RICHMOND, VIRGINIA

SWPPP SITE PLAN
NORTH ANNA POWER STATION

REVISION DESCRIPTION (SIGNATURES ON FILE)	CAD NO: NASPATHE21.DGN	
REVISED 6-1-10	DRAWING NO: NA-0-SP-STA-621	REV 14
DSGN: ANH	SCALE: NONE	UNLESS OTHERWISE NOTED | SH 1 OF 1

PC:HP1 & HP1

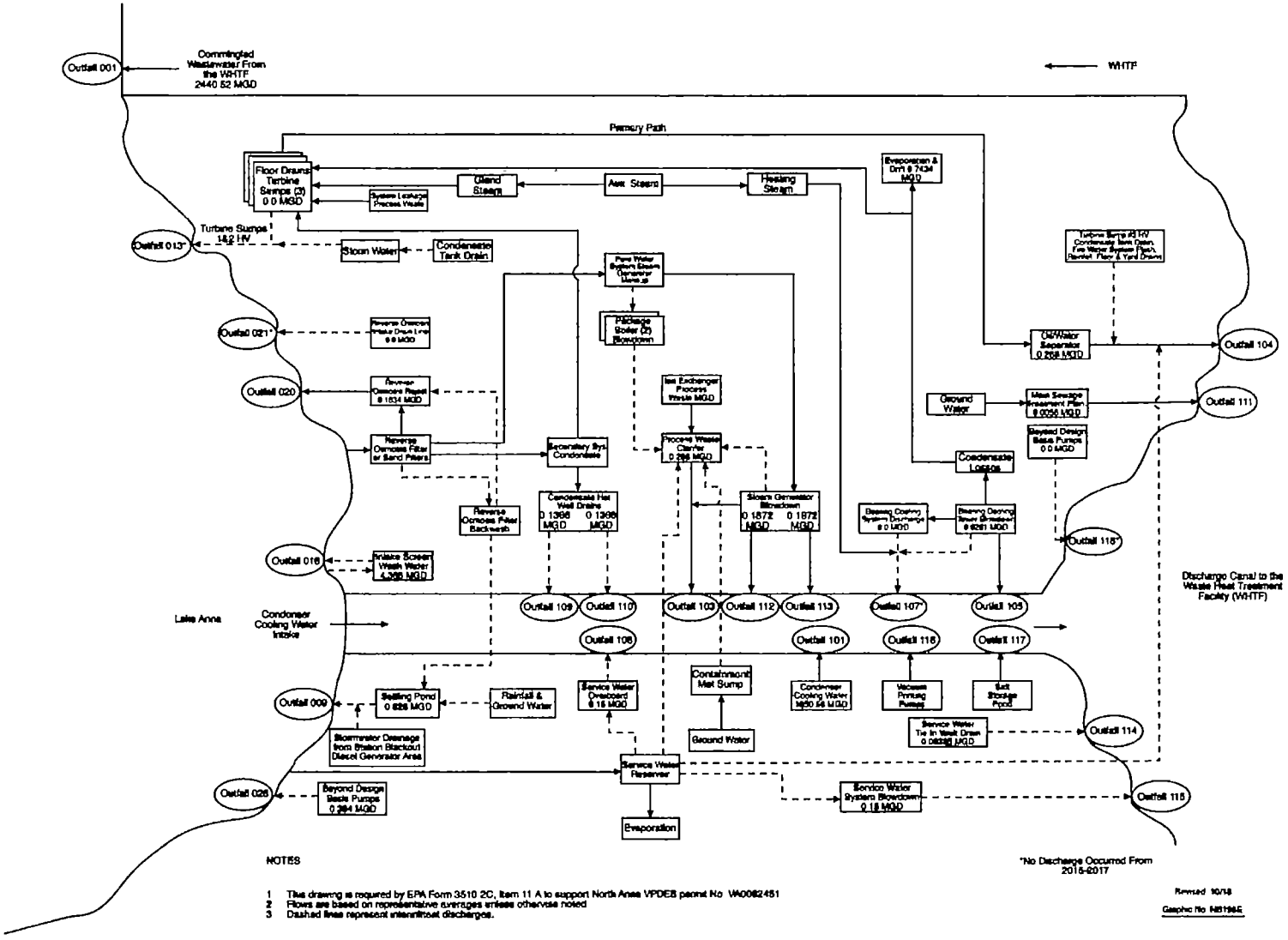
adam015
01-JUN-2010 14:16
NASPATHE21.DGN

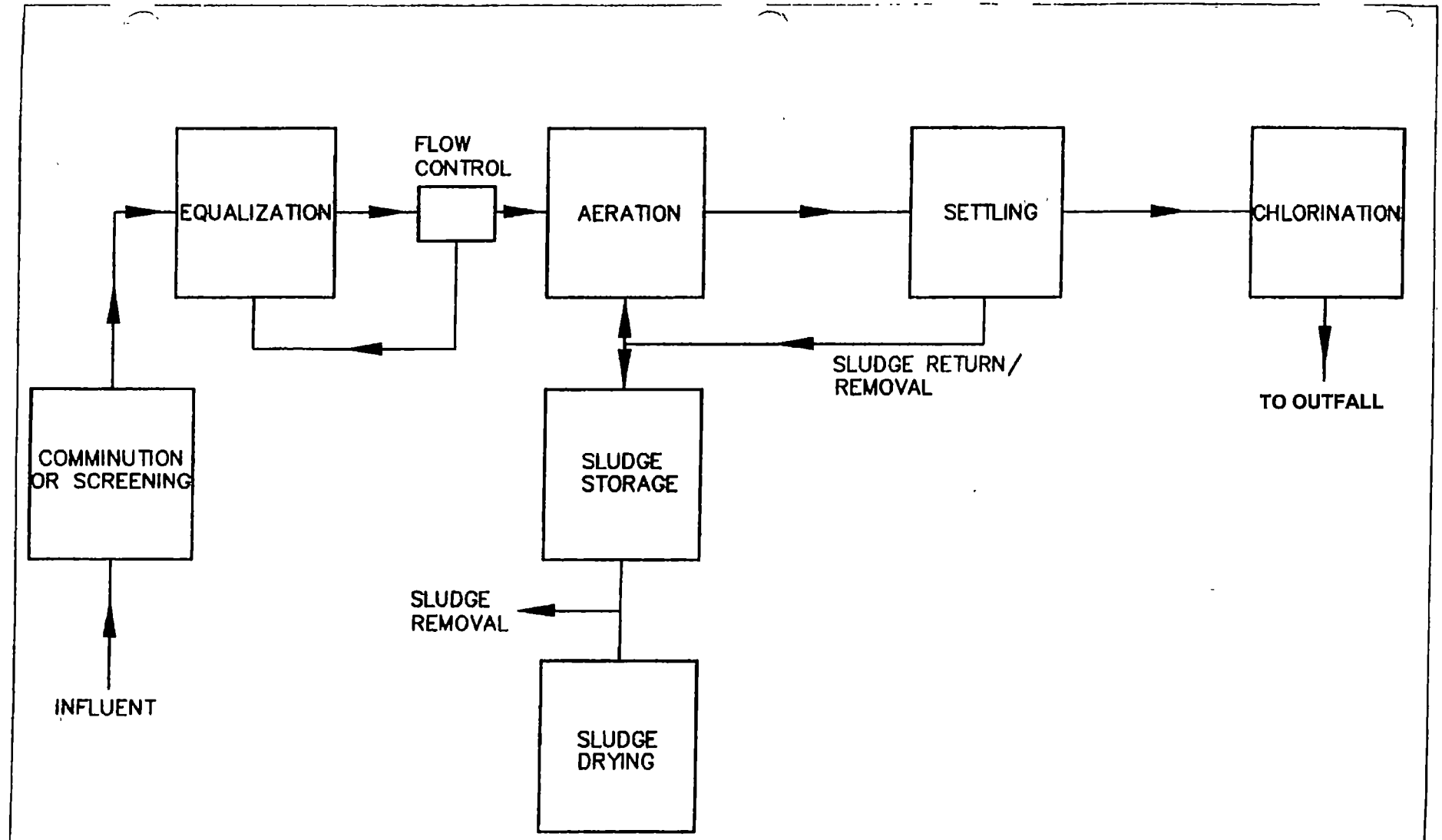
PRIOR TO USING FOR DESIGN WORK CHECK DMIS FOR WORK PENDING

Attachment B

Process Line Drawings

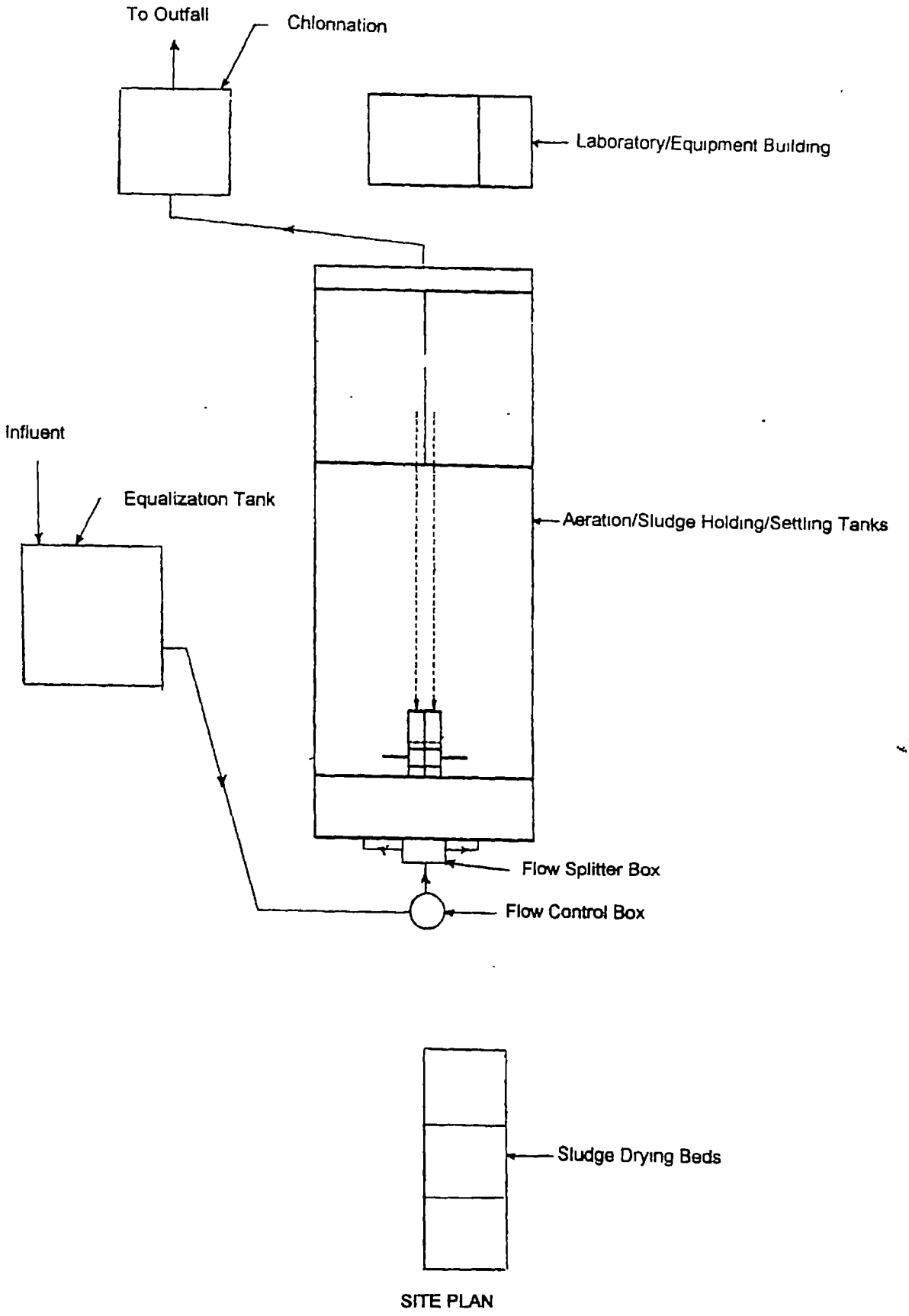
NORTH ANNA POWER STATION
WATER FLOW DIAGRAM





NORTH ANNA NUCLEAR POWER PLANT WWTP
PROCESS DIAGRAM

FIGURE 1



SITE PLAN

FIGURE 2

Attachment C

Potential Discharges Not Covered by Analysis

Potential Discharges Not Covered by Analysis

Numerous chemicals are used in minor and bulk amounts at the station. A list of the bulk chemicals employed is included below. Certain chemicals have multiple uses, and the stated purpose is not preclusive of other purposes or functions. Safety Data Sheets (SDSs) will be provided upon request.

System	Chemical
Bearing Cooling Water	Nalco 7384 (zinc chloride) Flogard MS6208 PCL 713 (phosphate) Dianodic DN2472 Nalco 2894 (biocide) Acti-Brom 1318 (bromine) Sodium hypochlorite Calgon H-900 (biocide) Calgon EVAC (biocide) Cortec VPCI-337 NALCO 71-D5 (Antifoam) NALCO 3DT TRASAR 3DT161 NALCO Towerbrom ® 960 NALCO 3DT TRASAR 3DT461
Service Water Cooling Water	Calgon TRC-256 Nalco 3DT177 Nalco 3DT180 ONDEO H-130 Calgon H-901G Calgon H-300 Calgon Poly EZ 7736 AB Aquashade (dye) Potassium hydroxide Potassium chromate Potassium dichromate Ion exchange resin Nalcolyte 7134 Cortec VPCI-337 Zinc Acetate Acetic Acid NALSPERSE 73551 NALCO 7320
Condenser Hotwell	ETA (monoethanolamine) Hydrazine Ammonium hydroxide

Steam Generator Wet Layup	ETA (monoethanolamine) Hydrazine Ammonium hydroxide Morpholine AMP (amino methyl propanol) MPA (methoxypropylamine) DMA (dimethylamine) Carbohydrazide
Station Chillers	CS Corrosion Inhibitor GE Inhibitor AZ8100 GE Corrshield MD4106 NALCO 2838 GE Corrshield BT4301 GE Spectrus NX1100
Water Purification	KLARAID IC1171 KLARAID CDP1339 KLARAID CDP1318 SPECTRUS NX1106 SPECTRUS DT1404 KLEEN MCT403 KLEEN MCT 404 KLEEN MCT 411 Sodium Chloride Hydrochloric Acid (Muriatic Acid) Sodium Hydroxide

Attachment D

Effluent Sampling Documents

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
NORTHERN REGIONAL OFFICE
13901 Crown Court, Woodbridge, Virginia 22193
(703) 583-3800
www.deq.virginia.gov

Matthew J Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas A Faha
Regional Director

February 1, 2018

Via Email (Jason.E.Williams@dominionenergy.com)

Mr. Jason Williams
Director – Environmental
Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060

Re: Dominion – North Anna Power Station
Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0052451
Permit Reissuance Application Sampling Plan and Waivers Request

Dear Mr. Williams:

Thank you for your correspondence dated January 18, 2018, regarding the sampling plan and testing waivers associated with the referenced VPDES permit reissuance application. Staff has reviewed Dominion's submittal and has the following comments.

Waiver Request – External Outfalls
Dominion requests that the requirement for 24-hour composite samples be waived and grab samples be allowed for the intake and Outfalls 001, 009, 013, 016, 020, and 021.

Staff Response
Staff has no objection to the use of grab sampling in lieu of 24-hour composite sampling for the intake and Outfalls 001, 009, 013, 016, 020, and 021. As such, the 24-hour composite sampling requirement is waived.

Waiver Request – Outfall 001
Dominion requests sampling and analysis relief from fecal coliform, tributyltin (TBT) and Dioxin.

Staff Response
Due to the facility's 316(a) thermal variance and the importance of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is made, it is staff's professional judgement that monitoring for TBT and Dioxin be performed at Outfall 001 to determine if there is any anthropogenic effect from activities on and/or adjacent to the Waste Heat Treatment Facility. Additionally, DEQ requests that Dominion sample Outfall 001 for all GC/MS Fraction – Pesticides found in Part V.C of EPA Form 2C, even if believed absent. The sampling and analysis requirement for TBT and Dioxin is not waived.

The sampling and analysis requirement for fecal coliform is waived.

Waiver Request – Outfall 009
Dominion requests sampling and analysis relief from fecal coliform, tributyltin (TBT) and Dioxin.

Staff Response
The sampling and analysis requirements for fecal coliform, TBT, and Dioxin are waived for Outfall 009.

Waiver Request – Outfall 020
Dominion requests sampling and analysis relief from fecal coliform, tributyltin (TBT) and Dioxin.

Staff Response
The sampling and analysis requirements for fecal coliform, TBT, and Dioxin are waived for Outfall 020.

Waiver Request – Internal Outfalls
Dominion requests waivers for testing for BOD, COD, TOC, Ammonia, Temperature and Form 2C (Part V-B and Part V-C) parameters.

Staff Response
Staff has no objection to Dominion's request. As such, limiting the parameters monitored for internal Outfalls 101, 103, 104, 105, 107, 108, 109, 110, 112, 113, 114, 115, 116, 117, and 118 to those parameters monitored in the effective VPDES permit is acceptable.

Internal Outfall 111 shall be monitored in accordance with the requirements of Form 2A. Sampling and analysis requirements are not waived.

Waiver Request – Internal Outfall 104
Dominion requests sampling and analysis relief from fecal coliform, tributyltin (TBT) and Dioxin.

Staff Response
The sampling and analysis requirements for fecal coliform, TBT, and Dioxin are waived for Internal Outfall 104.

Waiver Request – Internal Outfall 114
Dominion indicates that Internal Outfall 108 is substantially identical to Internal Outfall 114 and that data from Internal Outfall 108 will be submitted to represent Internal Outfall 114.

Staff Response
Please note that the effective VPDES permit does not acknowledge Internal Outfall 108 as being representative of Internal Outfall 114. As such, existing DMR data for Internal Outfall 114 should be submitted with the application.

Waiver Request – Stormwater Outfalls
Dominion requests for all stormwater samples that the requirement for flow-weighted composite samples be waived and only grab samples be collected.

Staff Response
Staff has no objection to the use of grab sampling in lieu of flow-weighted composite samples for stormwater outfalls As such, the flow-weighted composite sampling requirement is waived for stormwater outfalls.

Waiver Request – Stormwater Outfall 014
Dominion requests a waiver from stormwater sampling as there are no industrial activities associated with this drainage area.

Staff Response
Given there are no industrial activities within the drainage area to Stormwater Outfall 014, staff has no objection to Dominion's request. As such, sampling requirements are waived for this stormwater outfall.

Waiver Request – Stormwater Outfall 024
Dominion requests a waiver from stormwater sampling as there are no industrial activities associated with this drainage area.

Staff Response
Given there are no industrial activities within the drainage area to Stormwater Outfall 024, staff has no objection to Dominion's request. As such, sampling requirements are waived for this stormwater outfall.

If you have any questions, please contact Susan Mackert at (703) 583-3853 or by email at susan.mackert@deq.virginia.gov.

Respectfully,

Bryant Thomas
Water Permits and Planning Manager

Ec: Oula Shehab-Dandan (oula.k.shehab-dandan@dominionenergy.com)
VA0052451 – Reissuance File

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

Dominion Energy

BY U.S. MAIL
RETURN RECEIPT REQUESTED

January 18, 2018

Ms. Susan Mackert
Virginia Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, VA 22193

RE: Dominion Energy - North Anna Power Station VPDES Permit No. VA0052451
VPDES Permit Reissuance Sampling and Testing Plan and Requests for Waivers

Dear Ms. Mackert:

Correction: The reissuance application is due on November 8, 2018.

Dominion Energy is preparing the application for reissuance of the VPDES permit for the North Anna Power Station. The ~~current permit expires~~ on November 8, 2018. In accordance with the requirements as we understand them, we developed the attached sampling plan and included testing waivers requests for your review and approval.

If you have any questions, please contact Oula Shehab-Dandan at (804) 273-2697 or at oula.k.shehab-dandan@dominionenergy.com.

Sincerely,

Jason E. Williams
Director, Environmental

Attachment

North Anna Power Station
VPDES Permit No. VA0052451
SAMPLING PLAN

LIST OF VPDES OUTFALLS

EXTERNAL OUTFALLS

Outfall 001: Discharge from Waste Heat Treatment Facility at Dike 3.

Outfall 009: Groundwater, Stormwater, and Backwash from Sand Filters / Reverse Osmosis Unit.

Outfall 013: Turbine Building Sump #1 & #2 and Stormwater.

Outfall 016: Intake Screen Wash Water.

Outfall 020: Reverse Osmosis Reject.

Outfall 021: Reverse Osmosis Drain Line.

Outfall 028: Beyond Design Basis and Emergency Pumps discharge to Lake Anna.

INTERNAL OUTFALLS

Outfall 101: Discharge of Condenser Cooling Water to the Discharge Canal.

Outfall 103: Process Waste Clarifier.

Outfall 104: Turbine Sumps 1, 2 & 3 and Stormwater.

Outfall 105: Bearing Cooling Tower Blowdown.

Outfall 107: Bearing Cooling System Discharge – Lake to Lake Operation.

Outfall 108: Service Water Overflow.

Outfall 109 & 110: Hot Well Drains 1&2.

Outfall 111: Sewage Treatment Plant.

Outfall 112 & 113: Steam Generator Blowdown Units 1&2.

Outfall 114: Service Water Pipe Vault Drain.

Outfall 115: Service Water System Blowdown.

Outfall 116: Vacuum Priming Pumps.

Outfall 117: Salt Storage Pond.

Outfall 118: Beyond Design Basis and Emergency Pumps discharge to the Discharge Canal.

STORMWATER OUTFALLS

Outfall 014, Outfall 022, Outfall 024, Outfall 025, and Outfall 027

SAMPLING PLAN

EXTERNAL OUTFALLS

Dominion requests that the requirement for 24-hour composite samples be waived and grab samples be allowed for the intake and Outfalls 001, 009, 013, 016, 020, and 021. Intake and effluents water quality is not expected to vary greatly during a 24-hour period, and thus grab samples will be adequate to characterize these effluents.

Outfall 001 Discharge of Condenser Cooling Water from WHTF at Dike 3

This outfall continuously discharges condenser cooling water from the Waste Heat Treatment Facility (WHTF) to Lake Anna at Dike 3. The retention time in the WHTF > 24 hours.

- BOD_5, COD and TOC, Total Suspended Solids, Ammonia, Temperature:

We will submit data from a grab sample in accordance with Form 2C instructions (retention period > 24 hours).

- Flow, pH, Total Residual Chlorine, Total Nitrogen, TKN, Nitrate Nitrite, Total Phosphorus:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

- Form 2C - Part V-B and V-C parameters:

We will collect and analyze a grab sample for all pollutants included in Form 2C, Parts V-B & C of the permit application (Tables II, III and IV believed to be present). We acknowledge that the steam electric industry is not required to analyze for base neutrals or organic pesticide compounds [40 CFR Part §122, Appendix D, Note 1(c)(5), 7/1/03 edition] in once through cooling water. We also request sampling and analysis relief for fecal coliform, tributyltin (TBT) and Dioxin. These parameters are believed to be absent from the discharges.

Outfall 009 Settling Pond

This intermittent discharge is from ground water, backwash cleaning from sand filters and reverse osmosis units with the majority of the discharge consisting of storm water runoff. The retention time > 24 hours.

- BOD_5, COD, TOC, Ammonia, Temperature (summer and winter);

We will submit data from a grab sample in accordance with Form 2C instructions.

- Flow, pH, Oil & Grease, TSS:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

- Form 2C - Part V-B and V-C parameters:

We will collect and analyze a grab sample for all pollutants included in Form 2C, Parts V-B & C of the permit application (Tables II, III and IV believed to be present). We acknowledge that the steam electric industry is not required to analyze for organic pesticide compounds [40 CFR Part §122, Appendix D, Note 1(c)(5)]. We also request sampling and analysis relief for fecal coliform, tributyltin (TBT) and Dioxin. These parameters are believed to be absent from the discharges.

Outfall 013 Turbine Bldg Sumps #1 & #2 & Storm Water

This intermittent outfall is an alternate discharge route for the effluent making up the majority of the flow at Outfall 104. Outfall 104 will be sampled and will represent Outfall 013.

Outfall 016 Intake Screen Wash Water

This outfall is a low volume, non-process discharge that consists entirely of lake water. Intake data will be submitted to represent Outfall 016.

- Flow:

Existing data for 2015-2017 will be submitted consistent with sampling required by the current permit.

Outfall 020 Reverse Osmosis Reject

This outfall is designed to discharge continuously, but there are times, which are rare, normally during outages when no make-up water is needed and all tanks are full, when it does not discharge. It consists of reverse osmosis reject water that contains only a 3.3 x concentration of constituents of lake water, and a potential residual of free chlorine from sodium hypochlorite used in the Ionics system. No process waste waters or pollutants from other sources are added. Also, this outfall discharges into the incoming cooling water flow just outside the intakes. The retention time < 24 hours.

- BOD_5, COD, TOC, Ammonia, Temperature (summer & winter):

We request a waiver from the 24-hour composite sample requirement to be substituted with results from a grab sample.

- Flow, pH, TSS, Total Residual Chlorine:

Existing DMR data for 2015-2017 will be submitted consistent with sampling required by the current permit.

- Form 2C - Part V-B and V-C parameters:

We request a waiver from the 24-hour composite sample requirement to be substituted with results from a grab sample. We will collect and analyze for all pollutants included in Form 2C, Parts V-B & C of the permit application (Tables II, III and IV believed to be present). We acknowledge that the steam electric industry is not required to analyze for organic pesticide compounds [40 CFR Part §122, Appendix D, Note 1(c)(5)]. We also request sampling and analysis relief for fecal coliform, tributyltin (TBT) and Dioxin. These parameters are believed to be absent from the discharges.

Outfall 021 Reverse Osmosis Drain Line

This outfall intermittently and infrequently discharges pure lake water from the reverse osmosis system. Outfall 021 has never been used and is in the permit for emergency use only in the case where the whole ionic system is down and the line needs to be drained. Intake data will be submitted to characterize Outfall 021.

Outfall 028 Beyond Design Basis Pumps/ Portable Emergency Water Supply Pumps

Water is withdrawn from Lake Anna to exercise the BDB pumps quarterly. No chemicals are added during this process. The water is immediately re-circulated back to Lake Anna at the same location without coming in to contact with any other equipment or processes associated with the North Anna Power Station's normal operation.

- Flow:

Existing data for 2015-2017 will be submitted consistent with sampling required by the current permit. Intake data will represent this outfall.

INTERNAL OUTFALLS

Outfall 001 analytical results will be representative of the internal outfalls. We will submit DMR data for all internal outfalls except for Outfall 104 (see below). We request waivers for testing for BOD_5, COD, TOC, Ammonia, Temperature and Form 2C - Part V-B and V-C parameters.

Outfall 103 Process Waste Clarifier

This intermittent discharge includes intermittent small volumes of steam generator blowdown, also package boiler blowdown (not currently in use) and mat sump system discharge and ion exchanger waste, and intermittent blowdown of the Service Water Reservoir.

- Flow, pH, TSS, Oil & Grease:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 104 Oil/Water Separator & Storm Water

This discharge is representative of Outfalls 013 (Turbine Building Sumps #1 and #2). The flow is intermittent.

- BOD_5, COD, TOC, Ammonia, Temperature (summer and winter):

We will submit data from a grab sample in accordance with Form 2C instructions.

- Flow, pH, Oil & Grease, TSS:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

- Form 2C - Part V-B and V-C parameters:

We will collect and analyze a grab sample for all pollutants included in Form 2C, Parts V-B & C of the permit application (Tables II, III and IV believed to be present). We acknowledge that the steam electric industry is not required to analyze for organic pesticide compounds [40 CFR Part §122, Appendix D, Note 1(c)(5)]. We also request sampling and analysis relief for fecal coliform, tributyltin (TBT) and Dioxin. These parameters are believed to be absent from the discharges.

Outfall 105 Bearing Cooling Tower Blowdown

This outfall is used to control the water chemistry in the system intermittently when either of the units is operating.

- Flow, pH, Total Chromium, Total Zinc:

Existing DMR data for 2015-2017 will be submitted consistent with sampling required by the current permit.

Outfall 107 Bearing Cooling System Discharge - Lake to Lake Operation

This outfall is not currently in use. If a discharge were to occur, it would be temporary when the bearing cooling tower is valved off for maintenance work, and this is likely to occur within the next five years. Lake water would pass through the bearing cooling system, bypass the cooling tower and go straight to the WHTF. No treatment chemicals are used.

- Flow, TRC:

Existing DMR data for 2015-2017 will be submitted consistent with sampling required by the current permit.

Outfall 108 Service Water Overflow

This outfall is manually operated with a valve, and is used intermittently to control the level of the Service Water Reservoir as necessary. Outfall 108 is substantially identical to Outfalls 114 and Outfall 115.

- Flow, pH, Oil& Grease, TSS:

Existing data for 2015-2017 will be submitted consistent with sampling required by the current permit.

Outfall 109 Hot Well Drain #1

This intermittent outfall was previously approved to represent Outfall 110 (Hot Well Drain #2), relatively high-purity condensate water, with small concentrations of corrosion chemicals. The drains are normally used once per 18 months, on alternating schedules, during maintenance shutdowns of the respective units.

- Flow, pH, Oil & Grease, TSS:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 110 Hot Well Drain #2

Outfall 110 is substantially identical to Outfall 109 and we will submit Outfall 109 data to represent Outfall 110.

Outfall 111 Main Sewage Treatment Plant

All domestic sewage is routed to the main sewage treatment plant. The plant is equipped with two equalization basins, each with a capacity of 18,700 gallons. During normal operation only one side is used but during periods of high demand (outages) both sides are used. Form 2C will be submitted for this outfall.

- Flow, pH, BOD, TSS, TRC:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 112 Steam Generator Blowdown Unit 1

This outfall was previously approved to represent Outfall 113 (Steam Generator Blowdown Unit 2), and continuously discharges relatively high-purity condensate water from a closed system with small concentrations of corrosion chemicals while Unit 1 is operating. It is normally only shut off during outages (every 18 months) for maintenance.

- Flow, pH, Oil & Grease, TSS:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 113 Steam Generator Blowdown Unit 2

Outfall 113 is substantially identical to Outfall 112 and we will submit Outfall 112 data to represent Outfall 113.

Outfall 114 Service Water Pipe Vault Drain

This outfall is used when leakage accumulates in the Pipe Vault adjacent to the Service Water Reservoir. Outfall 108 is substantially identical to Outfalls 114 and we will submit Outfall 108 data to represent Outfall 114.

Outfall 115 Service Water System Blowdown

This outfall is for emergency use only, to blowdown the service water reservoir when other pathways are not available for whatever reasons. Outfall 108 is substantially identical to Outfall 115 and we will submit Outfall 108 data to represent Outfall 115.

Outfall 116 Vacuum Priming Pump

Vacuum priming pumps are located in the vacuum priming house on the discharge structure at the head of the discharge canal. The purpose of the vacuum priming pumps is to draw a vacuum on the circulating water tunnel to provide a motive force for the water being discharged through the tunnel. Water is pulled from the discharge canal, run through the pumps to create a vacuum, and then drained back to the discharge canal. No chemical treatment or process exposure occurs in the vacuum priming house.

- Flow:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 117 Salt Storage Pond

The salt storage pond is managed to avoid any discharges. Dominion is authorized to pump water from the pond to the Waste Heat Treatment Facility (WHTF) via the discharge canal on an as-needed basis to maintain adequate storage for storm events.

- Flow:

Existing DMR data for 2015-2017 will be submitted consistent with reporting required by the current permit.

Outfall 118 Beyond Design Basis and Emergency Pumps

Water is withdrawn from the discharge canal to exercise the BDB pumps quarterly. No chemicals are added during this process. The water is immediately re-circulated back to t at the same location without coming in to contact with any other equipment or processes associated with the North Anna Power Station's normal operation.

- Flow:

Existing data for 2015-2017 will be submitted consistent with sampling required by the current permit.

STORMWATER OUTFALLS

We request that the EPA Form 2F requirement for flow-weighted composite samples be waived and only grab samples be collected. Historic data collected suggest little difference between the grab sample and composite sample results, with the grab sample results being equal to or greater than the composite sample results approximately 75% of the time (141 of 180 observations) thus suggesting that grab samples provide a more conservative characterization of the discharge (see the enclosed stormwater data from the 2007 permit reissuance application).

Outfall 014

Outfall 014 has a drainage area of approximately 4.3 acres, with approximately 3.7 acres of impervious area. Stormwater is collected from the western half of the Turbine Bldg. and has no industrial activities associated with this drainage area. It discharges to Lake Anna. We request waiver from stormwater sampling.

Outfall 022

Has a drainage area of approximately 57.5 acres, with approximately 7.1 acres of impervious area. Stormwater collected from the higher portions near the old contractor shops, parking lots and the switchyard area, flows into a drop grating to a culvert near the northeast corner of the switchyard and discharges into Lake Anna. The lower, more level portion includes the old vehicle maintenance shop, the old paint shop (interim salt storage area) and part of an outdoor equipment laydown area. Stormwater runoff from the grassed portions around the shops and laydown areas, is collected in a swale which combines via culvert, with Outfall 022. Form 2F will be submitted.

- Form 2F-Part A Parameters:

We will collect a grab sample for pH, O&G, BOD, COD, TSS, Total Nitrogen and Total Phosphorus in accordance with Form 2F instructions.

- Form 2F-Part B Parameters: We will collect a grab sample for each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater.
- Form 2F - Part C parameters: We will collect a grab sample and analyze for all pollutants included in Form 2F, Part C if believed present.

Outfall 024

Has a drainage area of approximately 6.1 acres with primarily sheet flow runoff and approximately 0.08 acres of impervious area. The outfall receives flow from a field and an unpaved roadway. The stormwater is collected in a culvert and discharged to Lake Anna.

- No sampling is proposed for this outfall. We request that DEQ waive the requirement to monitor stormwater discharge from this outfall since there are no industrial activities in the drainage area associated with this outfall.

Outfall 025

Has a drainage area of approximately 58.6 acres, with approximately 4 acres being impervious. This area includes a portion of the warehouse facilities, laydown area, and some small utility buildings. Stormwater from the northern portion of this drainage area is conveyed under the paved roadway via two culverts. The culvert to the west carries the smaller amount of stormwater flow which drains from grassy fields with no industrial activity. The culvert to the east is the sampling point for this outfall since it collects the stormwater associated with the above referenced industrial activities. This outfall discharges to the Waste Heat Treatment Facility

- Form 2F-Part A Parameters:

We will collect a grab sample for pH, O&G, BOD, COD, TSS, Total Nitrogen and Total Phosphorus in accordance with Form 2F instructions.

- Form 2F-Part B Parameters: We will collect a grab sample for each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater.
- Form 2F - Part C parameters: We will collect a grab sample and analyze for all pollutants included in Form 2F, Part C if believed present.

Outfall 027

Has a drainage area of approximately 7.5 acres, with approximately 1.3 acres being impervious. This area includes a portion of the warehouse and storage facilities, hazardous material storage building, roadway and a fueling area. The area drains to a stormwater retention pond. The stormwater pond discharges over a riprap outfall to a drainage that discharges to the Waste Heat Treatment Facility. Materials are kept under cover with the exception of the fueling area. Stormwater from the fueling area is directed through an oil water separator prior to entering the stormwater pond.

- No sampling is proposed for this outfall. This outfall was sampled and the data submitted to DEQ on May 2, 2017. Since the data was generated less than 3 years ago and is still representative of the discharge, we will include a copy of the May 2, 2017 submittal in the reissuance application.

EPA ID Number *(copy from Item I of Form 1)*	Form Approved. OMB No. 2040-0086
VAD065376279	OUTFALL 023 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil and Grease	<5.00 ppm	N/A			1	
Biological Oxygen Demand (BOD5)	7.41 ppm	4.19 ppm			1	
Chemical Oxygen Demand (COD)	<5.00 ppm	300 ppm			1	
Total Suspended Solids (TSS)	160.0 ppm	287.0 ppm			1	
Total Nitrogen	1.30 ppm	0.92 ppm			1	
Total Phosphorus	0.12 ppm	0.04 ppm			1	
pH	Minimum 7.11	Maximum 7.11	Minimum	Maximum	1	

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
(continued	from page	VII-2)				
Titanium	1268 ppb	1105 ppb			1	
Zinc	2.550 ppm	0.561 ppm			1	

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Ammonia	0.13 ppm	0.06 ppm			1	
Boron	0.04 ppm	0.04 ppm			1	
Bromide	<0.20 ppm	<0.20 ppm			1	
Color	140	300			1	
Fluoride	0.060 ppm	0.118 ppm			1	
MBAS as LAS	<0.025 ppm	<0.025 ppm			1	
NO3+NO2	0.09 ppm	0.40 ppm			1	
Sulfate	5.76 ppm	5.94 ppm			1	
Sulfide	0.11 ppm	0.02 ppm			1	
Aluminum	24.17 ppm	18.97 ppm			1	
Antimony	<2 ppb	<2 ppb			1	
Arsenic	<3 ppb	<3 ppb			1	
Barium	275 ppb	176 ppb			1	
Beryllium	2.0 ppb	1.2 ppb			1	
Cadmium	3.3 ppb	0.9 ppb			1	
Chromium	14 ppb	13 ppb			1	
Cobalt	15 ppb	6 ppb			1	
Copper	78 ppb	42 ppb			1	
Iron	30.30 ppm	19.80 ppm			1	
Lead	46 ppb	23 ppb			1	
Magnesium	7.32 ppm	4.79 ppm			1	
Manganese	1.13 ppm	0.33 ppm			1	
Mercury	<0.2 ppb	<0.2 ppb			1	
Molybdenum	2 ppb	2 ppb			1	
Nickel	19 ppb	10 ppb			1	
Selenium	<3 ppb	<3 ppb			1	
Silver	<0.1 ppb	<0.1 ppb			1	
Thallium	<2 ppb	<2 ppb			1	
Tin	<5 ppb	<5 ppb			1	
(continued on page VII-1)						

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event (gallons/minute or specify units)	6. Total flow from rain event (gallons or specify units)
11/2 1999	300 minutes	0.91 inches	240 hours	4 gallons/minute	5,820 gallons estimated during sampling

9. Provide a description of the method of flow measurement or estimate.

Timed bucket collection, 5-gallon

EPA ID Number *(copy from Item 1 of Form 1)*	Form Approved. OMB No. 2040-0086
VAD065376279	OUTFALL 024 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil and Grease	5.00 ppm	N/A			1	
Biological Oxygen Demand (BOD5)	5.38 ppm	4.24 ppm			1	
Chemical Oxygen Demand (COD)	<5.00 ppm	<5.00 ppm			1	
Total Suspended Solids (TSS)	602 ppm	222 ppm			1	
Total Nitrogen	0.63 ppm	1.12 ppm			1	
Total Phosphorus	0.10 ppm	0.09 ppm			1	
pH	Minimum 7.06	Maximum 7.06	Minimum	Maximum	1	

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
(continued from page VII-2)						
Titanium	2499 ppb	442 ppb			1	
Zinc	0.414 ppm	0.135 ppm			1	

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Ammonia	0.06 ppm	0.03 ppm			1	
Boron	<0.02 ppm	0.03 ppm			1	
Bromide	<0.20 ppm	<0.20 ppm			1	
Color	400	150			1	
Fluoride	0.129 ppm	0.107 ppm			1	
MBAS as LAS	<0.025 ppm	<0.025 ppm			1	
NO3+NO2	0.02 ppm	0.07 ppm			1	
Sulfate	10.86 ppm	7.61 ppm			1	
Sulfide	0.08 ppm	0.03 ppm			1	
Aluminum	33.75 ppm	5.12 ppm			1	
Antimony	<2 ppb	<2 ppb			1	
Arsenic	<3 ppb	<3 ppb			1	
Barium	221 ppb	57 ppb			1	
Beryllium	3.0 ppb	0.5 ppb			1	
Cadmium	1.3 ppb	<0.3 ppb			1	
Chromium	20 ppb	6 ppb			1	
Cobalt	14 ppb	<3 ppb			1	
Copper	50 ppb	18 ppb			1	
Iron	35.10 ppm	5.78 ppm			1	
Lead	43 ppb	13 ppb			1	
Magnesium	10.5 ppm	2.47 ppm			1	
Manganese	0.65 ppm	0.14 ppm			1	
Mercury	<0.2 ppb	<0.2 ppb			1	
Molybdenum	2 ppb	<1 ppb			1	
Nickel	22 ppb	<5 ppb			1	
Selenium	<3 ppb	<3 ppb			1	
Silver	1.0 ppb	<0.1 ppb			1	
Thallium	<2 ppb	<2 ppb			1	
Tin	<5 ppb	<5 ppb			1	
(continued on page VII-1)						

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event (gallons/minute or specify units)	6. Total flow from rain event (gallons or specify units)
11/2 1999	300 minutes	0.91 inches	240 hours	5 gallons/minute	1,500 gallons estimated during sampling

9. Provide a description of the method of flow measurement or estimate.

Timed bucket collection, 5-gallon

EPA ID Number *(copy from Item I of Form 1)*	Form Approved. OMB No. 2040-0086
VAD065376279	OUTFALL 025 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil and Grease	<5.00 ppm	N/A			1	
Biological Oxygen Demand (BOD5)	4.87 ppm	2.64 ppm			1	
Chemical Oxygen Demand (COD)	32.00 ppm	10.00 ppm			1	
Total Suspended Solids (TSS)	12.9 ppm	4.7 ppm			1	
Total Nitrogen	0.68 ppm	1.90 ppm			1	
Total Phosphorus	0.08 ppm	0.06 ppm			1	
pH	Minimum 7.0	Maximum 7.0	Minimum	Maximum	1	

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
(continued from page VII-2)						
Titanium	15 ppb	<10 ppb			1	
Zinc	0.200 ppm	0.150 ppm			1	

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number (If available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Ammonia	0.14 ppm	0.13 ppm			1	
Boron	<0.02 ppm	0.02 ppm			1	
Bromide	<0.20 pp	<0.20 ppm			1	
Color	40	30			1	
Fluoride	0.205 ppm	0.104 ppm			1	
MBAS as LAS	0.097 ppm	0.082 ppm			1	
NO3+NO2	0.72 ppm	0.54 ppm			1	
Sulfate	22.34 ppm	8.11 ppm			1	
Sulfide	<0.01 ppm	<0.01 ppm			1	
Aluminum	0.67 ppm	0.38 ppm			1	
Antimony	<2 ppb	<2 ppb			1	
Arsenic	<3 ppb	<3 ppb			1	
Barium	25 ppb	15 ppb			1	
Beryllium	<0.2 ppb	<0.2 ppb			1	
Cadmium	0.6 ppb	<0.3 ppb			1	
Chromium	4 ppb	1 ppb			1	
Cobalt	<3 ppb	<3 ppb			1	
Copper	7 ppb	5 ppb			1	
Iron	1.55 ppm	0.40 ppm			1	
Lead	4 ppb	<1 ppb			1	
Magnesium	1.02 ppm	0.58 ppm			1	
Manganese	0.08 ppm	0.03 ppm			1	
Mercury	<0.2 ppb	<0.2 ppb			1	
Molybdenum	153 ppb	75 ppb			1	
Nickel	<5 ppb	<5 ppb			1	
Selenium	<3 ppb	<3 ppb			1	
Silver	0.1 ppb	<0.1 ppb			1	
Thallium	<2 ppb	< 2 ppb			1	
Tin	<5 ppb	< 5 ppb			1	
(continued on page VII-1)						

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event (gallons/minute or specify units)	6. Total flow from rain event (gallons or specify units)
10/4 1999	180 minutes	0.26 inches	90 hours	35 gallons/minute estimated	11,160 gallons estimated during sampling

8. Provide a description of the method of flow measurement or estimate.

Timed bucket collection, 5-gallon

EPA ID Number *(copy from Item 1 of Form 1)*: VAD065376279

Form Approved. OMB No. 2040-0086

OUTFALL 022

Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil and Grease	<5.00 ppm	N/A			1	
Biological Oxygen Demand (BOD5)	3.64 ppm	4.23 ppm			1	
Chemical Oxygen Demand (COD)	<5.00 ppm	18.00 ppm			1	
Total Suspended Solids (TSS)	6.5 ppm	88.0 ppm			1	
Total Nitrogen	0.62 ppm	0.64 ppm			1	
Total Phosphorus	0.04 ppm	0.07 ppm			1	
pH	Minimum 6.9	Maximum 6.9	Minimum	Maximum	1	

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
					1	
					1	
(continued from page VII-2)						
Titanium	<10 ppb	228 ppb			1	
Zinc	0.190 ppm	0.150 ppm			1	

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Ammonia	0.16 ppm	0.17 ppm			1	
Boron	0.03 ppm	0.04 ppm			1	
Bromide	0.58 ppm	<0.20 ppm			1	
Color	40	80			1	
Fluoride	0.133 ppm	0.134 ppm			1	
MBAS as LAS	0.046 ppm	0.065 ppm			1	
NO3+NO2	0.79 ppm	0.78 ppm			1	
Sulfate	6.99 ppm	17.36 ppm			1	
Sulfide	<0.01 ppm	0.17 ppm			1	
Aluminum	0.32 ppm	5.07 ppm			1	
Antimony	<2 ppb	<2 ppb			1	
Arsenic	<3 ppb	<3 ppb			1	
Barium	87 ppb	72 ppb			1	
Beryllium	<0.2 ppb	<0.2 ppb			1	
Cadmium	<0.3 ppb	0.4 ppb			1	
Chromium	4 ppb	8 ppb			1	
Cobalt	<3 ppb	<3 ppb			1	
Copper	1 ppb	12 ppb			1	
Iron	1.81 ppm	5.38 ppm			1	
Lead	1 ppb	7 ppb			1	
Magnesium	5.79 ppm	3.56 ppm			1	
Manganese	0.43 ppm	0.21 ppm			1	
Mercury	<0.2 ppb	<0.2 ppb			1	
Molybdenum	<1 ppb	7 ppb			1	
Nickel	<5 ppb	<5 ppb			1	
Selenium	<3 ppb	<3 ppb			1	
Silver	<0.1 ppb	<0.1 ppb			1	
Thallium	<2 ppb	<2 ppb			1	
Tin	<5 ppb	<5 ppb			1	
(continued on page VII-1)						

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event (gallons/minute or specify units)	6. Total flow from rain event (gallons or specify units)
10/4 1999	180 minutes	0.26 inches	90 hrs	50 gallons/minute estimated	15,000 gallons estimated during sampling

9. Provide a description of the method of flow measurement or estimate.

Timed bucket collection - 5 gallon

EPA ID Number *(copy from item I of Form 1)*	Form Approved. OMB No. 2040-0086
VAD065376279	OUTFALL 026 Approval expires 5-31-92

VII. Discharge Information *(Continued from page 3 of Form 2F)*

Part A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Oil and Grease	<5.00 ppm	N/A			1	
Biological Oxygen Demand (BOD5)	4.49 ppm	5.21 ppm			1	
Chemical Oxygen Demand (COD)	<5.00 ppm	<5.00 ppm			1	
Total Suspended Solids (TSS)	320 ppm	280 ppm			1	
Total Nitrogen	0.85 ppm	1.20 ppm			1	
Total Phosphorus	0.11 ppm	0.13 ppm			1	
pH	Minimum 6.95	Maximum 6.95	Minimum	Maximum	1	

Part B - List each pollutant that is limited in an effluent guideline which the facility is subject to or any pollutant listed in the facility's NPDES permit for its process wastewater (if the facility is operating under an existing NPDES permit). Complete one table for each outfall. See the instructions for additional details and requirements.

Pollutant and CAS Number *(if available)*	Maximum Values *(include units)*		Average Values *(include units)*		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
(continued	from page	VII-2)				
Titanium	1525 ppb	955 ppb			1	
Zinc	0.354 ppm	0.236 ppm			1	

Part C - List each pollutant shown in Tables 2F-2, 2F-3, and 2F-4 that you know or have reason to believe is present. See the instructions for additional details and requirements. Complete one table for each outfall.

Pollutant and CAS Number (if available)	Maximum Values (include units)		Average Values (include units)		Number of Storm Events Sampled	Sources of Pollutants
	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite	Grab Sample Taken During First 20 Minutes	Flow-weighted Composite		
Ammonia	0.10 ppm	0.07 ppm			1	
Boron	0.03 ppm	0.03 ppm			1	
Bromide	0.22 ppm	<0.20 ppm			1	
Color	200	350			1	
Fluoride	0.101 ppm	0.130 ppm			1	
MBAS as LAS	<0.025 ppm	<0.025 ppm			1	
NO3+NO2	0.10 ppm	0.30 ppm			1	
Sulfate	12.06 ppm	7.69 ppm			1	
Sulfide	0.03 ppm	0.05 ppm			1	
Aluminum	22.85 ppm	17.51 ppm			1	
Antimony	<2 ppb	<2 ppb			1	
Arsenic	<3 ppb	<3 ppb			1	
Barium	170 ppb	143 ppb			1	
Beryllium	1.3 ppb	0.8 ppb			1	
Cadmium	<0.3 ppb	0.9 ppb			1	
Chromium	15 ppb	11 ppb			1	
Cobalt	8 ppb	7 ppb			1	
Copper	31 ppb	26 ppb			1	
Iron	21.20 ppm	16.30 ppm			1	
Lead	26 ppb	24 ppb			1	
Magnesium	5.09 ppm	4.40 ppm			1	
Manganese	0.33 ppm	0.26 ppm			1	
Mercury	<0.2 ppb	<0.2 ppb			1	
Molybdenum	2 ppb	2 ppb			1	
Nickel	13 ppb	9 ppb			1	
Selenium	<3 ppb	<3 ppb			1	
Silver	<0.1 ppb	<0.1 ppb			1	
Thallium	<2 ppb	<2 ppb			1	
Tin	<5 ppb	<5 ppb			1	
(continued on page VII-1)						

Part D - Provide data for the storm event(s) which resulted in the maximum values for the flow weighted composite sample.

1. Date of Storm Event	2. Duration of Storm Event (in minutes)	3. Total rainfall during storm event (in inches)	4. Number of hours between beginning of storm measured and end of previous measurable rain event	5. Maximum flow rate during rain event (gallons/minute or specify units)	6. Total flow from rain event (gallons or specify units)
11/2 1999	300 minutes	0.91 inches	240 hours	2 gallons/minute	540 gallons estimated during sampling

9. Provide a description of the method of flow measurement or estimate.

Timed bucket collection, 5-gallon

Oula K Shehab-Dandan (Services - 6)

From: Mackert, Susan (DEQ) <Susan.Mackert@deq.virginia.gov>
Sent: Tuesday, March 13, 2018 9:07 AM
To: Herbert F Chriscoe (Services - 6)
Cc: Oula K Shehab-Dandan (Services - 6)
Subject: [External] RE: North Anna Permit Reissuance

Hi Herbert,

DEQ has no objection to a sampling waiver for sulfite. Based on our conversation this morning, this waiver would apply to all outfalls that require sampling under Form 2C.

Please let me know if you have any other questions or concerns.

Regards,
Susan

Susan Mackert
Water Permit Writer, Senior II
Virginia Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, VA 22193
Phone: (703) 583-3853
susan.mackert@deq.virginia.gov

From: Herbert F Chriscoe [mailto:herbert.f.chriscoe@dominionenergy.com]
Sent: Monday, March 12, 2018 1:12 PM
To: Mackert, Susan (DEQ)
Cc: Oula K Shehab-Dandan
Subject: North Anna Permit Reissuance

Ms. Mackert;

In reviewing the letter from DEQ regarding the permit reissuance sapling plan for North Anna, it was discovered that sulfite was not included in the waiver request. Typically a waiver is requested and granted for this analyte. We have updated our sampling plan development process to prevent this in the future. Dominion Energy requests sampling and analysis relief for sulfite as it is a field test with a short hold time and is not believed to be present. Can you please respond that we do not need to analyse for sulfite?

Please contact me if you have any questions.

Thank you,

Herbert Chriscoe
Environmental Consultant
GES - Generation Environmental Services
(804)273-2484
tieline 8-730-2484
ll (804)971-8288

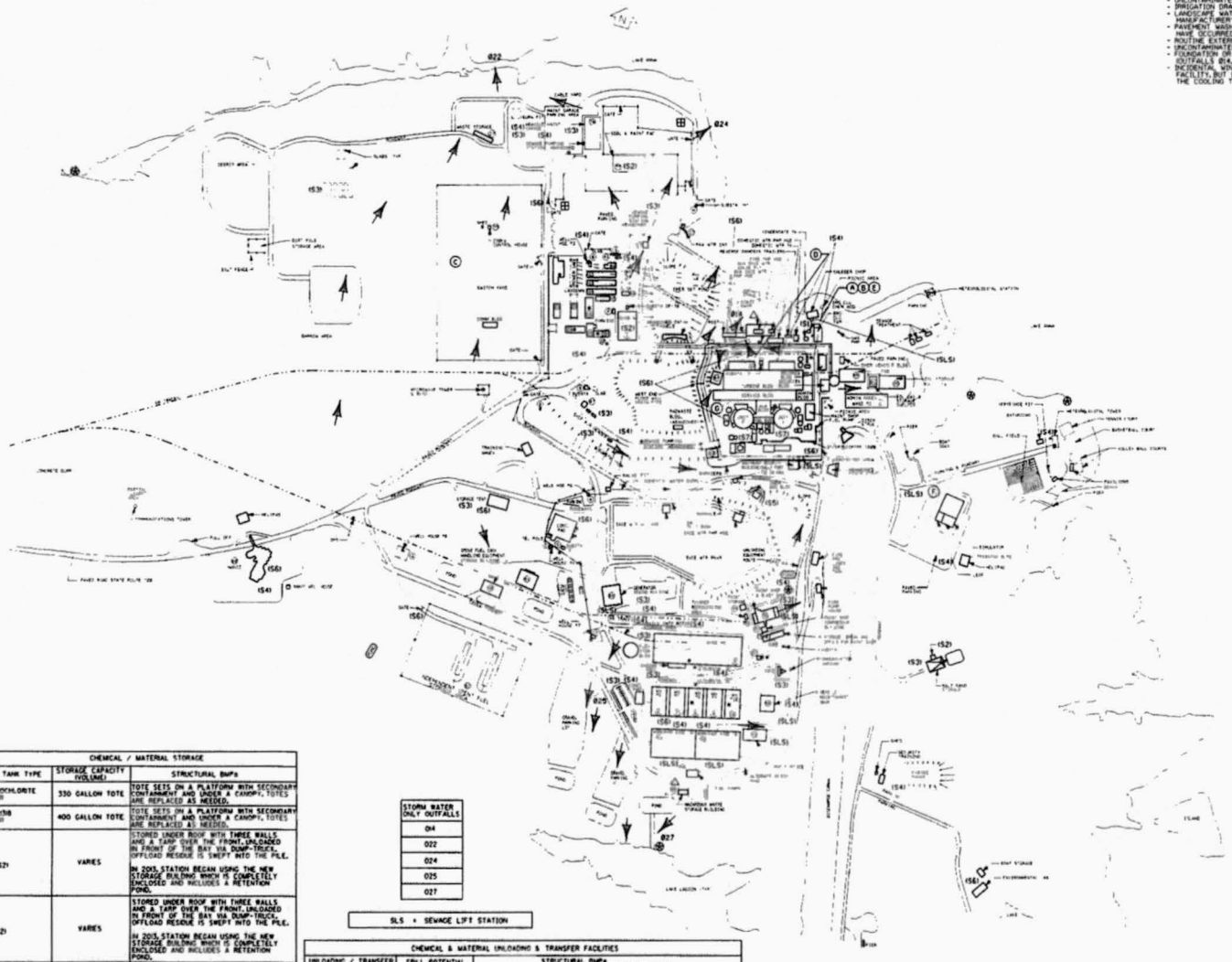
Attachment E

Site Drainage Maps

DRAWING NO.: NA-0-SP-STA-621 | REV: 7

THE OUTFALLS MOST LIKELY TO RECEIVE THE FOLLOWING NON-STORMWATER DISCHARGES ARE ITENTIFIED BELOW IN PARENTHESES:

- DISCHARGES FROM FIRE FIGHTING ACTIVITIES (OUTFALLS 014, 022, 024, 025, AND 027).
- FIRE HYDRANT FLUSHING (OUTFALLS 014, 022, 024, 025, AND 027).
- POTABLE WATER INCLUDING WATER LINE FLUSHINGS (OUTFALLS 014, 022, 024, 025, AND 027).
- UNCONTAMINATED AIR CONDITIONING OR COMPRESSOR CONDENSATE (OUTFALLS 014, 024, 025, AND 027).
- IRRIGATION DRAINAGE (OUTFALLS 025, 014, 025, AND 027).
- LANDSCAPE WATERING PROVIDED ALL PESTICIDES, HERBICIDES, AND FERTILIZER HAVE BEEN APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS (OUTFALLS 022, 024, 025, AND 027).
- PAVEMENT WASH WATER WHERE NO DETERGENTS ARE USED AND NO SPILLS OR LEAKS OF TOXIC OR HAZARDOUS MATERIALS HAVE OCCURRED (UNLESS ALL SPILLED MATERIALS HAVE BEEN REMOVED) (OUTFALLS 014, 024, 025, AND 027).
- ROUTINE EXTERNAL BUILDING WASH DOWN WHICH DOES NOT USE DETERGENTS (OUTFALLS 014, 024, 025, AND 027).
- UNCONTAMINATED GROUND WATER OR SPRING WATER (OUTFALLS 014, 022, 024, 025, AND 027).
- FOUNDATION OR FOOTING DRAINS WHERE FLOWS ARE NOT CONTAMINATED WITH PROCESS MATERIALS SUCH AS SOLVENTS (OUTFALLS 014, 022, 024, 025, AND 027).
- CONDENSATE DRAINAGE FROM REFRIGERATION AND AIR CONDITIONING EQUIPMENT (OUTFALL 027).
- COOLING TOWER BLOWDOWN MAY RESULT FROM COOLING TOWERS THAT COLLECTS FROM ROOFTOPS OR ADJACENT PORTIONS OF THE FACILITY, BUT NOT INTENTIONAL DISCHARGE FROM THE COOLING TOWER (E.G. PIPED COOLING TOWER BLOWDOWN OR DRAINS). THE COOLING TOWER MIST STUDY IS INCLUDED IN THIS PLAN AS APPENDIX G (OUTFALLS 014 AND 024).



CHEMICAL / MATERIAL STORAGE		
STORAGE TANK TYPE	STORAGE CAPACITY (VOLUME)	STRUCTURAL BMPs
SODIUM HYPOCHLORITE MAP KEY (5)	330 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.
ACTI-BROM (58 MAP KEY (5)	400 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.
SAND (MAP KEY (52)	VARIES	STORED UNDER ROOF WITH THREE WALLS AND A TARP OVER THE FRONT. UNLOADED IN FRONT OF THE BAY VIA DUMP-TRUCK. OFFLOAD RESIDUE IS SWEPT INTO THE PILE. IN 2015, STATION BEGAN USING THE NEW STORAGE BUILDING WHICH IS COMPLETELY ENCLOSED AND INCLUDES A RETENTION POND.
SALT MAP KEY (52)	VARIES	STORED UNDER ROOF WITH THREE WALLS AND A TARP OVER THE FRONT. UNLOADED IN FRONT OF THE BAY VIA DUMP-TRUCK. OFFLOAD RESIDUE IS SWEPT INTO THE PILE. IN 2015, STATION BEGAN USING THE NEW STORAGE BUILDING WHICH IS COMPLETELY ENCLOSED AND INCLUDES A RETENTION POND.
LAYDOWN AREA MAP KEY (53)	VARIES	GRADED FLAT.
ROLL OFF CONTAINERS (GENERAL REFUSE, ONLY WASTE, & SCRAP METAL) MAP KEY (54)	VARIOUS SIZE CONTAINERS	SMALLER "TRASH CANS" ARE EQUIPPED WITH LIDS. LARGER DUMPSTERS ARE STRATEGICALLY POSITIONED IN AREAS THAT MINIMIZE SHEET-FLOW TRANSPORT TO STORMWATER CONVEYANCES.
3D TRASAR 3DT461 MAP KEY (51)	275 GALLON TOTE	TOTE SETS ON A PLATFORM WITH SECONDARY CONTAINMENT AND UNDER A CANOPY. TOTES ARE REPLACED AS NEEDED.

CHEMICAL CONTAINING EQUIPMENT		
STORAGE TANK TYPE	STORAGE CAPACITY (VOLUME)	STRUCTURAL BMPs
BEARING COOLING TOWER; - SYC - BIOCIDE - ACTI-BROM (58 - SODIUM HYPOCHLORITE - 3D TRASAR 3DT464 MAP KEY (50	25,000 GPM	CATCHMENT STRUCTURE

STORM WATER ONLY OUTFALLS
014
022
024
025
027

SLS = SEWAGE LIFT STATION

CHEMICAL & MATERIAL UNLOADING & TRANSFER FACILITIES		
UNLOADING / TRANSFER FACILITY NAME, NUMBER	SPILL POTENTIAL (VOLUME)	STRUCTURAL BMPs SECONDARY CONTAINMENT (GALLONS)
H-130 BIOCIDE MAP KEY (55)	2200 GALLON TANKER TRUCK LOADS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. CATCH PANS ARE USED UNDER LINE CONNECTIONS.
3D TRASAR 3DT177 (CORROSION INHIBITOR) MAP KEY (55)	55 GALLONS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. TRANSFERS ARE CONDUCTED IN SECONDARY CONTAINMENT OF THE SERVICE WATER CHEMICAL ADDITION BUILDING (SWCAB). ALL DRAINS INSIDE THE SWCAB ARE COLLECTED IN A SUMP WHICH IS PERIODICALLY PUMPED TO THE SERVICE WATER RESERVOIR.
3D TRASAR 3DT180 (CORROSION INHIBITOR) MAP KEY (55)	55 GALLONS	FACILITY PERSONNEL ARE REQUIRED TO BE PRESENT DURING TRANSFER OPERATIONS. TRANSFERS ARE CONDUCTED IN SECONDARY CONTAINMENT OF THE SERVICE WATER CHEMICAL ADDITION BUILDING (SWCAB). ALL DRAINS INSIDE THE SWCAB ARE COLLECTED IN A SUMP WHICH IS PERIODICALLY PUMPED TO THE SERVICE WATER RESERVOIR.
PORTABLE RESTROOMS MAP KEY (56)	VARIOUS	STORED IN AREAS THAT ARE AWAY FROM STORM DRAIN INLETS. THE DRIVERS RECEIVE SPILL RESPONSE BRIEFING VIA STATION PROCEDURE MA-AA-1001 SUPPLEMENTAL PERSONNEL
DYNACOOL 1583 MAP KEY (57)	55 GALLONS	CHEMICAL TRANSFER OPERATIONS ARE PERFORMED BY CHEMISTRY DEPT. PERSONNEL. THE CHEMICAL IS TRANSFERRED TO 330 GALLON TOTES, WHICH ARE LOCATED IN COVERED SUMPS NEX TO THE UNIT CONTAINMENT BUILDINGS OR IN THE DECON BUILDING BASEMENT.

REPORTABLE SPILL LOCATION		
	DATE	SOURCE
A	12/10/09	BEARING COOLING TOWER
B	08/23/11	BEARING COOLING TOWER
C	08/23/11	TRANSFORMER
D	08/25/11	UNIT 2 MAIN GENERATOR
E	10/14/11	BEARING COOLING TOWER
F	2/15/12	TRAINING BUILDING'S SEWAGE SUMP
G	12/14/16	2HB FUEL OIL LINE LEAK

NOTES:
1. IMPERVIOUS SURFACES INCLUDE PAVED ROADS, PARKING LOTS, CONCRETE DITCHES, METAL STRUCTURES, AND BUILDING ROOFTOPS.

SYMBOLS AND LEGEND:
- DRAINAGE PATH
- WETLAND AREA
- BUILDING
- ROADWAY
- OIL/WATER SEPARATOR
- STORMWATER RETENTION POND
- STORMWATER DROP INLET W/ BLOCK AND GRAVEL PROTECTION

Dominion
NUCLEAR ENGINEERING
RICHMOND, VIRGINIA

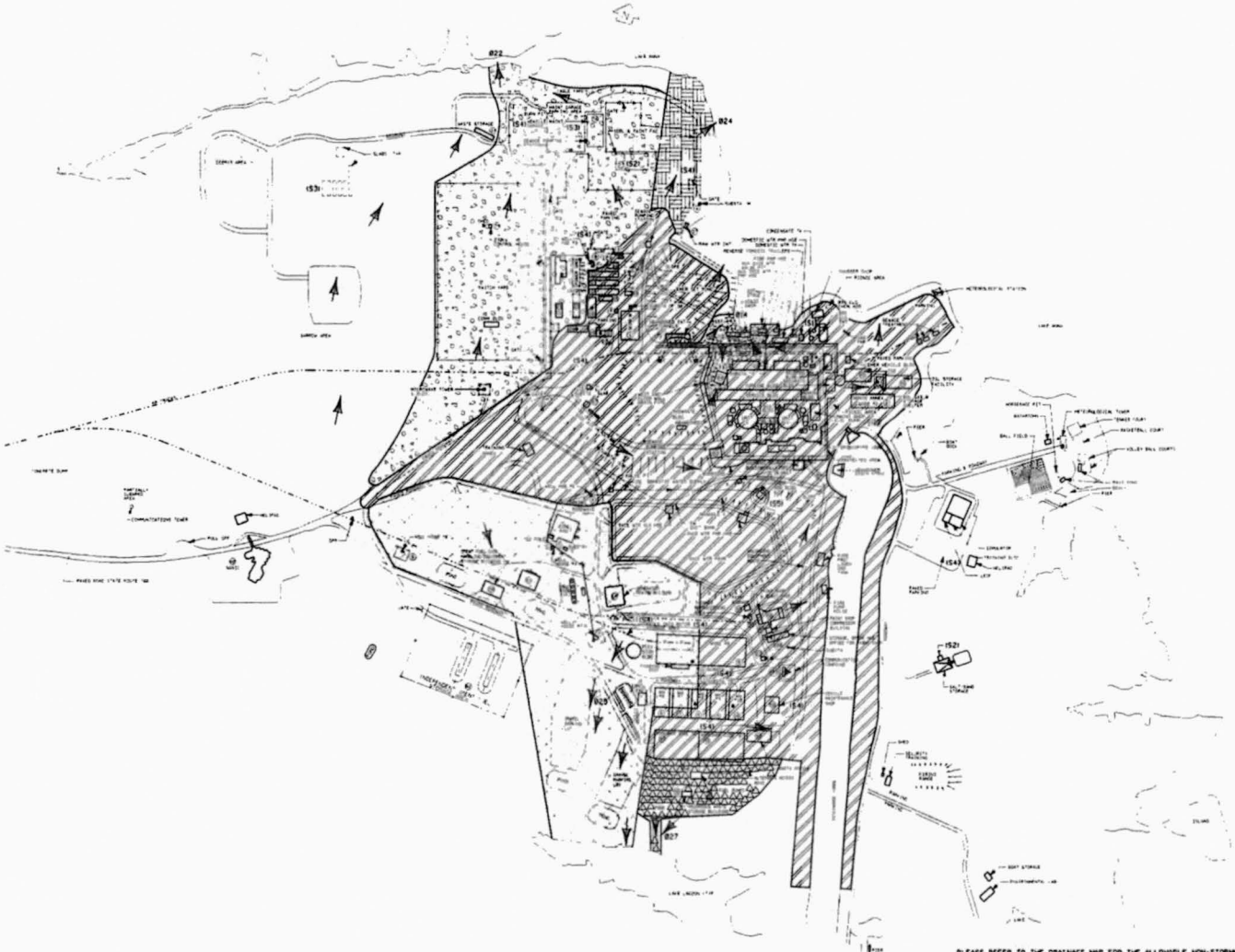
SWPPP SITE PLAN
NORTH ANNA POWER STATION

REVISION DESCRIPTION (SIGNATURES ON FILE)	CAD NO: NAGRAT621.DGN	
REVISED 6-1-18	DRAWING NO: NA-0-SP-STA-621	REV 14
DSGN: ANH	SCALE: NONE	UNLESS OTHERWISE NOTED: SH 1 OF 1

PC:HF1 & HP1

adam015
01-JUN-2018 14:16
NAGRAT621.DGN

PRIOR TO USING FOR DESIGN WORK CHECK DMIS FOR WORK PENDING



NOTES:

1. SEE STATION SWPPP SITE PLAN MAP FOR LOCATIONS OF ALL STORMWATER DITCHES, PIPES, SWALES, INLETS, WETLANDS, ROLL-OFFS, CHEMICAL STORAGE/LOADING AREAS, AND PORTA-JOHNS.

PLEASE REFER TO THE DRAINAGE MAP FOR THE ALLOWABLE NON-STORMWATER DRAINAGE LOCATIONS. THE ISSUES THAT MIGHT BE ASSOCIATED WITH THE ABOVE ALLOWABLE NON-STORMWATER DISCHARGES (I.E. EROSION) ARE EVALUATED DURING THE ROUTINE INSPECTIONS. NONE OF THE ABOVE ALLOWABLE NON-STORMWATER SOURCES CURRENTLY REQUIRE SPECIFIC BMP(S). FOR DETAILS ON THE STORMWATER BMP(S) CURRENTLY UTILIZED AT NORTH ANNA POWER STATION, PLEASE REFER TO SECTION 5.0 OF THE SWPPP.

LEGEND:

- DISCHARGES FROM FIRE FIGHTING ACTIVITIES;
- FIRE HYDRANT FLUSHING;
- POTABLE WATER INCLUDING WATER LINE FLUSHINGS;
- UNCONTAMINATED AIR CONDITIONING OR COMPRESSOR CONDENSATE;
- IRRIGATION DRAINAGE;
- LANDSCAPE WATERING PROVIDED ALL PESTICIDES, HERBICIDES, AND FERTILIZER HAVE BEEN APPLIED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS;
- PAVEMENT WASH WATER WHERE NO DETERGENTS ARE USED AND NO SPILLS OR LEAKS OF TOXIC OR HAZARDOUS MATERIALS HAVE OCCURED (UNLESS ALL SPILLED MATERIALS HAVE BEEN REMOVED);
- ROUTINE EXTERNAL BUILDING WASH DOWN WHICH DOES NOT USE DETERGENTS;
- UNCONTAMINATED GROUND WATER OR SPRING WATER;
- FOUNDATION OR FOOTING DRAINS WHERE FLOWS ARE NOT CONTAMINATED WITH PROCESS MATERIALS SUCH AS SOLVENTS;
- INCIDENTAL WINDBLOWN MIST FROM THE COOLING TOWER (E.G., "PIPER" COOLING TOWER BLOWDOWN OR DRAINS). THE COOLING TOWER MIST STUDY IS INCLUDED IN THIS PLAN AS APPENDIX B.

Dominion

NUCLEAR ENGINEERING
RICHMOND, VIRGINIA

SWPPP SITE DRAINAGE
NORTH ANNA POWER STATION

REVISION DESCRIPTION (SIGNATURES ON FILE)	CAD NO: NADRAIN622.DGN	
REVISED 6-1-18	DRAWING NO: NA-0-SP-STA-622	REV 7
DSGN: ANH	SCALE: NONE	UNLESS OTHERWISE NOTED | SH 1 OF 1

PC=NP1 & NP2

adam015
01-JUN-2018 13:20
NADRAIN622.DGN

PRIOR TO USING FOR DESIGN WORK CHECK DMIS FOR WORK PENDING

Attachment F

Stormwater Pollution Prevention

4.0 POTENTIAL POLLUTANT SOURCES

VA0052451, Part I, F.6.a) Storm Water Controls (SWPPP Cross Reference #9)
VA0052451, Part I, F.3. Description of Potential Pollutant Sources. (SWPPP Cross Reference #6)
VA0052451, Part I, F.6.b)(ii) Eliminating and Minimizing Exposure (SWPPP Cross Reference #12)

A SWPPP evaluation and associated SPCC Plan identified the following areas and equipment as potentials to impact stormwater runoff. The likelihood is low and is primarily associated with stormwater drainage areas and equipment / operations within those drainage areas. Please refer to Appendix C for general equipment locations, drainage patterns, and directions relevant to each stormwater outfall.

The following areas were evaluated on whether or not stormwater comes into direct contact with the material identified and whether or not the runoff has Best Management Practices (BMPs) to minimize direct discharges from Stormwater Outfalls.

4.1 SUMMARY OF POTENTIAL POLLUTANT SOURCES

VA0052451, Part I, F.3.2.(e) Risk Identification and Summary of Potential Pollutant Sources (SWPPP Cross Reference #16)

Facility Area	Activity	Pollutant(s) or Pollutant Parameter(s)
Bearing Cooling Tower: - EVAC – Biocide - Acti Brom 1318 - Sodium Hypochlorite - 3D Trasar 3DT461 Corrosion Inhibitor	Unloading / Storage	POLLUTANT: Chemicals DIRECT EXPOSURE: No POTENTIAL TO DISCHARGE: Low
Chemical Addition Building: - H-130 Biocide - 3D Trasar 3DT177 - 3D Trasar 3DT180	Unloading	POLLUTANT: Chemicals DIRECT EXPOSURE: No POTENTIAL TO DISCHARGE: Low
Bulk Petroleum Storage Facility	Unloading / Storage	POLLUTANT: Petroleum DIRECT EXPOSURE: No POTENTIAL TO DISCHARGE: Low
Salt Storage	Unloading / Storage	POLLUTANT: Salt DIRECT EXPOSURE: No POTENTIAL TO DISCHARGE: Low
Laydown Areas	Storage	POLLUTANT: Metals DIRECT EXPOSURE: Yes POTENTIAL TO DISCHARGE: Moderate
General Refuse Containers	Unloading / Storage	POLLUTANT: Various Pollutants DIRECT EXPOSURE: Yes POTENTIAL TO DISCHARGE: Moderate
Unit 1 and 2 Mat Sumps - Dynacool 1383 Scale Inhibitor	Unloading	POLLUTANT: Chemical DIRECT EXPOSURE: No POTENTIAL TO DISCHARGE: Low

4.2 EPCRA § 313 Potential

Toxic Release Inventory (TRI) Applicability and Reporting as it relates to North Anna Power Plant

As stated in 40 CFR 372.22, a facility must meet all 3 of the established threshold criteria before being subject to the TRI requirements. One of the 3 criteria includes SIC Code 4911 of which North Anna can best be classified. *But* 40 CFR 372.22 further states that SIC Code 4911 must produce electricity from coal and/or oil combustion. Therefore, North Anna does not meet all 3 of the threshold requirements and is not subject to EPCRA 313 (i.e., TRI).

3 threshold criteria needed to be met to be subject to TRI:

10 or more full-time employees (>20,000 hrs/year), including contractors

Facility under a covered SIC code to include: 20 - 39, 10 (except 1011, 1081, 1094), 12 (except 1241), 4911 (with coal and/or oil combustion), 4931 (with coal and/or oil combustion), 4939 (with coal and/or oil combustion), 4953 (RCRA facilities only), 7389 (contracted solvent recovery), 5169, 5171

MPOU (Manufactured, Processed, and Otherwise Used) Criteria (Note: Combustion is viewed as coincidentally manufacturing)

Manufactured or Processed a TRI chemical >25,000 lbs or Otherwise Used a TRI chemical >10,000 lbs.

Manufactured or Processed or Otherwise Used a Persistent, Bio-accumulative, Toxic chemical >100 lbs.

Manufactured or Processed or Otherwise Used a Persistent, Bio-accumulative, Toxic chemical >10 lbs.

EPCRA § 313 Potential Spills or Leaks That Can Impact Stormwater and Drainage Points		
Equipment or Unloading / Transfer Area	**Spill Likelihood and Predicted Quantity**	**Drainage Point**

4.3 Site Bulk Chemicals/ Materials

Chemical / Material Storage		
Storage Tank Type	**Storage Capacity (Volume)**	**Structural BMPs**
Sodium Hypochlorite **Map Key (S1)**	330 Gallon Tote	Tote sets on a platform with secondary containment and under a canopy. Totes are replaced as needed.
Acti – Brom 1318 **Map Key (S1)**	400 Gallon Tote	Tote sets on a platform with secondary containment and under a canopy. Totes are replaced as needed.
Sand **Map Key (S2)**	Varies	Stored under roof with three walls and a tarp over the front. Unloaded in front of the bay via dump-truck. Offload residue is swept into the pile. In 2013, station began using the new storage building which is completely enclosed and includes a retention pond.
Salt **Map Key (S2)**	Varies	In 2013, station began using the new storage building which is completely enclosed and includes a retention pond. The old paint shop building, which is completely enclosed, is also used as an additional salt storage area, when needed. During the cold weather months, salt is temporarily stored in closed 5 gallon buckets, near building entrance ways, sidewalks, and outdoor stairwells.
Laydown Area **Map Key (S3)**	Varies	Graded Flat.
General Refuse **Map Key (S4)**	Various Size Containers	Smaller "trash cans" are equipped with lids; larger dumpsters are strategically positioned in areas that minimize sheet-flow transport to stormwater conveyances.
3D Trasar 3DT461 **Map Key (S1)**	275 Gallon Tote	Tote sets on a platform with secondary containment and under a canopy. Totes are replaced as needed.

Chemical Containing Equipment		
Storage Tank Type	**Storage Capacity (Volume)**	**Structural BMPs**
Bearing Cooling Tower: - EVAC – Biocide - Acti Brom 1318 - Sodium Hypo chlorite - 3D Trasar 3DT461 **Map Key (S1)**	25,000 GPM	Catchment Structure

Chemical & Material Unloading & Transfer Facilities		
Unloading/Transfer Facility Name, Number	**Spill Potential (Volume)**	**Structural BMPs**
H-130 Biocide **Map Key (S5)**	1,200 Gallon Tanker Truck Loads	Facility Personnel are required to be present during transfer operations. Catch pans or buckets are used under line connections.
3D Trasar 3DT177 (Corrosion Inhibitor) **Map Key (S5)**	55 Gallons	Facility Personnel are required to be present during transfer operations. Transfers are conducted in secondary containment of the Service Water Chemical Addition Building (SWCAB). All drains inside the SWCAB are collected in a sump which is periodically pumped to the Service Water Reservoir.
3D Trasar 3DT180 (Corrosion Inhibitor) **Map Key (S5)**	55 Gallons	Facility Personnel are required to be present during transfer operations. Transfers are conducted in the secondary containment of the Service Water Chemical Addition Building (SWCAB). All drains inside the SWCAB are collected in a sump which is periodically pumped to the Service Water Reservoir.
Portable Restrooms **Map Key (S6)**	Various	Stored in areas that are away from storm drain inlets. The drivers receive spill response briefing via station procedure *MA-AA-1001 Supplemental Personnel*
Dynacool 1383 **Map Key (S7)**	55 Gallons	Chemical transfer operations are performed by Chemistry Dept. personnel. The chemical is transferred to 300 gallon totes which are located in covered sumps next to the unit containment buildings or in the Decon. Building basement.

4.4 Site Bulk Oil

The Station's petroleum storage and handling equipment is managed in accordance with the applicable SPCC regulations. For specifics on storage, unloading and relevant secondary containment, please refer to the Station's SPCC/VA ODCP Plan, which is in a separate plan and available upon request.

4.5 Sediment & Erosion

VA0052451, Part I, F.b)(vi) Sediment and Erosion Control. (SWPPP Cross Reference #17)

This Section describes both routine and construction project run-off management.

4.5.1 Sediment and Erosion Control

VA0052451, Part I, F.6.b)(vii) Management of Runoff (SWPPP Cross Reference #18)

The Station utilizes curbs, concrete ditches, rocks, silt fence, (filter bags), and grates/inlets to control stormwater runoff. Approximately 35% of the property has impervious surfaces such as roof tops and paved parking lots and roads. The other 65% are vegetated woodlands, grassy areas, ponds, and graveled areas. No evidence of severe erosion is currently present. Silt fencing is utilized around the base of earthen material stockpiles. Issues requiring corrective action, noted by station personnel, are entered into the Station's CRS, where the corrective actions for the issues noted can be tracked.

4.5.2 Construction Erosion & Sediment Control

In the event of construction activities, Appendix I is reserved for the Construction Project's Erosion Control and Sediment Plan. Such plans are required for Construction Stormwater Permits and developed with a specific focus on site topography, drainage patterns, soils, ground cover, and adjacent runoff areas.

During the Unit 3 Site Separation Project, six sediment basins were installed at the facility under Construction Stormwater Permit No. VAR101574. Each of these sediment basins were converted into permanent stormwater management basins prior to closing the construction stormwater permit. A Stormwater Maintenance Agreement (provided in Appendix J) was signed by Louisa County and Dominion in October 2014. Basin #1 (Outfall 027) was included in the Station's industrial stormwater permit during the 2014 permit reissuance. Due to a lack of industrial activity in the drainage areas, the remaining stormwater management basins (Basins #2 - #6) were not added to the Station's industrial stormwater permit. However, these basins will be managed and maintained in accordance with the aforementioned Stormwater Maintenance Agreement.

5.0 STORMWATER CONTROLS

VA0052451, Part I, F.6.a) Storm Water Controls. (SWPPP Cross Reference #9)
VA0052451, Part I, F.6.b) Control Measures. (SWPPP Cross Reference #10)
VA0052451, Part I, F.6.b)(ii) Eliminating and Minimizing Exposure (SWPPP Cross Reference #12)
VA0052451, Part I, F.6.b)(vii) Management of Runoff (SWPPP Cross Reference #18)

Stormwater management controls appropriate for the Station can be summarized as follows:

UNIT OR AREA NAME	APPROPRIATE STORMWATER MANAGEMENT CONTROLS (Runoff Controls)
Switchyard Area	Concrete Ditches, Gravel, Bermed Containment
Main Station Area	Concrete Ditches, Drop Inlets, Concrete Retention Boxes / Oil Water Separators, Rip-rap, Straw Bales,
Warehouse / Workshop Bldgs.	Rip-rap, Vegetation, Ditches, Downspout Dispersion Lines, Retention Pond, Oil Water Separators
Discharge Canal	Rip-rap, Vegetation
ISFSI	Retention Pond, Gravel, Rip-rap
Maintenance / Laydown Area	Rip-rap, Gravel, Flat Grade Surface, Silt Fence, Straw Bales
Backup Measures and Controls	As part of the routine practice, station staff monitors stormwater discharges for indicators of pollutants (ex. color, sheen, and foam). In the event of a spill, drain covers are maintained at the facility to cover the storm water drop inlets until the spill can be recovered by absorbent pads, absorbent booms, and/or a vacuum truck. Other non-routine backup measures and BMPs may be utilized as per the conditions at the time of any particular event.

5.1 Structural BMPs

Refer to Section 4.3 & 4.4 for structural BMPs in place at this Station.

5.2 Non-Structural BMPs

The Station has Operating Procedures (OP) that are related to stormwater contact management. They reduce the potential for stormwater contact due to equipment failure or operational losses. The associated OPs are listed in Section 5.2.1:

5.2.1 Employee Training

VA0052451, Part I, F.6.b)(vi) Employee Training. (SWPPP Cross Reference #16)

The positions noted in the Pollution Prevention Team with (2) are responsible for ensuring that stormwater training requirements are met. The Station has the following training that encompasses stormwater management:

- New Employee Plant Access Training (PAT)
- SWPPP Inspections
- Hazard Communication Program

- Annual Employee Environmental Awareness - LMS (which includes basic stormwater pollution awareness, good housekeeping, and spill prevention training)

The following table represents the Operational Procedures (OP) associated with stormwater and used as training. Copies of the OPs are maintained in the Station's files and available upon request.

OP Number	Operating Procedure Name
VPAP – 2202	Control of Chemicals & Hazardous Substances
VPAP - 2203	Oil Spill Prevention Control, And Countermeasures (SPCC) Plan
1-PT-9.3	Erosion Control Inspection – Station Site
0-PT-75.12	Visual Inspection of the Service Water Reservoir Dike Crest and Toe
0-AP-23	Oil or Hazardous Substance Spill Response
0-OP-53.4	Draining of 1-DB-TK-2A and 1-DB-TK-2B 275 Gallon Fuel Oil Drain Collection Tanks
1-ICP-SW-F-117	Supply Header Number 1 SW Discharge Flow (1-SW-F-117) Calibration
2-ICP-SW-F-217	Supply Header Number 2 SW Discharge Flow (2-SW-F-217) Calibration
1-OP-41.12	Waste Oil Collection System
0-GOP-12.4	Pumping Down Service Water Bladder Tank
0-GOP-53.0	Lube Oil And Fuel Oil Storage Tanks Weekly Checks
0-MOP-49.08	Removing No.1 Supply (A) And No.4 Return (A) Headers From Service And Returning To Service
0-MOP-49.08.1	Removing No.1 Supply (A) And No.4 Return (A) Headers From Service And Returning To Service With Unit 1 In Cold Shutdown
0-MOP-49.08.2	Removing No.1 Supply (A) And No.4 Return (A) Headers From Service And Returning To Service With Unit 2 In Cold Shutdown
0-MOP-49.09	Removing Service Water (B) No.2 Supply And (B) No.3 Return Headers From Service And Returning To Service
0-MOP-49.09.1	Removing Service Water (B) No.2 Supply and And (B) No.3 Return Headers from From Service and And Returning to To Service With Unit 1 In Cold Shutdown
0-MOP-49.09.2	Removing Service Water (B) No.2 Supply and And (B) No.3 Return Headers from From Service and And Returning to To Service With Unit 2 In Cold Shutdown
0-OP-22.17	Discharging Service Water To Lake Anna Via The Liquid Waste System
1/2-OP-7.8	Refueling Water Chemical Addition Tank
CH-32.926	Bearing Cooling Tower Chemical Addition System
CH-32.928	BC Tower Chemical Addition System: Chemical Tote Change-out And Pump Venting
CH-32.940	SW System: Aquashade Addition
CH-11.981	Unit 1 Containment Mat Sumps: Charging Chemical Addition Tanks
CH-11.982	Unit 2 Containment Mat Sumps: Charging Chemical Addition Tanks
0-MOP-53.30	Filling and Draining 1-EG-TK-2A Emergency Generator Storage Tank
0-MOP-53.31	Filling and Draining 1-EG-TK-2B Emergency Generator Storage Tank
0-OP-41.7	Transfer of Used Oil To Disposal Truck And Receipt Of New Oil From A Tanker Truck

1-OP-53.1	Emergency Diesel Generator Fuel Oil Storage And Transfer System
1-OP-53.3	Above Ground Fuel Oil Storage And Transfer System
CH-32.933	Service Water System – Adding Chemicals To Chemical Addition Tanks
CH-32.939	Service Water Chemical Addition System : Operation
CY-AA-CTL-510	Chemical Control
0-GEP-7	Engineering Chemical Locker Inspection
0-GOP-3.5	Operations Monthly Chemical Lockers Inspections
0-GPP-1	Outage and Planning Chemical Locker Inspection
0-HSP-INSP-001	Health Physics Monthly Chemical Locker Inspection
GMP-E-136	NSS Chemical Control Program
RP-AA-232	Radioactive Material Control
EV-AA-WTR-101	Water Quality
CH-88.107	Sewage Lift Station Operations
CH-88.505	Sewage Treatment Plant: Operational Activities
CH-88.600	Chemistry Response To Construction Power Outage
MA-AA-2000	Housekeeping
SA-AA-106	Drilling, Digging, And Cutting
MA-AA-1001	Supplemental Personnel

Material Safety Data Sheets (MSDS / SDS) are also utilized as part of training to ensure that employees understand the nature of materials that could cause equipment leaks. Refer to the station's MSDS/SDS database for copies of the MSDSs/ SDSs.

5.2.2 Good Housekeeping

VA0052451, Part I, F.6.b)(i) Good Housekeeping. (SWPPP Cross Reference #11)
VA0052451, Part I, F.7.a. Good Housekeeping Measures (SWPPP Cross Reference #19)

For details on the Sector Specific Good Housekeeping, please refer to Section 6.0 of this plan.

5.2.3 Minimizing Exposure

The station minimizes exposure by use of station procedures, structural & non-structural BMPs.

5.2.4 Routine Facility Inspections

(VA0052451, Part I, F.6.b)(v) Routine Facility Inspections. (SWPPP Cross Reference #15)

Routine facility inspections are comprehensive in scope. Refer to Appendix E. The inspections include:

- Stormwater: Weekly, Monthly, Quarterly Inspections and Annual Evaluation
- SPCC Plan Inspections

5.2.5 Spill Prevention and Response Procedures

VA0052451, Part I, F.6.b)(iv) Spill Prevention and Response Procedures. (SWPPP Cross Reference #14)

During the spill response process, Station Operations will initiate the facility's spill response procedure: 0-AP-23 which addresses oil and chemical spills. In addition, for petroleum spills, please refer to the SPCC/VA OCDP Plan, which is under a separate cover.

All station personnel receive annual spill prevention/response and storm water pollution prevention training through LMS. Also, on an annual basis, a SWPPP and SPCC briefing is conducted for station personnel.

For significant and high risk spill scenarios, a certified spill response contractor will be contacted for cleanup. Contact information for spill response contractors are listed in the SPCC and ODCP Plans. Necessary equipment (e.g., spill kits, sand bags, and soil) to implement a cleanup is available to site personnel.

5.3 Preventive Maintenance

VA0052451, Part I, F.6.b)(iii) Preventive Maintenance. (SWPPP Cross Reference #13)

The Facility inspects the BMPs in accordance with applicable station's procedures listed in the above table in Section 5.2.1.

5.4 Maintenance

VA0052451, Part I, F.7.c. Maintenance (SWPPP Cross Reference #20)

Based upon facility evaluation, Section 4.0 (Potential Pollutant Sources) identified those types and locations of equipment that can potentially impact stormwater as a result of operational or equipment failure or human error. Structural and non-structural Best Management Practices (BMPs) are currently utilized to minimize impacts to stormwater runoff. These BMP's will continue to be utilized, until planned BMP feasibility studies are completed for possible future construction and/or implementation, as necessary. Refer also to Section 4.3. Inspections and maintenance of station vehicles and equipment as well as vendor supplied vehicles and equipment are performed in accordance with station policies and procedures. All preventative maintenance, work orders, and corrective action records are maintained and tracked in the station's PAMSP database.

5.4.1 BMPs Planned for Consideration

BMPs planned for consideration at this facility are limited to those identified during periodic evaluations. Before structural BMPs can be implemented, the suggested BMP normally has to go through a Station Engineering review process. The following table is providing to track the progress of suggested BMPs. Refer to Appendix D, Annual Compliance Evaluation for the most recent BMP recommendations.

New BMP Candidates Since the Last Site Evaluation:	Responsible Person	Status

5.5 Facility Security

The facility implements all necessary security equipment to meet Nuclear Regulatory Commission (NRC) requirements which includes but not limited to: armed onsite security staff / force that is present at all times 24/7 at the facility's main entrance and various towers located throughout the property, security cameras, fencing and permitted restricted areas around the station's property (i.e. intake barriers).

6.0 GOOD HOUSEKEEPING MEASURES

VA0052451, Part I, F.6.b)(i) Good Housekeeping. (SWPPP Cross Reference #11)
VA0052451, Part I, F.7.a. Good Housekeeping Measures. (SWPPP Cross Reference #19)

6.1 Fugitive Dust Emissions

There is no coal handling areas on site. The Paint Shop utilizes a ventilation filtration system to control sand blasting dust.

6.2 Delivery Vehicles

Bulk chemicals are delivered in closed container trucks and are unloaded in accordance with station procedures 1/2-OP-7.8, CH-32.933, CH-32.926 and CH-32.939 which are designed to minimize spillage. The delivery of petroleum products are handled in accordance with the Station's SPCC/VA ODCP Plan.

6.3 Fuel Oil Unloading Areas

Measures to prevent or minimize contamination of stormwater runoff from fuel oil unloading areas are described in the Facility's SPCC/VA ODCP Plan.

6.4 Chemical Loading/Unloading Areas

Station procedures are used for unloading tankers to minimize accidents/spillage. Facility personnel trained in spill response procedures are required to be present during unloading activities.

6.5 Miscellaneous Loading/Unloading Areas

Miscellaneous materials are handled at the Warehouse 5 loading dock which is under cover.

6.6 Small Chemical Storage Containers

Small chemical storage containers are maintained in accordance with station chemical procedures. The chemical storage areas are routinely inspected in accordance with the following procedures: 0-GEP-7, 0-GOP-3.5, 0-GPP-1, 0-HSP-INSP-001, GMP-E-136 and CY-AA-CTL-510.

6.7 Large Bulk Fuel Storage Tanks

Refer to Section 4.4 of this plan and the Facility's SPCC/VA ODCP Plan, which is maintained under separate cover.

6.8 Spill Reduction Measures

The Facility's SPCC/VA ODCP Plan addresses the petroleum related equipment and inspections, which is maintained under separate cover. The chemical equipment that has been identified as a potential to stormwater exposure is inspected at least weekly by facility Operations and/or Chemistry's personnel. The inspections are documented in applicable electronic databases and can be provided upon request.

6.9 Oil Bearing Equipment in Switchyard

The Oil Bearing equipment in the facility's switchyard is maintained in the Transmission / Distribution's SPCC plan, which is maintained under separate cover.

6.10 Residue Hauling Vehicles

The facility does not conduct routine hauling activities that are suspected to generate residue.

6.11 Ash Loading Areas

This facility does not generate ash.

6.12 Areas Adjacent to Disposal Ponds or Landfills

This facility does not utilize disposal ponds and/or landfills. The ponds located at this facility are used as various water treatments and/or storm water retention.

6.13 Landfills, Scrap Yards, Surface Impoundments, Open Dumps, General Refuse Sites

There no active landfills or open dumps on this facility's property. A contractor handles general refuse (solid waste) disposal. This facility does not contain a general refuse site, but manages the general refuse in dumpsters which are routinely taken offsite for proper disposal.

The areas around the surface impoundments (i.e. retention ponds) are graded such that runoff is directed to the pond(s) for solids retention. The Settling Pond's berms are inspected in accordance with dam safety regulations.

6.14 Vehicle Maintenance Activities

6.14.1 Vehicle and Equipment Storage Areas

Vehicle repairs are performed indoors.

6.14.2 Fueling Areas

Measures to prevent or minimize contamination of stormwater runoff from fueling areas are described in the facility's SPCC/VA ODCP Plan, which is maintained under separate cover.

6.14.3 Material Storage Areas

Materials and waste associated with vehicle maintenance activities are stored in covered buildings.

6.14.4 Vehicle and Equipment Cleaning Areas

Any wash-water from the Maintenance Shop is directed to the sewage treatment plant.

6.14.5 Vehicle and Equipment Maintenance Areas

Vehicle maintenance is performed indoors at the Vehicle Maintenance Garage.

6.15 Material Storage Areas

Materials are either stored under roof or in areas that drain to the facility's waste water system or are stored on flat graded areas.

6.16 Salt Storage

VA0052451, Part I, G.22. Snow and Ice Control Materials (SWPPP Cross Reference #24)

This Facility maintains a sand storage pile under the outside walkway of the SCOBN building, any runoff is routed to the settling ponds, which is discharged in accordance with the VPDES permit requirements.

During the end of 2013, the station began using the new salt / sand storage building which is located on the "rec. island". The salt and sand is unloaded and stored inside the building. The area around the storage building drains to a retention pond. The water level within the retention pond is maintained by pumping water to the station's discharge canal, which has been approved by DEQ and is not considered a storm water discharge.

The old paint shop building is also used as an additional salt storage area, when needed. The old paint shop is completely enclosed and the area adjacent to it is graded flat.

During the cold weather months, salt is temporarily stored in closed 5 gallon buckets, near building entrance ways, sidewalks, and outdoor stairwells.

Attachment G

Supplemental Information

NORTH ANNA POWER STATION
VPDES Permit Renewal Application Supplemental Information

FORM 1

The North Anna Power Station is a nuclear electric generating facility located in Louisa County, VA. The station is owned by Virginia Electric and Power Company and Old Dominion Electric Cooperative own the North Anna Power Station. Virginia Electric and Power Company d/b/a Dominion Energy Virginia operates the facility and is the VPDES permit holder.

ITEM 2E - HAZARDOUS WASTE

The station may temporarily store hazardous waste for short periods of time in an accumulation area located on-site. Any accumulation and storage activities are conducted in accordance with the applicable requirements of 40 CFR 262. The current generator status for the station is a small quantity generator.

ITEM X -

In addition to the Units 1 and 2 related environmental permits listed in Part X, the facility holds the following authorizations:

Type of Permit	Permit Number	Issuing Agency
Virginia Water Protection	VWP10-1256	VA DEQ
Impacts to Navigable Waters	10-V1256/NAO2008-2534	USACE
Land disturbance	ESCP30-80	Louisa County
Water Supply Wells	PWSID 2109600 (station wells) PWSID 2109610 (NANIC well)	VDH, Louisa County
Virginia Water Protection-Water Withdrawal	VWP10-1496	VA DEQ

ITEM XI- MAP

A topographic map showing the location of the North Anna Power Station is included with this application. Additional drawings showing the outfall locations and other more detailed site features can be found in the aerial maps and also in site drawings included with application FORM 2F.

FORM 2C

ITEM II-A: WATER FLOW BALANCE DIAGRAM

The facility's water flow balance diagram shows the general route taken by water from intake to discharge. An exact water balance cannot be provided because a substantial component of the water flow is derived from rainfall. Some water is also lost to evaporation. Additionally, water inflow and outflow are dependent upon time of year and generating output. The data used to generate the average flows shown on the diagram are described under Item V. below.

Item II-B: OUTFALL DESCRIPTION

The North Anna Power Station's discharges are permitted by the Virginia Department of Environmental Quality as part of Individual Industrial Major VPDES Permit No. VA0052451. This VPDES permit combines both industrial wastewater and storm water discharges. The facility has several external process water outfalls that discharge to Lake Anna, in addition to internal outfalls that discharge to the Waste Heat Treatment Facility (WHTF).See list below.

EXTERNAL OUTFALLS
Outfall 001: Discharge from Waste Heat Treatment Facility at Dike 3
Outfall 009: Groundwater, Stormwater, and Backwash from Sand Filters / Reverse Osmosis Unit
Outfall 013: Turbine Building Sump #1 & #2 and Stormwater
Outfall 016: Intake Screen Wash Water
Outfall 020: Reverse Osmosis Reject
Outfall 021: Reverse Osmosis Drain Line
Outfall 028: Beyond Design Basis and Emergency Pumps discharge to Lake Anna

INTERNAL OUTFALLS
Outfall 101: Discharge of Condenser Cooling Water to the Discharge Canal
Outfall 103: Process Waste Clarifier
Outfall 104: Turbine Sumps 1, 2 & 3 and Stormwater
Outfall 105: Bearing Cooling Tower Blowdown
Outfall 107: Bearing Cooling System Discharge – Lake to Lake Operation
Outfall 108: Service Water Overflow
Outfall 109 & 110: Hot Well Drains 1&2
Outfall 111: Sewage Treatment Plant
Outfall 112 & 113: Steam Generator Blowdown Units 1&2.
Outfall 114: Service Water Pipe Vault Drain
Outfall 115: Service Water System Blowdown
Outfall 116: Vacuum Priming Pumps
Outfall 117: Salt Storage Pond
Outfall 118: Beyond Design Basis and Emergency Pumps discharge to the Discharge Canal

ITEMS V-A.B. & C: INTAKE AND EFFLUENT CHARACTERISTICS
Samples used to generate the data included on Form 2C were collected during periods representative of facility operations by persons experienced in the sampling of industrial effluents. The samples were collected in accordance with procedures described in the instructions for Form 2C as modified by waivers approved by DEQ (See Attachment D). Sample analyses were performed in accordance with methods promulgated in 40 CFR Part 136, alternative approved methods, VPDES permit regulations, Attachment B requirements, and using sufficiently sensitive methods.

For DMR parameters that are routinely monitored under Part I of the current permit the existing discharge monitoring data for the period from January 1, 2015 through December 31, 2017 were used to produce the data included on Form 2C. For reported temperature data, winter temperatures were based on measurements taken from November to April. Summer temperatures were based on the measurements taken from June to September.

For non-DMR parameters, the data was collected in accordance with the approved sampling plan:
- Outfalls 001, 009, 020, 104 and intake were sampled.
- Outfall 104 was deemed substentially identical to Outfall 013, so outfall 104 data can be used for Outfall 013.
- Outfall 021 was deemed substantially identical to the intake, so intake data can be used for Outfall 021.

For data reporting, and when analyzing a mixed data set (a mixture of real values and less than quantification level values), the less than quantification level value was treated as a zero in accordance with the DMR reporting requirements. In cases where all measured data were less than the quantification level, the mass loading was reported as "less than" the calculated value. When all data were less than the

quantification level and different quantification levels were achieved, the average concentration was reported as less than the highest quantification level achieved (e.g. if four sample results were <0.1, <0.01, <0.001, and <0.005, the average and maximum concentrations were reported as <0.1).

ITEM VI: POTENTIAL DISCHARGES NOT COVERED BY ANALYSES

Numerous chemicals are used in minor and bulk amounts at the station. A list of the bulk chemicals employed is included in Attachment C. Certain chemicals have multiple uses, and the stated purpose is not preclusive of other purposes or functions. Safety Data Sheets (SDSs) will be provided upon request.

Information on chemical use, material storage, and waste management are located below in the section of this form related to Form 2F.

In addition to the material discussed in this document, North Anna Power Station uses numerous chemicals to operate and maintain its equipment, vehicles, and facilities. Examples of these chemicals include lubricants, cleaners, detergents, polishes, waxes, cleaners, cutting oils, sanitizers, paints, solvents, and protectants. The majority of these chemicals are managed in small containers, but some are managed in larger quantities. It is conceivable that these chemicals and chemical types could appear in discharges from the North Anna Power Station at very low concentrations (i.e., below the level of detection).

FORM 2F

ITEM IV.B: NARRATIVE DESCRIPTION OF POLLUTANT SOURCES

North Anna Power Station has five stormwater outfalls; four storm water outfalls are associated with industrial activity, and one outfall with no industrial activities in its drainage area. All storm water outfalls and their associated drainage areas are shown on the site map included in Attachment E.

STORMWATER OUTFALLS:

Outfall 014 has a drainage area of approximately 4.3 acres, with approximately 3.7 acres of impervious area. Stormwater is collected from the western half of the Turbine Bldg. and has no industrial activities associated with this drainage area. It discharges to Lake Anna.

Outfall 022 has a drainage area of approximately 57.5 acres, with approximately 7.1 acres of impervious area. Stormwater collected from the higher portions near the old contractor shops, parking lots and the switchyard area, flows into a drop grating to a culvert near the northeast corner of the switchyard and discharges into Lake Anna. The lower, more level portion includes the old vehicle maintenance shop, the old paint shop (interim salt storage area) and part of an outdoor equipment laydown area. Stormwater runoff from the grassed portions around the shops and laydown areas, are collected in a swale which combines via culvert, with Outfall 022.

Outfall 024 has a drainage area of approximately 6.1 acres with primarily sheet flow runoff and approximately 0.08 acres of impervious area. The outfall receives flow from a field and an unpaved roadway. The stormwater is collected in a culvert and discharged to Lake Anna.

Outfall 025 has a drainage area of approximately 58.6 acres, with approximately 4 acres being impervious. This area includes a portion of the warehouse facilities, laydown area, and some small utility buildings. Stormwater from the northern portion of this drainage area is conveyed under the paved roadway via two culverts. The culvert to the west carries the smaller amount of stormwater flow which drains from grassy fields with no industrial activity. The culvert to the east is the sampling point for this outfall since it collects the stormwater associated with the above referenced industrial activities. This outfall discharges to the Waste Heat Treatment Facility.

Outfall 027 has a drainage area of approximately 7.5 acres, with approximately 1.3 acres being

impervious. This area includes a portion of the warehouse and storage facilities, hazardous material storage building, roadway and a fueling area. The area drains to a stormwater retention pond. The stormwater pond discharges over a riprap outfall to a drainage that discharges to the Waste Heat Treatment Facility. Materials are kept under cover with the exception of the fueling area. Stormwater from the fueling area is directed through an oil water separator prior to entering the stormwater pond.

North Anna Power Station implements a Storm Water Pollution Prevention Plan (SWPPP) that was developed in accordance with the current VPDES permit. Section 4 of the SWPPP included in Attachment F provides additional information on potential pollutant sources.

ITEM IV.C: NARRATIVE DESCRIPTION OF SIGNIFICANT MATERIALS, MATERIALS MANAGEMENT PRACTICES, AND EXISTING STRUCTURAL AND NONSTRUCTURAL CONTROLS

Sections 5 and 6 of the SWPPP provide a detailed listing of significant materials and materials management practices.

In addition to the SWPPP, the station also implements an oil contingency plan in accordance with the Federal regulatory requirements for Spill Prevention Control, and Countermeasure (SPCC) Plans 40 CFR 112.1 - 112.15. The SPCC plan is a comprehensive description of the facility's containment and countermeasures that would prevent oil spills from occurring as well as procedures to respond to and clean up oil spills that do occur. The purpose of an SPCC Plan is to prevent oil spills from entering a waterway and must address the following three areas: 1) operating procedures that prevent and detect oil spills, 2) control measures installed to prevent a spill from reaching the environment, and 3) countermeasures to contain, clean up, and mitigate the effects of an oil spill that reaches the environment.

ITEM VII. PARTS A, B, C, D: DISCHARGE INFORMATION

The data presented in Form 2F for Outfalls 022 and 025 was generated from grab samples collected following the initiation of qualified storm event discharges on August 20, 2018. According to Weather Sentry, the total rainfall amount for North Anna/ Louisa was 2.02" (> 0.1") on August 20, 2018. The previous qualifying rain event occurred on August 12, 2018 (>72 hours). No stormwater discharge flows were provided since Part D of this section pertains to composite stormwater samples.

Outfall 27 was previously sampled and the data was submitted to DEQ on May 2, 2017. Since the data was generated less than 3 years ago and since it is still representative of the discharge, a copy of the May 2, 2017 submittal is included with Form 2 F.

Effluent samples used to generate the data included in Form 2F were collected during periods representative of facility operations by persons experienced in the sampling of industrial effluents. The samples were collected in accordance with procedures described in the instructions for Form 2F and per the data generation strategy approved by DEQ. Sample analyses were performed in accordance with methods promulgated in 40 CFR Part 136 alternative approved methods, VPDES permit regulations, and using sufficiently sensitive methods.

FORM 2A

The facility's Sewage Treatment Plant discharges internally to the WHTF through Outfall 111. DMR data for flow, pH, BOD, and TSS from January 1, 2015 to December 31, 2017 was used to complete Form 2A Section A.12. As for fecal coliform and temperature, three fecal coliform samples were collected and the discharge temperature was measured on three different days with two samples /readings at least four months apart. The results are included in the tables below.

Date	Fecal Coliform MPN/100 ml
May 10, 2018	<2
September 25, 2018	2
October 3 2018	<2

Date	STP Effluent Temperature (°C)
May 10, 2018	21.4
September 25, 2018	24.1
October 4 2018	24.5

Please note that pages 10 to 21 of Form 2A were not included in this application as they are not applicable to this facility.

PERMIT REQUESTS

1. **Installation of Motor Operated Valve to Control Releases from the Lake Anna Dam**
   Description of Change:
   A motor operated hydro unit bypass / throttle valve is being installed to provide an automated means of providing river flow when the hydro units are out of service. The MOV will receive a trip signal from the Hydro Units when they are not in service, which will automatically fully open the valve. Additionally, electrical circuitry will ensure the valve trips open on a loss of power, since a Hydro Unit trip and a loss of power event often occur coincident. Since the valve alone can discharge flows much greater than 40 CFS, an orifice plate will be installed designed to discharge 43 CFS. Since the required discharge is a minimum of 40 CFS, designing the orifice plate to 43 CFS will provide adequate regulatory margin and ensure release of the minimum required flow. The valve will be also used to throttle flow during drought conditions during which the Operator will slowly decrease the lake discharge to 20 cfs in accordance with North Anna's VPDES. Since the flow is based on the static pressure head between the lake level and the piping discharge, this configuration will require much less adjustments when small lake level fluctuations occur. Physical installation of the valve was completed the week of October 1, 2018; however, the electrical components have yet to be installed and manual adjustments of the valve would be the only possible method of operation at this time. The valve has not been operated to date.

   Part I.D.3. of North Anna Power Station's current VPDES permit requires that Lake Anna dam gate adjustments be performed in accordance with the DEQ-approved Station Operating Procedure (SOP). The existing DEQ-approved SOP has been revised to recognize the new MOV as the preferred method of achieving minimum flow during periods without operation of the hydro units. The revised SOP is included with this application for review and approval by DEQ.

2. **Stormwater Outfall 024**
   There are no industrial activities in Outfall 024's drainage area. We request that the stormwater outfall be recognized in the permit with no monitoring requirements during the next permit term.

3. **Outfall 117 Annual DMR**
   Part I G. 22.c.2. of North Anna Power Station's current VPDES permit requires that the flow and the number of days of discharge for Outfall 117 be submitted with the DMR of the month in which the discharge took place. However, the only e-DMR that was provided for this outfall is the annual e-DMR. We request that either the condition be revised to allow the annual submittal of the data, or include a monthly e-DMR for outfall 117.

4. **Toxicity Monitoring Reporting**
   Whereas, Part I C.1.f. of North Anna Power Station's current VPDES permit requires the submittal of the toxicity test results and report with the monthly e-DMR for the month following the receipt of the report, Part I C.2. requires that the toxicity test results and report be submitted with the annual e-DMR by January 10 for the preceding year. We request that either Part I C.1.f. permit condition be deleted, or include a monthly e-DMR for toxicity test reporting.

North Anna Power Station
Main Dam Spillway Gate Standard Operating Procedure
Maintaining VPDES Permit Minimum Discharge

Introduction

The Station Operating Procedure (SOP) has been revised and is being submitted to the Department of Environmental Quality (DEQ) Northern Regional Office for review and approval. The SOP reflects the use of both engineering calculations and the flow gauging station on the North Anna River downstream of the Lake Anna dam (USGS 01670400), with the target of achieving the flow releases of 40 cubic feet per second (cfs) and below.

Bypass Valve and Gate Information

1. Hydro Unit Bypass Valve (bypass valve) is used to provide minimum flow when the hydro units are not in operation.
2. Skimmer Gate 1 (SG1) feeds the penstock to both hydro units and the bypass valve.
3. Skimmer Gate 2 (SG2) is used as a backup to provide minimum flow when bypass valve is out of service and hydro units are not in operation.

General Overview

The small hydro unit (hereafter referred to as the hydro unit), when in operation, provides approximately 44 cfs when the lake level is between 248.1' msl and 250.0' msl. Alternatively, if the hydro unit is out of service, the bypass valve is operated to provide the minimum flow, with SG2 providing a backup means to achieve required flow. The hydro unit is used to discharge water until lake level reaches 248.1' msl. At 248' msl the hydro unit is removed from service and the bypass valve is used to start reducing flow in accordance with the lake level contingency plan. Flows are reduced from 40 cfs to 20 cfs using the bypass valve, with SG2 as a backup means of reducing flow.

Maintaining Minimum 40 cfs Discharge

Both engineering calculated valve or gate positions and USGS 01670400 gauging station will be used to ensure a minimum discharge of 40 cfs is maintained at all times. The hydro unit normally operates providing the minimum discharge release of 40 cfs when the lake level is between 248.1' msl and 250.1' msl. Station personnel will continue to monitor the flows recorded by USGS Gauging Station No. 01670400. The USGS Richmond Virginia office will be notified of any changes (i.e., > plus or minus 20 percent) of recorded flows from the gauging station that do not correspond to the expected flow with the hydro unit in service, bypass valve position, or gate position.

If the hydro unit is out of service, the bypass valve will be opened; ensuring the required minimum discharge release of 40 cfs is met. As with the hydro unit operation the USGS Richmond Virginia office will be notified of any changes (i.e., > plus or minus 20 percent) of recorded flows from the gauging station that do not correspond to the expected flow based on the bypass valve position.

Maintaining Minimum 20 cfs Discharge with Lake level < 248' msl

Both engineering calculated valve or gate positions and USGS 01670400 gauging station will be used to ensure flow reductions from Lake Anna. The hydro units are offline and flows are controlled using the bypass valve. Adjustments below 40 cfs will occur in 5 cfs increments (i.e. 35 cfs, 30 cfs, 25 cfs, and 20 cfs), not to decrease below 20 cfs.

A graduated step scale is mounted to the top of SG 2 that provides the gate position below the surface of the water. As lake level decreases SG 2 is adjusted accordingly to maintain the proper

gate position to meet required discharge flow. Station personnel will continue to monitor the flows recorded by USGS Gauging Station No. 01670400. The USGS Richmond Virginia office will be notified of any changes (i.e., > plus or minus 20 percent) of recorded flows from the gauging station that do not correspond to the expected flow following changes from SG 2 positions.

Technical References

1. UFSAR 3.8.3, Main Dam
2. VPDES Permit No. 0052451Special Conditions – Lake Level Contingency Plan
3. TRM 3.7.4, North Anna Reservoir
4. 0-OP-59.1, Reservoir Spillway
5. 0-OP-59.5, Reservoir Discharge Control During Drought Conditions

USGS Provisional Data Statement

Data are provisional and subject to revision until they have been thoroughly reviewed and received final approval. Current condition data relayed by satellite or other telemetry are automatically screened to not display improbable values until they can be verified. Provisional data may be inaccurate due to instrument malfunctions or physical changes at the measurement site. Subsequent review based on field inspections and measurements may result in significant revisions to the data. Data users are cautioned to consider carefully the provisional nature of the information before using it for decisions that concern personal or public safety or the conduct of business that involves substantial monetary or operational consequences. Information concerning the accuracy and appropriate uses of these data or concerning other hydrologic data may be obtained from the USGS.

Attachment H
CWA §316 (a) Variance Request

CWA §316(a) Thermal Variance

North Anna Power Station currently operates under a Clean Water Act (CWA) §316(a) thermal variance. Previously, the State Water Control Board determined that effluent limitations more stringent that the thermal limitations included in the existing permit were not necessary to assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in Lake Anna and the North Anna River downstream of the lake.

The facility operations have not significantly increased heat input, and the station's thermal loading to the lake from Units 1 and 2 is not expected to increase. Additionally, the annual biological reports, submitted to the Virginia DEQ under Part I.E.15 of the VPDES permit, indicate that Lake Anna and the Lower North Anna River continue to support a well-balanced ecological community.

Continuance of 316(a) Variance

Dominion Energy believes that the data generated during the §316(a) demonstration studies remain representative for Lake Anna and the North Anna River and for the station operations; therefore, Dominion Energy requests continuance of the 316(a) variance.

Attachment I
CWA §316 (b) NPDES Permit
Applications Requirements

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
NORTHERN REGIONAL OFFICE
13901 Crown Court, Woodbridge, Virginia 22193
(703) 583-3800
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

Thomas A. Faha
Regional Director

October 5, 2018

Via Email (Jason.E.Williams@dominionenergy.com)

Mr. Jason Williams
Director – Environmental
Dominion Energy Services, Inc.
5000 Dominion Boulevard
Glen Allen, VA 23060

Re: Dominion – North Anna Power Station
Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0052451
§316(b) Peer Review

Dear Mr. Williams:

By letter dated August 2, 2018, the Department of Environmental Quality (DEQ) advised Dominion of concerns with apparent conflict of interest related to the selection of Stantec as the §316(b) peer reviewer for the North Anna Power Station. The Department previously communicated to Dominion that DEQ's internal auditor had concluded that Stantec would present a conflict if they are the only independent peer reviewer of this project. Your correspondence dated October 1, 2018, provided additional information with respect to the §316(b) peer review process. In that correspondence Dominion requested a response from DEQ specific to two areas: (1) approval to move forward with the hiring on qualified individuals/consultants to perform an impartial evaluation of Stantec's peer review, and (2) a determination concerning a request for a later submittal date for information required by §122.21(r)(10)-(13). Staff has reviewed Dominion's submittal and has the following comments.

1. *Impartial Review of Peer Review*
   DEQ has no objection to Dominion's proposal of the hiring of qualified individuals/consultants to perform an impartial evaluation of the completeness and technical soundness of Stantec's peer review. DEQ looks forward to reviewing the list of candidates to perform the impartial evaluation. Dominion's submittal of such candidates should address any conflict of interest issues with both Dominion and Stantec. Alternatively, a scope of work that includes a separate and concurrent independent peer review would be acceptable. With the list of candidates, it would be helpful to DEQ if the scope of work to be conducted by the third party were outlined.

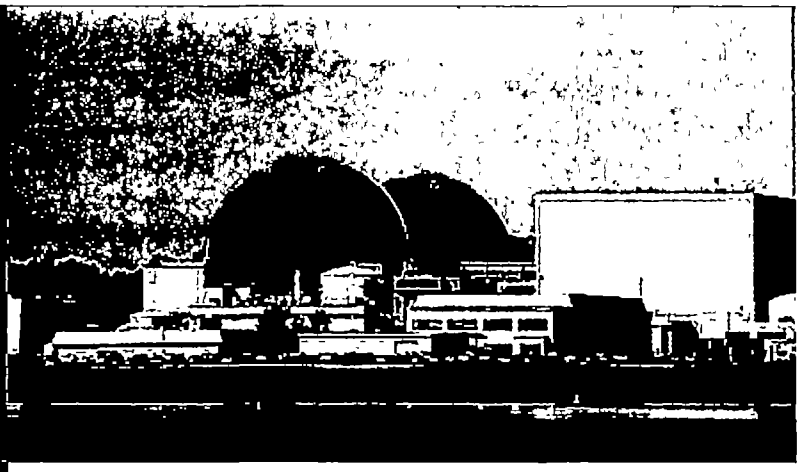
2. *Determination Concerning a Request for a Later Submittal Date*
   DEQ has no objection to granting an extension of the permit application to March 15, 2019, for submission of the 40CFR§122.21(r)(10)-(13) requirements. We understand the requirements of 40CFR§122.21(r)(2)-(9) will be submitted with the rest of the VPDES application for renewal by November 8, 2018. Please notify DEQ as soon as possible if Dominion foresees being unable to provide the necessary application requirements by the requested submission date.

In the interest of resolving these concerns and completing the 316(b) peer review in a timely manner, we encourage you to submit the list of potential candidates as soon as feasible. If you have any questions or would like to discuss this matter further, please contact Susan Mackert at (703) 583-3853 or by email at susan.mackert@deq.virginia.gov.

Respectfully,

Bryant Thomas
Regional Water Permits & Planning Manager

Ec: Ken Roller (kenneth.roller@dominionenergy.com)





Clean Water Act §316(b) Compliance Submittal Requirements

§122.21(r)(2)-(9) Reports

Prepared for:
Dominion Energy, Inc.

Prepared by:
HDR Engineering, Inc.

June 27, 2018

North Anna Power Station

Louisa County, Virginia

Table of Contents

Executive Summary 1
1 Introduction 4
2 Source Water Physical Data [§122.21(r)(2)] 7
2.1 Description of Source Waterbody [§122.21(r)(2)(i)] 7
2.1.1 Dimensions and Other Physical Characteristics 7
2.1.2 Temperature and Salinity Regime 7
2.2 Characterization of Source Waterbody [§122.21(r)(2)(ii)] 10
2.2.1 Hydrology 10
2.2.2 Geomorphology 11
2.2.3 Determination of Area of Influence 11
2.3 Locational Maps [§122.21(r)(2)(iii)] 14
3 Cooling Water Intake Structure Data [§122.21(r)(3)] 16
3.1 Description of CWIS Configuration [§122.21(r)(3)(i)] 16
3.2 Latitude and Longitude of CWIS [§122.21(r)(3)(ii)] 17
3.3 Description of CWIS Operation [§122.21(r)(3)(iii)] 17
3.4 Description of Intake Flows [§122.21(r)(3)(iv)] 21
3.5 Engineering Drawings of CWIS [§122.21(r)(3)(v)] 24
4 Source Water Baseline Biological Characterization Data [§122.21(r)(4)] 25
4.1 List of Unavailable Biological Data [§122.21(r)(4)(i)] 25
4.2 List of Species and Relative Abundance in the vicinity of CWIS [§122.21(r)(4)(ii)] 25
4.2.1 Historical Entrainment Studies 25
4.2.2 Historical Impingement Studies 30
4.2.3 Historical Ambient Fish Sampling 30
4.2.4 Recent Ambient Fish Sampling 31
4.2.5 Recent Entrainment Studies 32
4.3 Identification of Species and Life Stages Susceptible to Impingement and Entrainment [§122.21(r)(4)(iii)] 33
4.4 Identification and Evaluation of Primary Growth Period [§122.21(r)(4)(iv)] 39
4.4.1 Reproduction 39
4.4.2 Larval Recruitment 39
4.4.3 Period of Peak Abundance for Relevant Taxa 40
4.5 Data Representative of Seasonal and Daily Activities of Organisms in the Vicinity of CWIS [§122.21(r)(4)(v)] 41
4.6 Identification of Threatened, Endangered, and Other Protected Species Susceptible to Impingement and Entrainment at CWIS [§122.21(r)(4)(vi)] 46
4.7 Documentation of Consultation with Services [§122.21(r)(4)(vii)] 53

4.8 Methods and QA Procedures for Field Efforts [§122.21(r)(4)(viii)] 55
4.9 Definition of Source Water Baseline Biological Characterization Data [§122.21(r)(4)(ix)] 55
4.10 Identification of Protective Measures and Stabilization Activities [§122.21(r)(4)(x)] 55
4.11 List of Fragile Species [§122.21(r)(4)(xi)] 55
4.12 Information Submitted to Obtain Incidental Take Exemption or Authorization from Services [§122.21(r)(4)(xii)] 56
5 Cooling Water System Data [§122.21(r)(5)] 57
5.1 Description of Cooling Water System Operation [§122.21(r)(5)(i)] 57
5.1.1 Operation of Cooling Water System 57
5.1.2 Temporal Characteristics of Cooling Water System Operation 59
5.1.3 Proportion of Design Flow Used in the Cooling Water System 59
5.1.4 Distribution of Water Reuse 60
5.1.5 Description of Reductions in Total Water Withdrawals 60
5.1.6 Description of Cooling Water Used in Manufacturing Process 60
5.1.7 Proportion of Source Waterbody Withdrawn 60
5.2 Design and Engineering Calculations [§122.21(r)(5)(ii)] 62
5.3 Description of Existing Impingement and Entrainment Reduction Measures [§122.21(r)(5)(iii)] 62
6 Chosen Method(s) of Compliance with Impingement Mortality Standard [§122.21(r)(6)] 63
7 Entrainment Performance Studies [§122.21(r)(7)] 64
8 Operational Status [§122.21(r)(8)] 64
8.1 Description of Operating Status [§122.21(r)(8)(i)] 64
8.1.1 Individual Unit Age 64
8.1.2 Utilization for Previous 5 Years 64
8.1.3 Major Upgrades in Last 15 Years 64
8.2 Descriptions of Consultation with Nuclear Regulatory Commission [§122.21(r)(8)(ii)] 65
8.3 Other Cooling Water Uses for Process Units [§122.21(r)(8)(iii)] 65
8.4 Descriptions of Current and Future Production Schedules [§122.21(r)(8)(iv)] 65
8.5 Descriptions of Plans or Schedules for Any New Units Planned within the Next 5 Years [§122.21(r)(8)(v)] 65
9 Entrainment Characterization Study [§122.21(r)(9)] 66
9.1 Entrainment Data Collection Method [§122.21(r)(9)(i)] 66
9.1.1 Sampling Gear 66
9.1.2 Sampling Location 66
9.1.3 Sample Collection Period and Frequency 68
9.1.4 Laboratory Analysis 68
9.1.5 Identification of Species Susceptible to Entrainment 69

9.1.6 Identification of Protected Species 70
9.2 Biological Entrainment Characterization [§122.21(r)(9)(ii)] 70
9.2.1 Species Abundance 70
9.2.2 Spatial Characteristics 72
9.2.3 Temporal Characteristics 72
9.3 Analysis and Supporting Documentation [§122.21(r)(9)(iii)] 75
9.3.1 Representative Operational Flows 75
9.3.2 Latent Mortality 75
9.3.3 Total Entrainment 76
10 References 82

List of Appendices

Appendix A – Dominion Energy's Report "North Anna Power Station as Closed-Cycle Recirculating System with Stocked and Managed Fisheries" and Personal E-mail Correspondence with Virginia Department of Environmental Quality..... .. . .A-1

Appendix B – North Anna Power Station §122.21(r)(2) – (9) Submittal Requirement Checklist..... .....B-1

Appendix C – 11- x 17-inch Engineering Drawings of Cooling Water Intake Structures. C-1

Appendix D – Information, Planning, and Consultation and State-Threatened or Endangered Species Query Results.... .. .. D-1

Appendix E – Engineering Calculations of Through-Screen Velocity..... .....E-1

Appendix F – North Anna Power Station 2016-2017 Entrainment Characterization Study Report.....F-1

List of Tables

Table 1-1. Facility Flow Attributes and Permit Application Requirements 4
Table 1-2. Summary of 40 CFR §122.21(r)(2)-(9) Submittal Reports 5
Table 2-1 Monthly Average Water Temperature (°C) and Specific Conductivity (µS/cm) during Entrainment Sampling Study at North Anna Power Station, 2016-2017 (HDR 2018) 10
Table 3-1. North Anna Power Station Cooling Water Intake Pump Characteristics 17
Table 3-2. Unit-combined Total Daily Withdrawal (MGD) of North Anna Power Station from Lake Anna in 2015-2017 21
Table 3-3. North Anna Power Station Monthly Average Daily Withdrawal (MGD) by Unit from Lake Anna in 2015-2017 21
Table 4-1. Master Species List for Fish Taxa Collected During Impingement, Entrainment, and Ambient Studies Conducted at North Anna Power Station 26
Table 4-2. Annual Total and Percent Composition of Fish Larvae Collected in Entrainment Samples at North Anna Power Station from 1978-1983 (VEPCO 1985) 29
Table 4-3. Entrainment Potential for Fish Species to Occur near North Anna Power Station CWIS 36
Table 4-4. Seasonal and Daily Activities of Organisms in the Vicinity of the North Anna Power Station Cooling Water Intake Structure 43
Table 4-5. Federal- and State-Threatened and Endangered with the Potential to Occur within the North Anna Action Area 50
Table 4-6. Summary of U.S. Nuclear Regulatory Commission's ESA Section 7 Consultations with USFWS Related to Construction and Operation of North Anna Power Station Unit 3 54
Table 5-1. Percent (%) of North Anna Power Station Design Flow used in Cooling Water System during 2015-2017 59
Table 8-1. Capacity Factors at North Anna Power Station from 2013-2017 64
Table 8-2. Annual Net Generation at North Anna Power Station During 2013-2017 64
Table 8-3. North Anna Power Station's Relicensing Status and Approved Uprates 65
Table 9-1. Sampling Depths Relative to Normal Water Level at North Anna Power Station 67
Table 9-2. North Anna Power Station Entrainment Sampling Details, 2016-2017 68
Table 9-3. Master Species List of All Distinct Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017 69
Table 9-4. Total Number of Fish by Taxa and Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling 71
Table 9-5. Monthly Average Baseline Density (#/100 m^3) of Finfish by Depth Stratum at North Anna Power Station, 2016-2017 75
Table 9-6. Excluded Impingeable Finfish (i.e. Percent of Finfish that Measured Greater than 14.2-mm Body Depth) at North Anna Power Station (Years 1 and 2 Combined) 78
Table 9-7. Estimated Annual Entrainment Based on Year-specific Densities with Sampling Year-specific Flows and Rule-defined AIF 80

List of Figures

Figure 2-1. Aerial Photo of North Anna Power Station and its Environs 8
Figure 2-2. Locational Map of North Anna Power Station and Lake Anna including Waste Heat Treatment Facility 9
Figure 2-3. Location of North Anna Power Station within the York River Watershed 11
Figure 2-4. Topographic Map of Area near North Anna Power Station 15
Figure 3-1. Site Plan of North Anna Power Station 18
Figure 3-2. Plan View of Cooling Water Intake Structure at North Anna Power Station 19
Figure 3-3. Section View of Cooling Water Intake Structure at North Anna Power Station 20
Figure 3-4. Seasonal Variation of North Anna Power Station Cooling Water Intake Flows Based on 2015-2017 Operation 22
Figure 3-5. North Anna Power Station Water Balance Diagram 23
Figure 4-1. Depth-averaged Total Entrainment Density (#/100 m^3) for All Finfish Life Stage Combined at North Anna Power Station, 2016-2017 40
Figure 4-2. Service-Defined Action Area 47
Figure 4-3. Information for Planning and Conservation Database Search Area 48
Figure 4-4. Virginia Fish and Wildlife Information System Database Search Area 48
Figure 5-1. Diagram of Steam-electric and Waste-heat-dissipation System at North Anna Power Station 58
Figure 9-1. Entrainment Pump Sampling System Configuration 66
Figure 9-2. Design of Intake Piping for Entrainment Sampling 67
Figure 9-3. Baseline Entrainment Density (#/100 m^3) by Depth Stratum at North Anna Power Station, 2016-2017 72
Figure 9-4. Average Baseline Entrainment Density (#/100 m^3) During Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017 73
Figure 9-5. Average Baseline Entrainment Density (#/100 m^3) during Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017 74
Figure 9-6. Monthly Average Actual Intake Flows by Unit at North Anna Power Station, during 2016-2017 Entrainment Sampling 76
Figure 9-7. Summary of the Step-Wise Process Used to Estimate Entrainment based on the Rule and Existing Screens Installed at North Anna Power Station 77

Acronyms and Abbreviations

°F	degrees Fahrenheit
°C	degrees Celsius
AIF	actual intake flow
AOI	area of influence
BTA	Best Technology Available
CCRS	Closed-cycle recirculating system
CFR	Code of Federal Regulations
cm	centimeters
CWRT	cooling water retention time
CWA	Clean Water Act
CWIS	cooling water intake structure
DIF	design intake flow
Director	National Pollutant Discharge Elimination System permit Director
DO	dissolved oxygen
Dominion	Dominion Energy, Inc.
Dominion Energy	Dominion Energy, Inc.
El.	elevation
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
feet msl	feet above mean sea level
fps	feet per second
gpm	gallons per minute
IPAC	USFWS Information, Planning, and Consultation System
m	meter
MGD	million gallons per day
mm	millimeter
µm	micron
µS	microSiemens
MW	megawatt
MWe	megawatt electrical
MWt	megawatt thermal
NSSS	nuclear steam supply system
NAPS	North Anna Power Station
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NVE	non-viable eggs
QA/QC	quality assurance/quality control
R_{AOI}	radius of the area of influence
Rule	CWA Section 316(b) rule for existing facilities
TWS	traveling water screens
USEPA	U.S. Environmental Protection Agency

USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAFWIS	Virginia Fish and Wildlife Information System
VDGIF	Virginia Department of Game and Inland Fisheries
VDEQ	Virginia Department of Environmental Quality
VEPCO	Virginia Electric Power Company
VPDES	Virginia Pollutant Discharge Elimination System
WHTF	Waste Heat Treatment Facility

Executive Summary

The U.S. Environmental Protection Agency's (USEPA) Final Regulations to Establish Requirements for Cooling Water Intake Structure at Existing Facilities (the Rule), which became effective October 14, 2014, established requirements under the Clean Water Act (CWA) for existing power generating facilities that withdraw more than two million gallons per day (MGD) of water from waters of the United States and use at least 25 percent of that water for cooling purposes. Those requirements, implemented through Natural Pollutant Discharge Elimination System (NPDES) permits, apply to the location, design, construction, and capacity of cooling water intake structures (CWIS) that reflect best technology available (BTA) for minimizing adverse environmental impacts. There are two main components of the Rule for existing facilities such as North Anna Power Station (NAPS). The first requires the owner or operator of the facility to choose from one of seven options for meeting BTA requirements for reducing impingement. The second component requires that the facility conduct site-specific studies and provide data to the permitting authority to aid in the determination of whether site-specific controls would be required to reduce entrainment and, more specifically, which controls, if any, would be necessary.

After consultation with the USEPA (Region 3), the Virginia Department of Environmental Quality (VDEQ) concurred that NAPS's cooling system, which includes Lake Anna and a Waste Heat Treatment Facility (WHTF), meets the administrative criteria of a closed-cycle recirculating system (CCRS), consistent with the definition in 40 Code of Federal Regulations (CFR) §125.92(c)(2). Therefore, NAPS is compliant with the impingement mortality reduction requirements contained in the Rule based on BTA Compliance Alternative 1 (§125.94(c)(1)) and this is the alternative method chosen by Dominion Energy, Inc. (Dominion Energy) for compliance with impingement BTA as specified in 40 CFR §122.21(r)(6). BTA for entrainment, however, has yet to be determined. While VDEQ has the authority to issue waivers relative to any or all of the requirements at 40 CFR §122.21(r)(9)-(13) for CCRS facilities with stocked and managed fisheries such as Lake Anna, VDEQ has denied Dominion Energy's requests for such waivers[1]. Consequently, Dominion Energy has agreed to develop material required under 40 CFR §122.21(r)(9), contained as part of this report, to assist VDEQ in their BTA determination of NAPS. This report addresses the submittal requirements at 40 CFR §122.21(r)(2)-(9)[2]. The following submittal requirements are being developed separately from this report:

- §122.21(r)(10) – Comprehensive Technical Feasibility and Cost Evaluation Study;
- §122.21(r)(11) – Benefit Valuation Study;
- §122.21(r)(12) – Non-water Quality Environmental and Other Impacts Study; and

[1] Refer to Dominion Energy's report "North Anna Power Station as Closed-Cycle Recirculating System with Stocked and Managed Fisheries" submitted on September 9, 2015 and Personal E-mail Correspondence with Virginia Department of Environmental Quality (see Appendix A).

[2] Refer to Appendix B for a summary of the specific requirements under each of the §122.21(r)(2)-(9) and a checklist summary for how each is addressed in this report or why it is not applicable to NAPS.

- §122.21(r)(13) – Peer Review.

NAPS is a two-unit nuclear generating facility with a combined generating capacity of 2,046 megawatts (MW), located on a peninsula on the southwestern shore of Lake Anna in Louisa County, Virginia. Make-up water to the NAPS cooling water system is obtained from the North Anna River, which was impounded to create Lake Anna in 1972, specifically for the purpose of providing cooling water and other process water for NAPS. Cooling water is drawn from Lake Anna through one intake structure located north of the station. A trash rack is installed across the intake structure to prevent the passage of large debris. There are eight traveling water screens, each 14 feet wide, that are designed to rotate once every 24 hours or when the differential pressure increases to a predetermined level. Each screen is constructed with 16-gauge wire, providing a vertically aligned, 1/8-inch by 1/2-inch screen mesh. Fish and debris collected on the traveling screens are conveyed to a debris collection structure and disposed of off-site.

As a man-made reservoir, Lake Anna is managed by the Virginia Department of Game and Inland Fisheries (VDGIF) for sport fishing. To that end, Lake Anna was stocked with forage and sport fish after it was filled, and has been stocked with sport fish annually since that time. Based on the annual fish population surveys by VDGIF to monitor fishing activities and inform management decisions, the fishery of Lake Anna is considered successfully stocked and managed to meet its goals of maintaining a robust recreational fishery and its forage base.

The most current, representative data on the existing fish community in the vicinity of NAPS was collected during Dominion Energy's recent entrainment study, which was conducted from April through September 2016 and March through September 2017. A total of 12 and 10 distinct taxa[3] were collected during the first and second year of entrainment sampling, respectively. No shellfish were collected during sampling. Entrainment densities were highest during late spring to summer months of May, June, and July and were dominated by post yolk sac larvae of herring and shad species (Clupeidae) and common sunfish species (*Lepomis* spp.). White Perch post yolk sac larvae contributed to the early spring densities (April) primarily during the first year of sampling. Overall, mid-depth and near-bottom samples accounted for the majority of entrained organisms; however, the contribution of each varied by year. Entrainment densities were highest at night in near-bottom samples and lowest in the early morning in near-surface samples.

To characterize inter-annual variability in entrainment, the two years of entrainment data were treated separately to estimate annual total entrainment based on sampling year specific intake flows as Year 1 (April 2016 – September 2016) or Year 2 (March 2017 – September 2017), as well as actual intake flows (AIF)[4] as defined by the Rule, which is the average volume of water

[3] When counting the number of distinct taxa collected, general taxonomic designations at the genus, family, and higher taxonomic levels are not considered distinct taxa if there was one valid lower-level designation for that group.

[4] Actual Intake Flow (AIF) in this case means the average volume of water withdrawn on an annual basis by the cooling water intake structures over the past three years. After October 14, 2019, Actual Intake Flow means the average volume of water withdrawn on an annual basis by the cooling water intake structures over the previous five years (Federal Register / Vol. 79, No. 158. p 48430).

withdrawn by the CWIS over the previous three years from 2015 to 2017 for NAPS. The estimated annual total entrainment[5] ranged from 53,593,333 to 83,421,119 finfish using the two-year entrainment data. No shellfish were entrained.

Information on federally listed species and critical habitat under the U.S. Fish and Wildlife Service (USFWS) jurisdiction, as well as Virginia state-listed species either known to occur or with the potential to occur in the vicinity of NAPS was reviewed. The only federally listed aquatic species with potential to occur in the Action Area is Dwarf Wedgemussel (*Alasmidonta heterodon*). The only state-listed species with the potential to occur in the Action Area is the Green Floater (*Lasmigona subviridis*). Both of these species are freshwater mussels, however, results of a desktop review of prior evaluations and site-specific surveys conducted on Lake Anna in 2008 indicate that these species do not occur in Lake Anna. USFWS has documented agreement with the conclusion that no federal- or state-listed species occur in the Action Area (USFWS 2005).

[5] The two-year entrainment sampling study was conducted during April 2016 – September 2016 (Year 1) and March 2017 – September 2017 (Year 2), which cover the period of peak entrainment abundance; therefore, the resulting entrainment estimates based on AIF are considered representative of annual total entrainment.

1 Introduction

Section 316(b) was enacted under the 1972 U.S. Environmental Protection Agency (USEPA) Clean Water Act (CWA), which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program. Certain facilities with NPDES permits are subject to §316(b) requirements, which mandate that the location, design, construction and capacity of cooling water intake structures (CWIS) reflect best technology available (BTA) for minimizing adverse environmental impacts. Water entering a CWIS may contain early life-stage fish and shellfish, which are drawn into and through cooling water systems (entrainment), or juvenile or adult fish may become trapped against the screens at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) rule (the Rule) for existing facilities was published in the Federal Register. The Rule applies to existing facilities that withdraw more than two 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 an NPDES permit. The Rule became effective on October 14, 2014.

Facilities subject to the Rule are required to develop and submit technical material, identified at 40 Code of Federal Regulations (CFR) §122.21(r)(2)-(13), that will be used by the NPDES Director (Director) to make a BTA determination for the facility. The actual intake flow (AIF) and design intake flow (DIF) at a facility determine which submittals will be required under the Rule. As shown in Table 1-1, facilities with an AIF of 125 MGD and less have fewer application submittal requirements and will generally be required to select from the impingement compliance options contained in the Rule. For such facilities, the Director must still determine BTA for entrainment on a site-specific basis and the applicant may supply information relevant to the Director's decision. Facilities with an AIF in excess of 125 MGD are required, unless granted applicable waivers, to address both impingement and entrainment, and provide specific entrainment studies which may involve extensive field studies and the analysis of alternative methods to reduce entrainment (40 CFR §122.21(r)(9)-(13)).

Table 1-1. Facility Flow Attributes and Permit Application Requirements

Facility and Flow Attributes	Permit Application Requirements
Existing facility with DIF of 2 MGD or less, or less than 25 percent of AIF used for cooling purposes	Best Professional Judgment of Director
Existing facility with DIF greater than 2 MGD and AIF less than 125 MGD	§122.21(r)(2)-(8)
Existing facility with DIF greater than 2 MGD and AIF greater than 125 MGD	§122.21(r)(2)-(13)

The §316(b) compliance schedule under the Rule is dependent on the facility's NPDES permit renewal date. Facilities are to submit their §316(b) application material to the Director along with their next permit renewal unless that permit renewal application is due prior to July 14, 2018, in which case an alternate schedule may be requested.

North Anna Power Station (NAPS) is subject to the Rule. After consultation with the USEPA (Region 3), the Virginia Department of Environmental Quality (VDEQ) concurred that the NAPS cooling system, which includes Lake Anna with a Waste Heat Treatment Facility (WHTF), meets the administrative criteria of a closed-cycle recirculating system (CCRS) consistent with the definition in 40 CFR §125.92(c)(2). Therefore, NAPS is compliant with the impingement mortality reduction requirements contained in the Rule based on BTA Compliance Alternative 1 (§125.94(c)(1)), and this is Dominion Energy's chosen method for compliance with impingement BTA as specified in 40 CFR §122.21(r)(6).

NAPS is required to develop and submit each of the 40 CFR §122.21(r)(2)-(8) reports with its next permit renewal, in accordance with the Rule's technical and schedule requirements. While VDEQ has the authority to issue waivers relative to any or all of the requirements at 40 CFR §122.21(r)(9)-(13) for CCRS facilities with stocked and managed fisheries, such as Lake Anna, the agency has denied Dominion Energy's requests for such waivers[6]. Consequently, Dominion Energy has agreed to develop material required under 40 CFR §122.21(r)(9), contained herein (Section 9), to assist VDEQ in their BTA determination for the facility.

The following sections of this report provide information under 40 CFR §122.21(r)(2)-(9) (Table 1-2), and 40 CFR §122.21(r)(10)-(13) reports are being developed separately from this report. Appendix B provides a checklist summary of the specific requirements under each of the 40 CFR §122.21(r)(2)-(9) reports and documents how each is addressed in this report or why it is not applicable to NAPS.

Table 1-2. Summary of 40 CFR §122.21(r)(2)-(9) Submittal Reports

Submittal Requirements at §122.21(r)		Submittal Descriptions
(2)	Source Water Physical Data	Characterization of the source waterbody including intake structure area of influence.
(3)	Cooling Water Intake Structure Data	Narrative description of the configuration of each CWIS and where it is located in the waterbody and in the water column; 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 structure (species or relevant taxa, relative abundance); life history summaries (primary periods of reproduction larval recruitment, peak abundance of relevant taxa, seasonal and daily activities); susceptibility to impingement and entrainment; must include existing data; identification of missing data and efforts made to identify sources of the data; threatened and endangered species, any pertinent consultations or field studies, and designated critical habitat summary for action area; identifies fragile fish and shellfish species list (<30 percent impingement survival).

[6] Refer to Dominion Energy's report "North Anna Power Station as Closed-Cycle Recirculating System with Stocked and Managed Fisheries" submitted on September 9, 2015 and Personal E-mail Correspondence with Virginia Department of Environmental Quality (see Appendix A).

Submittal Requirements at §122.21(r)		Submittal Descriptions
(5)	Cooling Water System Data	Narrative description of the operation of the cooling water system and its relationship to CWIS; proportion of design flow used; water reuse summary; proportion of source waterbody 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 a summary of relevant entrainment mortality 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; descriptions of completed, approved, or scheduled uprates and NRC (Nuclear Regulatory Commission) relicensing status for nuclear facilities; decommissioning and replacement of units plans; current and future operation as it relates to actual and design intake flow.
(9)	Entrainment Characterization Study	Provides complete documentation of the data collection period and frequency of entrainment characterization, and an identification of the organisms sampled to the lowest taxon possible; the data collection must be representative of the entrainment at each intake; 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. The study must include analysis of the data to determine total entrainment and entrainment mortality.

2 Source Water Physical Data [§122.21(r)(2)]

2.1 Description of Source Waterbody [§122.21(r)(2)(i)]

NAPS is located on a peninsula on the southwestern shore of Lake Anna in Louisa County, Virginia. Make-up water to the NAPS CCRS is obtained from the North Anna River. In 1971, Virginia Electric and Power Company (VEPCO) impounded the North Anna River, creating the CCRS, which consists of the NAPS cooling system and Lake Anna, a 9,600-acre freshwater lake and the 3,400 acre WHTF, specifically for the purpose of constructing a nuclear power plant. VEPCO operates NAPS, which has two nuclear power-generating units (Unit 1 and 2). An aerial photograph of NAPS and its environs is shown on Figure 2-1.

2.1.1 Dimensions and Other Physical Characteristics

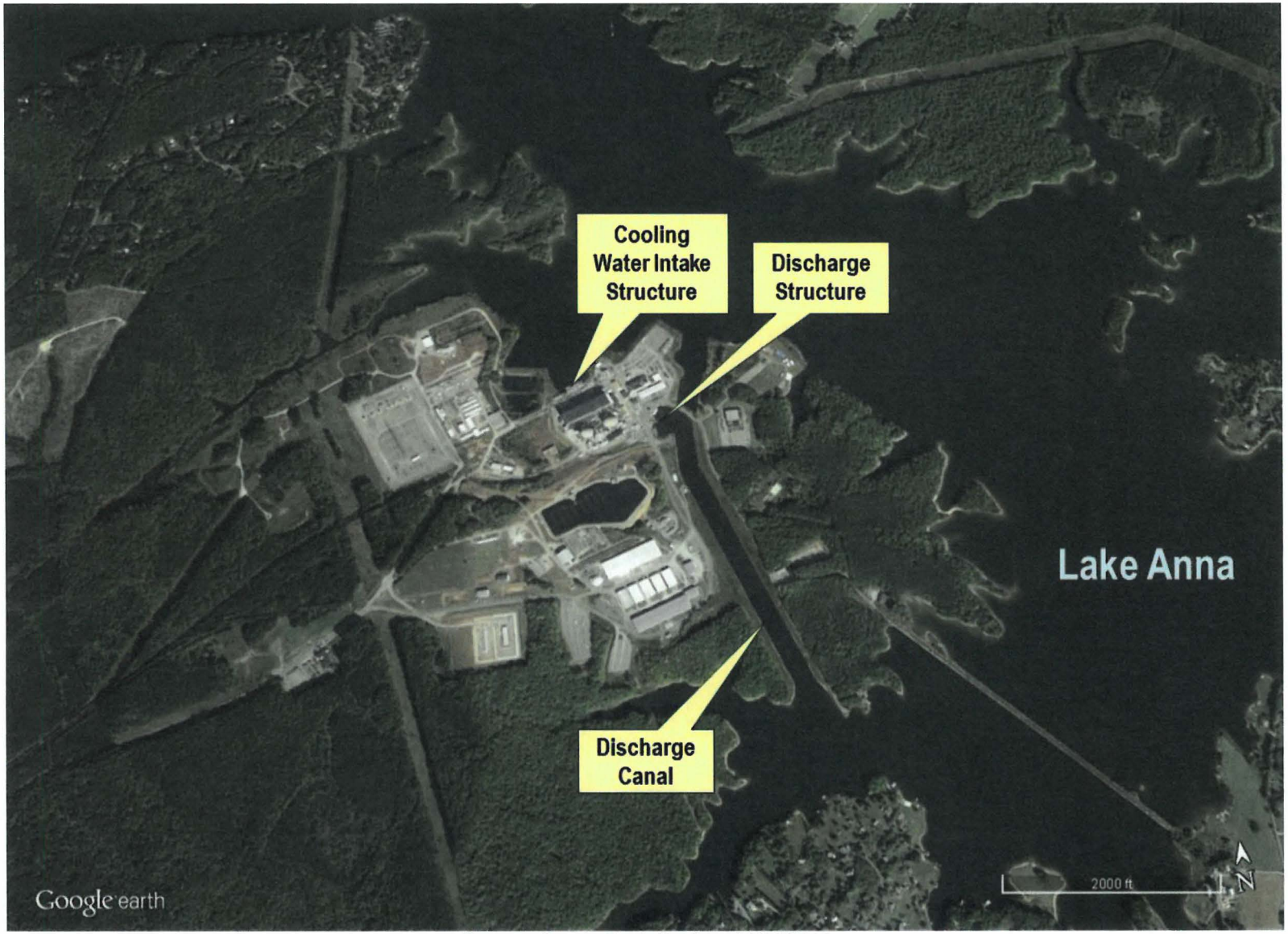
Lake Anna is approximately 17 miles long, with an irregular shoreline of more than 200 miles (Figure 2-2). The lake has a surface area of 13,000 acres and contains approximately 100 billion gallons of water. The larger portion of the lake is approximately 9,600 acres and functions as a storage impoundment to ensure adequate water for condenser cooling at NAPS. The smaller portion of Lake Anna, the WHTF, has an area of approximately 3,400 acres with three cooling facilities, separated from the larger portion of the lake by dikes. The first of the WHTF's three cooling facilities receives the heated condenser cooling water after its passage through the units. The heated water transfers heat to the atmosphere as it moves, via canals, to the second and third cooling facilities. The cooled water is discharged from the third cooling facility to the larger portion of the lake at a point immediately upstream of the North Anna Dam.

The lake is managed to target a water level elevation (El.) of 250 feet above mean sea level (msl), at which stage it holds approximately 305,000 acre-feet of water, and the maximum (full) pool level is El. 265 feet msl. The lake has a maximum depth of approximately 90.0 feet and an average depth of 24.9 feet at full pool. In the vicinity of the dikes, the WHTF has an average depth of 18.0 feet and a maximum depth of 49.2 feet (VEPCO 1985).

2.1.2 Temperature and Salinity Regime

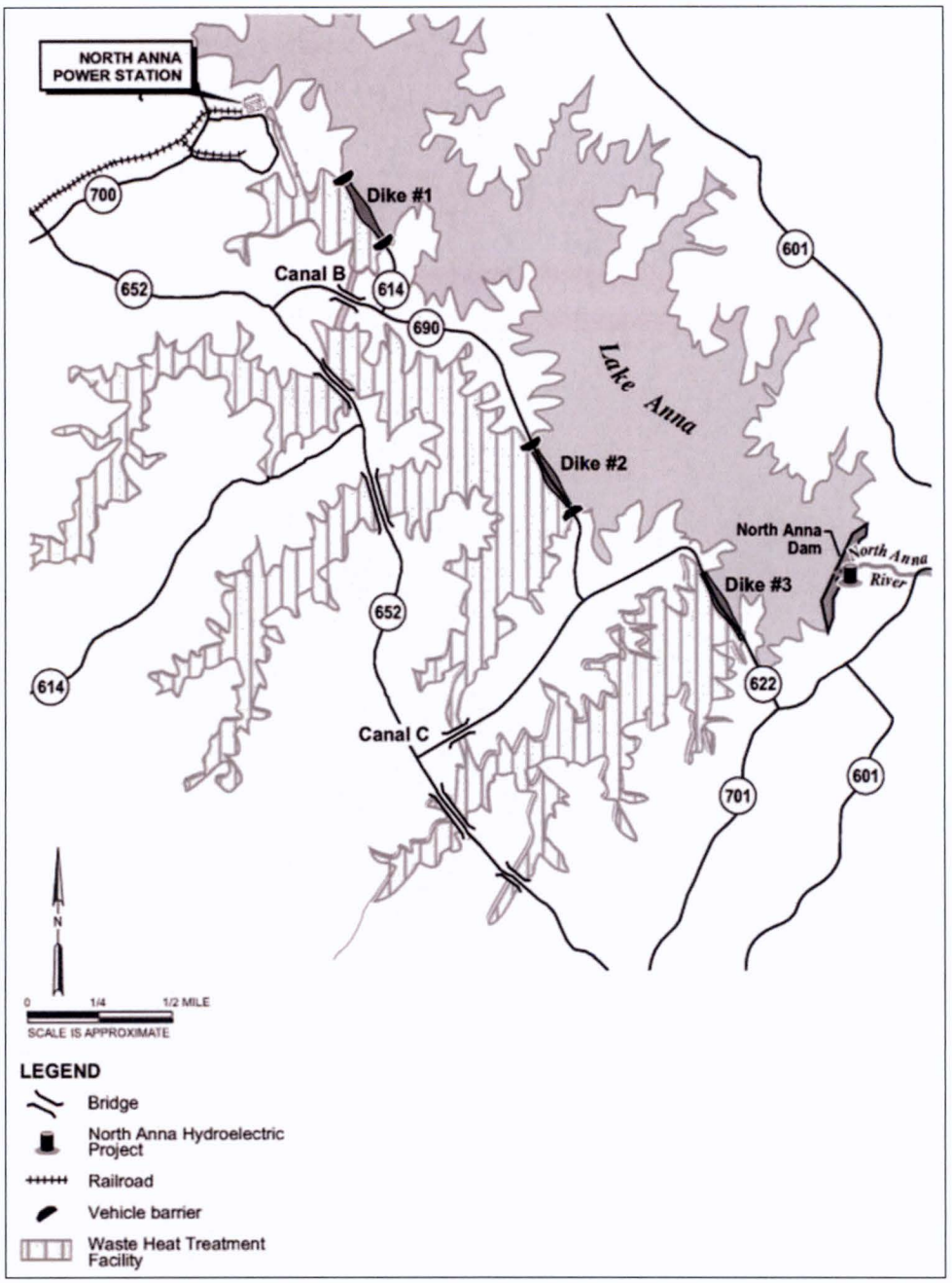
A two-year entrainment study was conducted at NAPS to support entrainment-related determinations required by the Rule (HDR 2018). As part of the entrainment study, water temperature and specific conductivity were monitored at entrainment sample locations (surface, mid-depth, and bottom depths) from April 2016 through September 2016, and from March 2017 through September 2017 (HDR 2018). The monthly average water temperature and specific conductivity collected at NAPS during the entrainment study are presented in Table 2-1.

During the two-year entrainment sampling study, monthly average water temperature ranged from 11.5 degrees Celsius (°C) near the bottom (in March 2017) to 31.7 °C at the surface (in July 2016) (HDR 2018). The lowest single temperature reading was 10.2 °C in March 2017, while the highest was 34.6 °C in July 2016 (HDR 2018).



Source: Google Earth Retrieved 4/13/2018

Figure 2-1. Aerial Photo of North Anna Power Station and its Environs



Source: Provided by Dominion Energy

Figure 2-2. Locational Map of North Anna Power Station and Lake Anna including Waste Heat Treatment Facility

In both years (2016-2017) of the entrainment study, water temperature in the vicinity of the CWIS exhibited slightly higher thermal stratification in the spring and early summer months (April, May, and June) when compared to late summer (July, August, and September). The data from the two-year entrainment study at NAPS is consistent with historical water temperature data collected in Lake Anna, which indicates that, as typical of lakes in seasonal climates, the lake undergoes thermal stratification in the summer (Lake Anna Special Area Plan Committee 2000). Monthly average specific conductivity data ranged from 66.8 (in April 2017) to 73.1 microSiemens per centimeter (µS/cm) (in April 2016), which are typical values of a freshwater lake.

Table 2-1 Monthly Average Water Temperature (°C) and Specific Conductivity (µS/cm) during Entrainment Sampling Study at North Anna Power Station, 2016-2017 (HDR 2018)

Year	Month	Water Temperature (°C)			Specific Conductivity (µS /cm)		
		Surface	Mid-depth	Bottom	Surface	Mid-depth	Bottom
2016	April	18.7	18.2	17.0	73.1	72.9	72.9
	May	20.4	19.9	19.0	72.4	72.4	72.3
	June	27.5	27.2	26.6	72.8	72.9	72.9
	July	31.7	31.1	30.4	70.8	70.7	70.5
	August	30.1	30.0	29.9	71.9	72.1	72.6
	September	29.0	28.7	28.7	70.5	70.4	70.5
2017	March	12.9	12.7	11.5	68.1	68.2	67.9
	April	18.0	17.7	17.3	67.4	67.4	66.8
	May	22.6	22.2	21.6	70.7	70.6	70.5
	June	28.7	28.0	26.6	71.6	71.6	71.5
	July	30.5	30.4	30.2	72.5	72.6	72.5
	August	29.6	29.6	29.4	70.6	70.7	70.6
	September	26.7	26.6	26.3	68.8	68.6	68.7

2.2 Characterization of Source Waterbody [§122.21(r)(2)(ii)]

2.2.1 Hydrology

The 70-mile long North Anna River rises in the eastern slopes of the Southwest Mountains in the Appalachian Range near Gordonsville in Orange County, Virginia, and flows along a southeasterly course to its confluence with the South Anna River five miles northeast of Ashland, Virginia, where the Pamunkey River is formed. The Pamunkey continues on a general southeasterly course to West Point, Virginia, where it is joined by the Mattaponi River to form the York River. The York River flows into the Chesapeake Bay about 15 miles north of Hampton, Virginia.

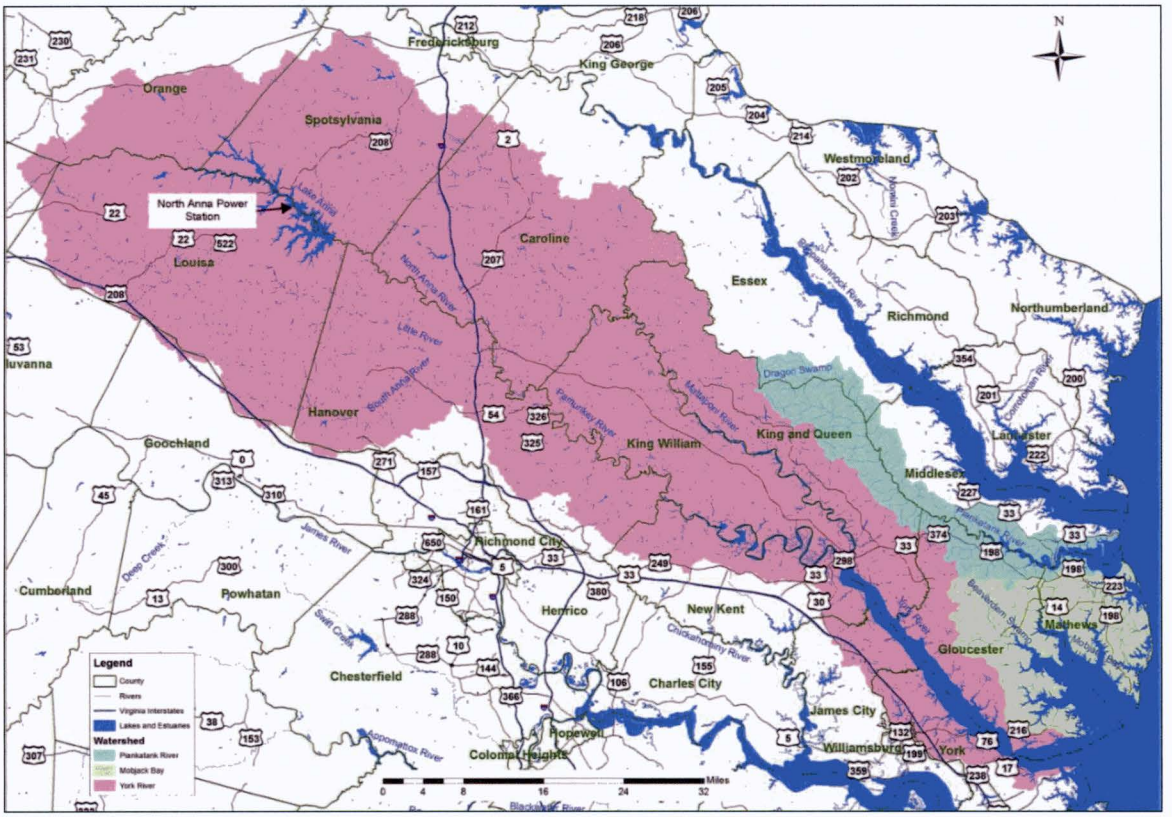
The North Anna River drains a watershed area of 343 square miles above the North Anna Dam, which is located about 4 miles north of Bumpass, Virginia, and about 0.5 mile upstream of Virginia Route 601. The nearest stream-gaging station on the North Anna River is about 0.5 mile downstream from the dam at Partlow, VA (U.S. Geological Survey [USGS] 01670400 North Anna River near Partlow, VA) with a drainage area of 342 square miles. Records have been maintained at this gaging station since October 1978 (USGS 2018). The annual discharge of the river is 264.8 cubic feet per second (cfs) (USGS 2018) based on the annual mean flow from water year 1979 to 2017 at the gage (USGS 01670400), which is used as a surrogate flow gage to measure discharge from the dam.

While Lake Anna was constructed for power station cooling purposes, it also provides the additional multipurpose benefits of low stream flow augmentation, flood control, and recreation. The normal pool level of El. 250 feet msl is maintained most of the time, and a minimum release of 40 cfs from the North Anna Dam at all times is required except during drought conditions,

according to Lake Level Management and Lake Anna Dam Flow Release Conditions pursuant to Virginia Pollutant Discharge Elimination System (VPDES) Permit (VA0052451). During drought conditions when the level in Lake Anna reaches El. 248 feet msl, releases are reduced in increments of 5 cfs over sequential 72-hour periods down to 20 cfs. A flood surcharge of 15 feet above the normal pool level is provided for flood peak reduction (NRC 2016a). Lake Anna holds 305,000 acre-feet of water at the mean water level of El. 250 feet msl and the total volume is 550,000 acre-feet at El. 265 feet msl.

2.2.2 Geomorphology

NAPS is situated in the York River watershed (see Figure 2-3), which lies within the central portion of the Piedmont Physiographic Province, with the Blue Ridge Province about 40 miles to the west and the Coastal Plain Province about 15 miles to the east. The Piedmont terrain is characterized by gently sloping upland areas and broad, relatively shallow valleys. Bedrock within the Piedmont is metasedimentary and metavolcanic and consists of granites, gneisses, and schists. The bedrock typically is deeply weathered into a saprolite mantle of up to 100 feet thick in areas (NRC 2016a).



Source: VDEQ 2016

Figure 2-3. Location of North Anna Power Station within the York River Watershed

2.2.3 Determination of Area of Influence

Reference to the "area of influence" (AOI) of a CWIS appears in three of the §122.21(r) sections of the Clean Water Act §316(b) Rule for existing facilities[7]:

[7] http://www.gpo.gov/fdsys/pkg/FR-2014-08-15/pdf/2014-12164.pdf (Accessed 5/15/2015)

- §122.21(r)(2) Source Water Physical Data requires information on "*the methods used to conduct any physical studies to determine the intake's* ***area of influence*** *in the waterbody and the results of such studies.*"
- §122.21(r)(4) Source Water Baseline Biological Characterization Data says: "*The study area should include, at a minimum, the* ***area of influence*** *of the cooling water intake structure.*"
- §122.21(r)(11) Benefits Valuation Study says: "*The study would also include discussion of recent mitigation efforts already completed and how these have affected fish abundance and ecosystem viability in the intake structure's* ***area of influence.***"

Although the Rule does not provide a definition of AOI, the §316(b) Phase I Rule for new facilities states that:

> *"The area of influence is the portion of water subject to the forces of the intake structure such that a particle within the area is likely to be pulled into the intake structure."*

While neither a formal definition of the AOI nor guidance for its estimation is provided within the Rule, AOI, for purposes of this report, is that area of the source waterbody from which organisms are potentially drawn into the intake structure and either entrained or impinged.

Impingement AOI

As a compliance option for impingement reduction, the Rule offers an intake through-screen velocity of 0.5 feet per second (fps)[8] or less based on the assumption that at velocities below this threshold most impingeable sized organisms can avoid impingement. Based on this assumption, a conservative definition of AOI[9] for impingement is the area encompassed by the 0.5 fps velocity contour at the CWIS. At this boundary and beyond it, the potential for impingement is approximately zero; within this boundary, the potential for impingement increases with increasing proximity to the intake. However, because juvenile and adult fish have differing swimming abilities and differing preferred habitats including those that involve velocities above 0.5 fps (Leonard and Orth 1988), the area contained by the 0.5 fps velocity threshold is not an area of direct impact.

Because the CWIS is located at the end of a cove just north of the station on the southwestern shore of Lake Anna (see Figure 2-1), an arc angle of 90° limited by the shorelines is used to calculate the radius of the impingement AOI (R_{AOI}) from the continuity equation:

$$Q_I = 0.5 \times \pi \times R_{AOI} \times d \times V \quad \text{.....Eq. 1}$$

where, Q_I = Intake Flow
R_{AOI} = Radius of Area of Influence
d = Water depth at R_{AOI}

[8] As per §316(b) Rule, the design through-screen velocity less than 0.5 fps meets the impingement mortality reduction standard through Compliance Alternative 2 (§125 94(c)(2)).

[9] This approach, in fact, was proposed to Ohio EPA (OEPA) by Dayton Power & Light (DPL) in their Proposal for Information Collection (PIC) for their Stuart Generating Station on the Ohio River. Their approach was accepted by OEPA and also recommended as a model for other facilities on the Ohio River (EPRI 2007).

V = Threshold velocity (i.e., 0.5 fps for impingement AOI)

Rearranging terms in equation 1 gives:

$$R_{AOI} = Q_I / (0.5 \times \pi \times d \times V) \quad \text{Eq. 2}$$

Entrainment AOI

The threshold velocity for entrainment should reflect the velocities induced by the intake that are greater than ambient velocities, such that plankton may be drawn into the intake rather than transported away in the ambient flow. Conservative threshold values can be developed for river and tidal river systems by basing them on minimum natural conditions found in a lake or at slack tide in a tidal system. Using the assumption that the wind induced surface drift velocities are typically 2 to 3 percent of the average wind speed (Wiegel 1964), the surface drift velocity would be 0.2 fps to 0.5 fps under conditions of a gentle breeze (average wind speed of 8-12 miles per hour). The mean ambient velocity (i.e., velocity averaged over the water column) is less than the surface drift velocity (typically 40 to 60 percent of the surface drift) although the relationship may depend on the speed and duration of the wind and water depth. Hence, at a location where the intake induced velocity is less than 0.1 fps to 0.3 fps, the ambient wind-induced currents likely will dominate the flow patterns and the "hydraulic influence" of the intake will no longer be significant (Golder Associates 2005). As a result, in the analysis that follows the entrainment AOI will be delineated by both the 0.1 and 0.3 fps velocity contours induced by the CWIS.

These threshold values are consistent with those used in other AOI studies. For example, the Electric Power Research Institute (EPRI) used threshold velocities of 1.0, 0.5 and 0.1 fps in their desktop analysis in "Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities" (EPRI 2007), and Golder Associates (2005) used 0.1 and 0.3 fps in their desktop analysis of AOI for the Crystal River Energy Complex.

For an organism to become entrained, it must enter the entrainment AOI of a CWIS. Physical and temporal factors that influence the entrainment AOI of a CWIS include the (EPRI 2004):

a) speed, direction, and distribution of flow in the waters that surround the CWIS;
b) bathymetry of the waters that surround the CWIS;
c) intake flow rate and variability of flow to the intake; and
d) design of the intake.

Similar to impingement AOI, the radius of the entrainment AOI (R_{AOI}) is calculated using an arc angle of 90° in the same equation (Eq. 2) used for the impingement AOI, but with the entrainment threshold velocities values of 0.1 and 0.3 fps.

Results

At NAPS, the design flow is 2,749.3 MGD and the extreme low water depth at the intake is 25.7 feet (refer to Figure 3-3 in Section 3.1). Based on the impingement AOI threshold velocity of 0.5 fps, the calculated radius of the impingement AOI is 211 feet. The calculated radii of the entrainment AOI are 351 feet and 1,054 feet for 0.3 fps and 0.1 fps threshold velocities, respectively.

The above analysis provides conservative estimates of the AOI (i.e., they err on the side of overestimating the size of the AOI) that can be used to support the specific requirements in the Rule. These AOI estimates should not be interpreted as the area of direct impact or the area in

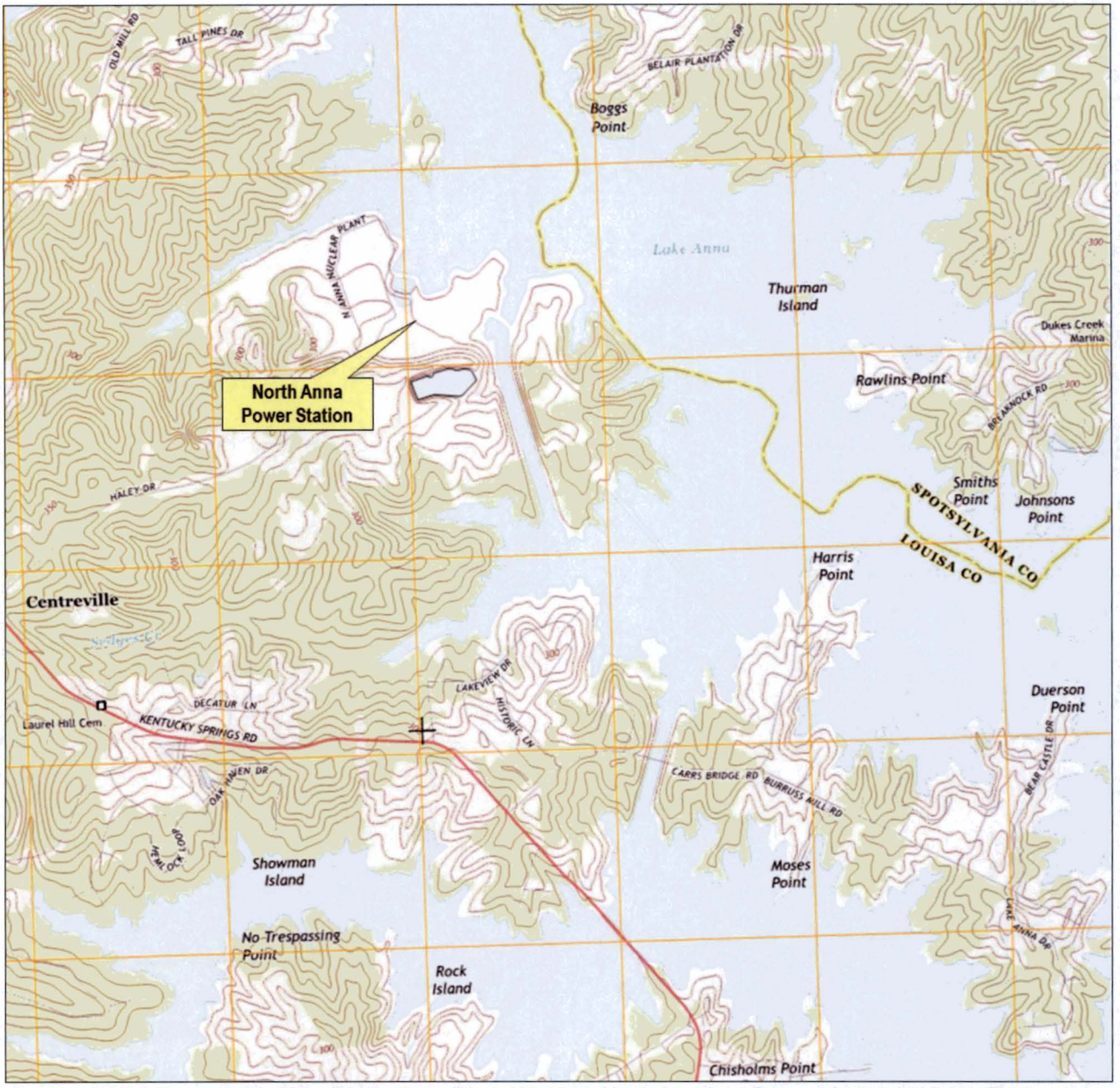
which organisms have a high probability of being withdrawn by the intake because actual entrainment and impingement at the facility will be the product of physical and biological factors that vary over space, time and species.

Based on the consistent approach used at other stations, the NAPS AOIs for impingement and entrainment were conservatively calculated as follows:

- AOI for impingement was calculated based on a threshold velocity of 0.5 fps and can be conservatively represented as a quarter circle area with a radius of 211 feet originating at the center of the intake structure.
- AOI for entrainment was calculated based on velocity thresholds of 0.1 fps and 0.3 fps. At locations where the intake-induced velocity is less than 0.1 fps to 0.3 fps, the ambient wind-induced currents likely will determine the flow patterns and, thus, the movement of the non-motile and limited mobility life stages (e.g., eggs and larvae). Under these assumptions, the overall AOI for entrainment is represented as a quarter circle area ranging from:
  - 351-foot radius originating at the center of the intake structure using a velocity threshold of 0.3 fps;
  - 1,054-foot radius originating at the center of the intake structure using a velocity threshold of 0.1 fps.

2.3 Locational Maps [§122.21(r)(2)(iii)]

Figure 2-1 presents an aerial photo of NAPS and its environs in Section 2.1. Figure 2-4 presents the locational map (USGS topographic map) of the area in the vicinity of the NAPS.



Source: USGS Topographic Map of Lake Anna West, VA 2013; North American Datum of 1983 (NAD83), Retrieved 4/13/2018

Figure 2-4. Topographic Map of Area near North Anna Power Station

3 Cooling Water Intake Structure Data [§122.21(r)(3)]

3.1 Description of CWIS Configuration [§122.21(r)(3)(i)]

NAPS withdraws its circulating water, which is used to cool the main condenser, from Lake Anna on the north side of the station and after passing through the condenser, water is discharged into the WHTF to dissipate heat before returning to the reservoir.

Cooling water for both units is withdrawn through two screenwells (one per nuclear unit) in a single CWIS, which is an eight-bay reinforced-concrete structure, located at the end of a cove just north of the station on the southwestern shore of Lake Anna (Figure 3-1). Figures 3-2 and 3-3 present plan and section views of the cooling water intake structure, respectively. Each screenwell consists of four 20-foot-wide intake bays and is equipped with four traveling water screens (TWS) (Figure 3-2). Each intake bay comprises a steel trash rack (0.5-inch-wide by 3.5-inch-thick vertical bars placed 4 inches on center), a traveling water screen, and a circulating water pump. The steel trash racks extend across the length of the CWIS to prevent large debris from damaging the TWS. There is a curtain wall behind the trash racks and the bottom El. of the curtain wall is 244.5 feet msl. The trash rack is serviced by a movable rake, and debris cleaned from the screens is sluiced to a common debris trough and collected in a large steel basket located on the east side of the CWIS; debris is not returned to Lake Anna. Each TWS, located approximately 16 feet downstream from each trash rack, is 14 feet wide and constructed with 16-gauge wire providing a vertically aligned, 1/8-inch by 1/2-inch screen mesh size. The invert El. of the TWS is 221.0 feet msl.

Eight circulating water pumps (four pumps per unit) supply cooling water drawn from Lake Anna. Each pump capacity is 238,200 gallons per minute (gpm) (i.e., 343.0 MGD) and the maximum design capacity for eight circulating water pumps is 2,744.1 MGD. The CWIS also contains service water pumps: two screenwash pumps, each rated at 910 gpm for each unit, and two auxiliary service water pumps (Table 3-1). There are two independent sources of service water for NAPS Units 1 and 2: Lake Anna and the Service Water Reservoir. Service water is used as cooling water for heat exchangers that remove heat from the component cooling system, the recirculation spray subsystem, and other station applications such as main control room air-conditioning condensers, charging pump lubricating-oil and instrument air compressors. In addition, service water is provided as a backup supply to the steam generator feed system, the fuel pit coolers, and the recirculation air cooling coils (NRC 2016a). Either screenwash pumps or auxiliary service water pumps can also provide make-up water to the Service Water Reservoir which stores enough service water to guarantee 30 days of operation without makeup should the normal make-up pumps become nonfunctional.

The total maximum design flow at NAPS is 2749.3 MGD including service water pumps.

Table 3-1. North Anna Power Station Cooling Water Intake Pump Characteristics

Unit	Purpose	# of Pumps	Pump Capacity	Design Flow per Unit
1	Circulating Water	4	343.0 MGD (238,200 gpm)	1,372.0 MGD (952,800 gpm)
	Service Water	2	1.3 MGD (910 gpm)	2.6 MGD (1,820 gpm)
2	Circulating Water	4	343.0 MGD (238,200 gpm)	1,372.0 MGD (952,800 gpm)
	Service Water	2	1.3 MGD (910 gpm)	2.6 MGD (1,820 gpm)
Maximum Design Intake Flow				**2,749.3 MGD (1,909,240 gpm)**

The circulating water pumps discharge to the common concrete intake tunnel, which conveys the circulating water to the station area, from which four buried steel pipes convey the water to the condensers. Steel pipes convey discharge water to a common concrete discharge tunnel, which terminates at a seal pit located at the entrance to the WHTF (NRC 2016a). A single discharge canal is located 200 feet south of the CWIS; the 3,600-foot long canal discharges into the first of three waste heat treatment facilities in series, which disperse heat before the water is retumed to Lake Anna (Figure 3-1).

3.2 Latitude and Longitude of CWIS [§122.21(r)(3)(ii)]

The latitude and longitude (in degrees, minutes, and seconds) of NAPS cooling water intake structure are:

Latitude	38° 3' 43.52" N
Longitude	77° 47' 26.54" W

3.3 Description of CWIS Operation [§122.21(r)(3)(iii)]

NAPS and its CWIS are intended for year-round, 24 hours/day operation, with the exception of down time for refueling outages. During refueling outages, intake flow is reduced but the intake structure is utilized to some degree at all times, particularly for safety related systems. Circulating water pump operation is seasonally variable in response to generation demand and maintenance activities. Unit refueling outages are generally scheduled for the winter, late fall, and/or early spring months.

The number of circulating water pumps operating at a given time can vary. At times, mainly during late fall, winter, and early spring (Fall Operation), cooling water circulation at NAPS can be accomplished with two or three pumps, rather than all four pumps for each unit. From early summer (Spring Operation), a minimum of three circulating water pumps per unit is required. Under either (i.e., Fall or Spring Operation) case, circulating water pumps could be throttled back gradually up to about 50 percent using motor operated valves based on condenser pressures and lake temperature according to operation guidelines. The service water pumps (auxiliary service water pumps and screenwash pumps) are also located within the CWIS and downstream of the TWS.

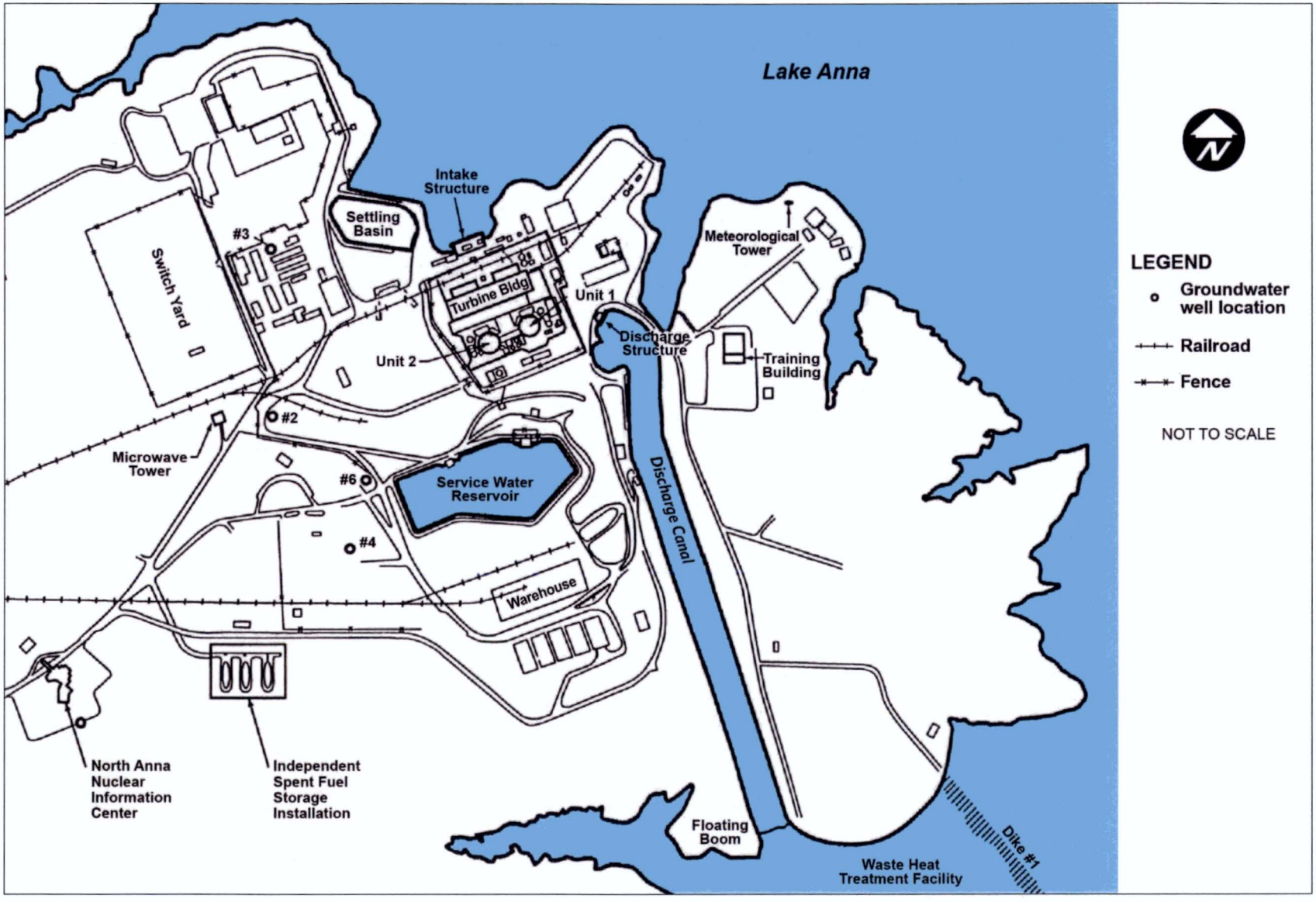


Figure 3-1. Site Plan of North Anna Power Station

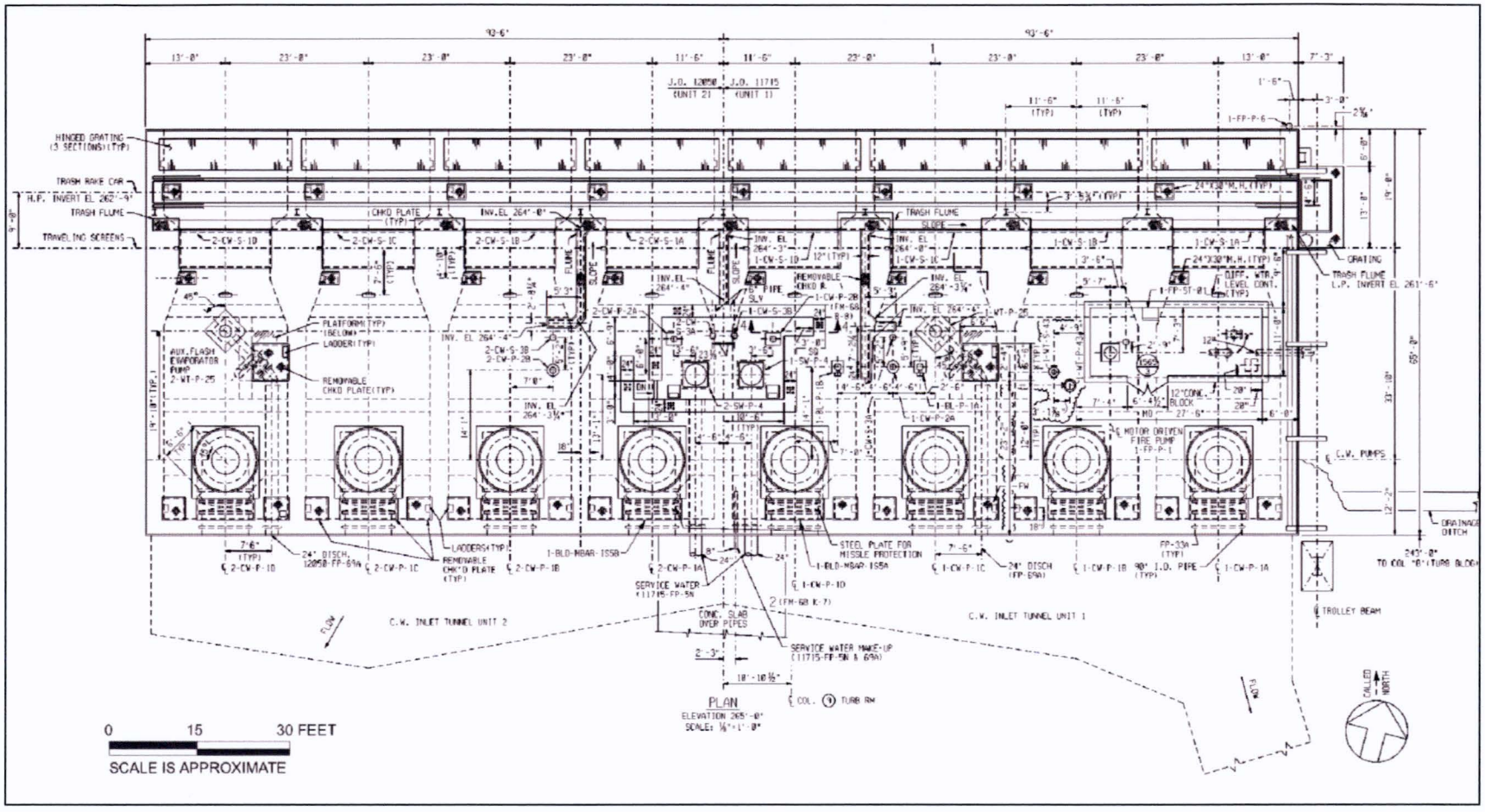


Figure 3-2. Plan View of Cooling Water Intake Structure at North Anna Power Station

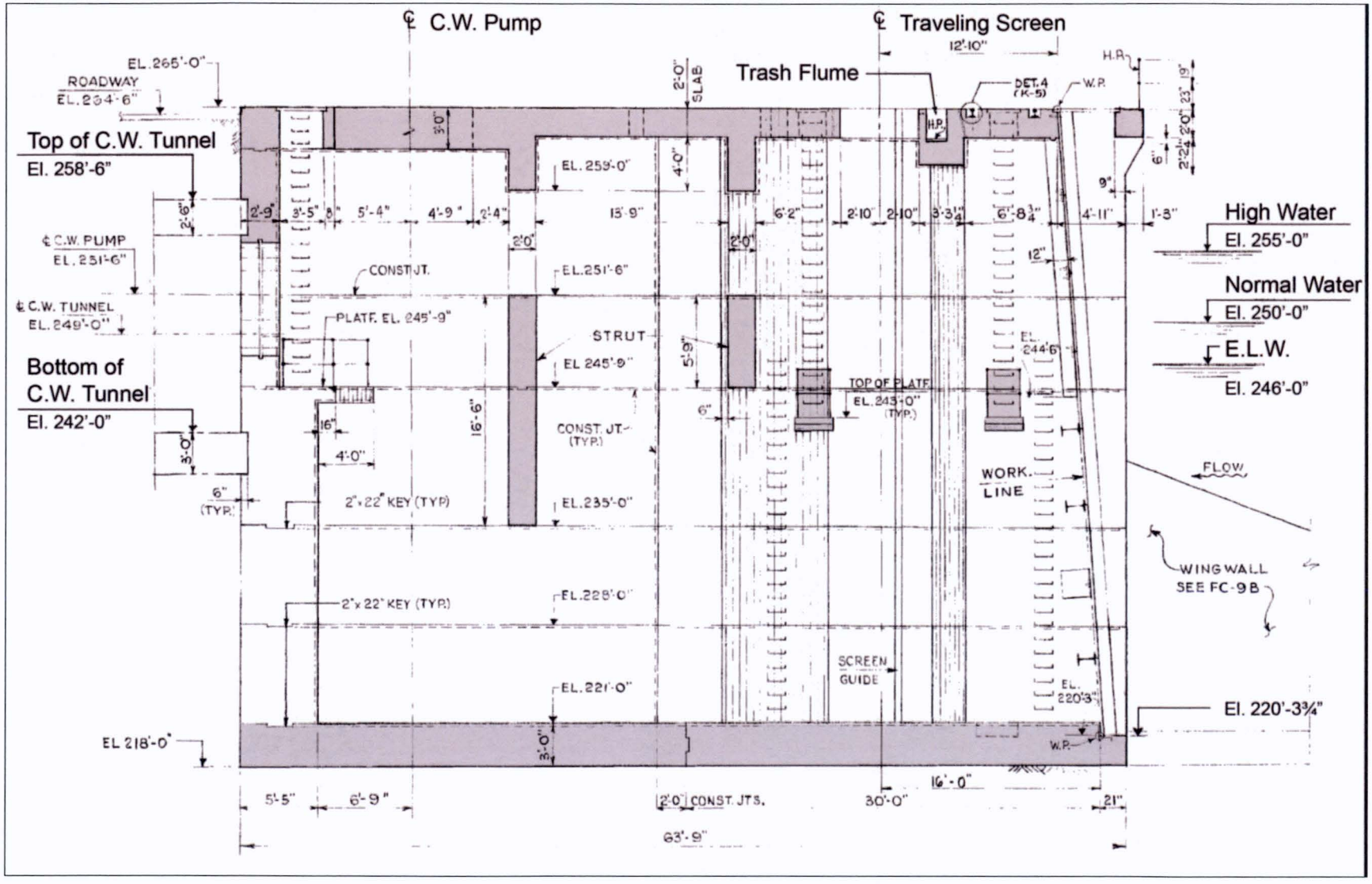


Figure 3-3. Section View of Cooling Water Intake Structure at North Anna Power Station

3.4 Description of Intake Flows [§122.21(r)(3)(iv)]

The monthly average flows from 2015 to 2017 are considered AIF, which is defined by the Rule as the average volume of water withdrawn on an annual basis by the CWIS over the previous three years for station permits that expire before October 14, 2019. Tables 3-2 and 3-3 present the daily actual withdrawal (two units combined) from the circulating water pumps and monthly average daily withdrawal by unit from 2015 through 2017, respectively.

Table 3-2. Unit-combined Total Daily Withdrawal (MGD) of North Anna Power Station from Lake Anna in 2015-2017

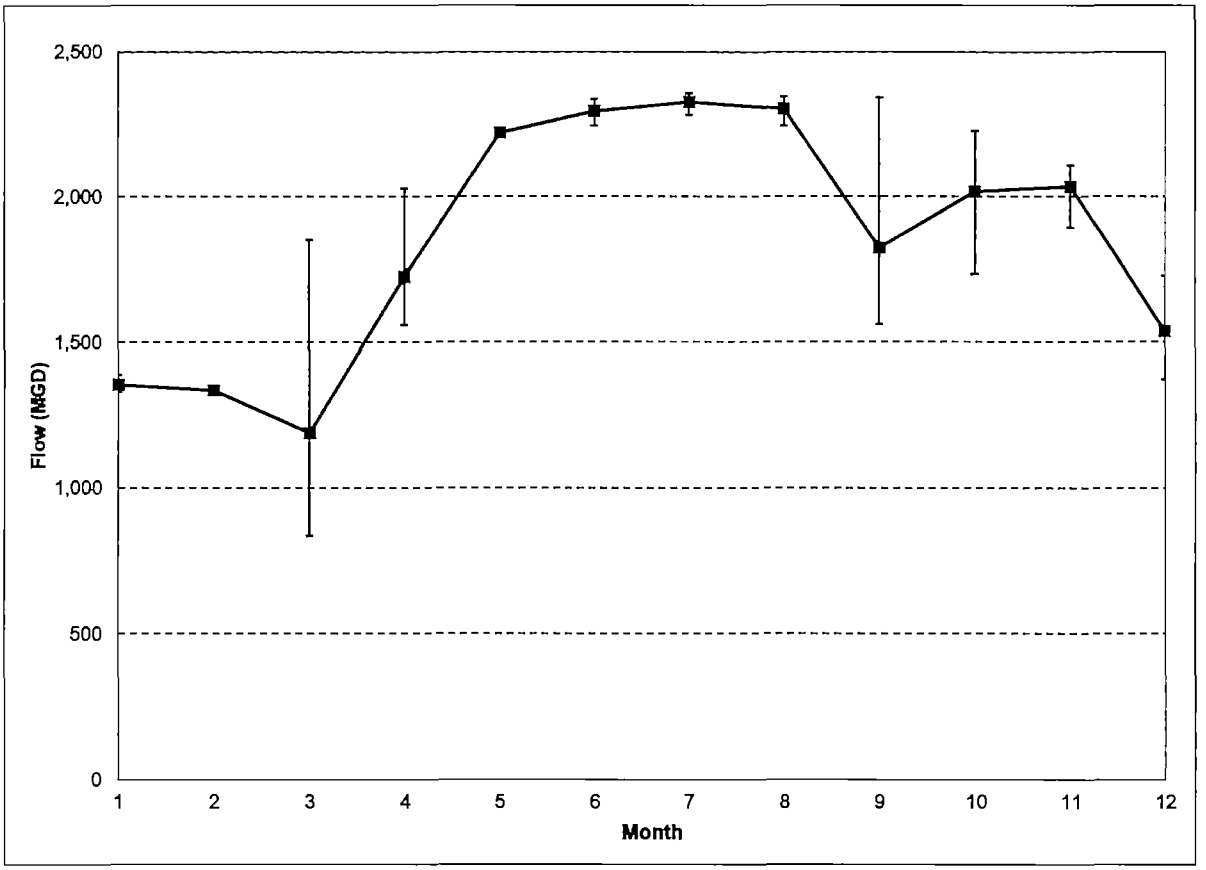
Month	Year			2015-2017 Average
	2015	2016	2017	
January	1,348.5	1,386.4	1,328.6	1,354.5
February	1,323.6	1,339.9	1,339.9	1,334.5
March	880.0	833.5	1,850.2	1,187.9
April	1,585.3	1,559.0	2,027.5	1,723.9
May	2,227.5	2,220.6	2,218.8	2,222.3
June	2,304.8	2,245.1	2,337.4	2,295.8
July	2,344.2	2,281.2	2,355.6	2,327.0
August	2,321.8	2,246.7	2,344.1	2,304.2
September	2,341.5	1,560.0	1,564.8	1,822.1
October	2,227.5	1,732.6	2,095.0	2,018.4
November	1,892.3	2,103.1	2,108.0	2,034.4
December	1,726.8	1,371.8	1,511.2	1,536.6
Annual Average	**1,877.0**	**1,740.0**	**1,923.4**	**1,846.8**

Table 3-3. North Anna Power Station Monthly Average Daily Withdrawal (MGD) by Unit from Lake Anna in 2015-2017

Month	Unit		Total (MGD)
	Unit 1 (MGD)	Unit 2 (MGD)	
January	696.0	658.4	1,354.5
February	683.8	650.7	1,334.5
March	622.9	565.0	1,187.9
April	880.4	843.6	1,723.9
May	1,100.4	1,121.9	2,222.3
June	1,141.2	1,154.6	2,295.8
July	1,172.9	1,154.0	2,327.0
August	1,162.9	1,141.3	2,304.2
September	912.8	909.3	1,822.1
October	945.6	1,072.7	2,018.4
November	990.4	1,044.0	2,034.4
December	789.4	747.2	1,536.6

In addition to circulating water withdrawal, NAPS withdraws service water for the use of cooling water for other plant equipment, screen wash and make-up water to the Service Water Reservoir evaporation and blowdown; however, the service water flow (estimated to be 0.016 percent of circulating water flows based on 2016-2017 plant operation) is insignificant so it was not included in the intake flows described in this section.

Figure 3-4 presents the average of monthly circulating water flows from 2015 to 2017 with monthly minimum and maximum flows in vertical bars. As shown on Figure 3-4, the water withdrawal during the summer (May to August) is higher than the rest of the year, and flows during early spring and late fall months are highly variable because of the typical unit refueling outage schedule. Figure 3-5 presents the water balance diagram for NAPS.



Note: Vertical bars represent daily maximum and minimum.

Figure 3-4. Seasonal Variation of North Anna Power Station Cooling Water Intake Flows Based on 2015-2017 Operation

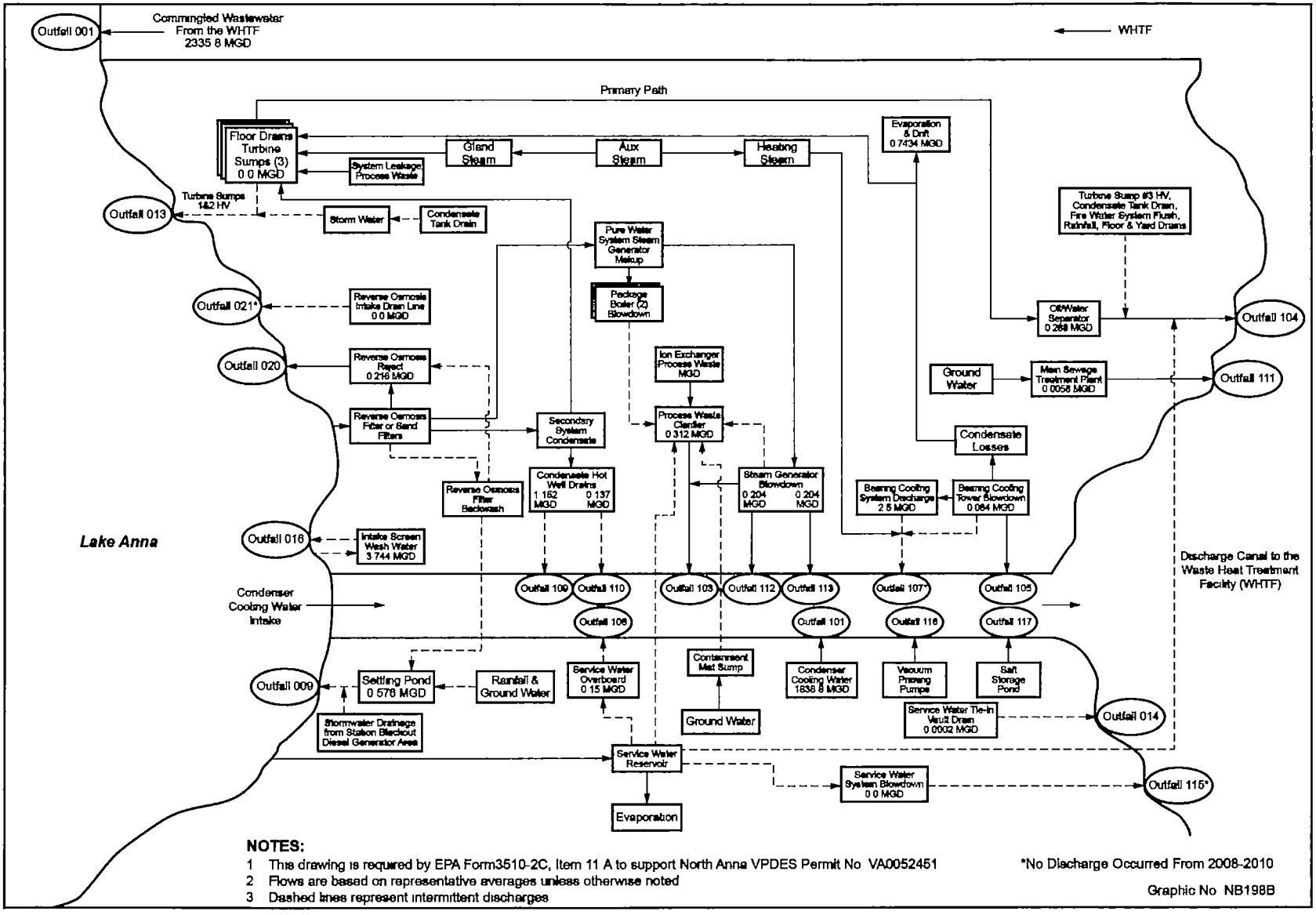


Figure 3-5. North Anna Power Station Water Balance Diagram

3.5 Engineering Drawings of CWIS [§122.21(r)(3)(v)]

The engineering drawings of NAPS CWIS showing plan and section views of eight intake bays with locations of trash racks, traveling screens, circulating/service water pumps and cooling water intake tunnel are provided in Appendix C. The following drawings are in the order of increasing details from Sheet 1 to Sheet 5:

- Drawing No. 11715-FC-9A-5: North Anna Power Station Intake Structure Outline Sheet 1
- Drawing No. 11715-FC-9B-5: North Anna Power Station Intake Structure Outline Sheet 2
- Drawing No. 11715-FC-9C-15: North Anna Power Station Intake Structure Outline Sheet 3
- Drawing No. 11715-FC-9D-7: North Anna Power Station Intake Structure Outline Sheet 4
- Drawing No. 11715-FC-9E-7: North Anna Power Station Intake Structure Outline Sheet 5

4 Source Water Baseline Biological Characterization Data [§122.21(r)(4)]

4.1 List of Unavailable Biological Data [§122.21(r)(4)(i)]

The data needed to prepare 40 CFR §122.21(r)(4) are available.

4.2 List of Species and Relative Abundance in the vicinity of CWIS [§122.21(r)(4)(ii)]

Table 4-1 presents a master species list for entrainment, impingement, and ambient fish studies conducted intermittently at or near NAPS in chronological order between the years 1978 and 2016. Lake Anna was developed as a cooling water reservoir in the 1970s and operations at NAPS began with Unit 1 in 1978, followed by the addition of Unit 2 in 1980. The results from the individual studies are discussed in detail in the following sections organized by study type; historical entrainment studies, historical impingement studies, historical ambient finfish sampling, recent ambient finfish sampling, and recent entrainment studies.

While recognizing that each study differed in scope and objectives, some general trends are evident. The fish species that appear relatively consistently as the most dominant species over the various studies consist of Gizzard Shad (*Dorosoma cepedianum*), White Perch (*Morone ameriana*), Bluegill (*Lepomis macrochirus*), and Black Crappie (*Pomoxis nigromaculatus*). Additional species that were commonly collected throughout most studies include Yellow Perch (*Perca flavescens*), Blueback Herring (*Alosa aestivalis*), Channel Catfish (*Ictalurus punctatus)*, and Largemouth Bass (*Micropterus salmoides*).

4.2.1 Historical Entrainment Studies

Virginia Electric Power Company (VEPCO) conducted entrainment sampling at NAPS from March through July of each year from 1978 to 1983. During this period, samples were collected at 0600, 1200, 1800, and 2400 hours over one day each week. Samples were collected at the surface, mid-depth, and bottom by placing paired conical nets with 505-micron (µm) mesh in front of a predetermined intake forebay (VEPCO 1985).

Table 4-2 presents the annual total collected and percent composition of organisms collected during the entrainment studies (VEPCO 1985). A total of 7,908 fish larvae (the only life stage reported) were collected from 1978-1983 (Table 4-2). The most abundant entrained larvae over all years were Gizzard Shad (65.7%) followed by White Perch (15.0%), Sunfish species (*Lepomis spp.;* 13.4%), Yellow Perch (4.9%) and Black Crappie (1.0%). Channel Catfish and Largemouth Bass were each represented by a single collected individual. Sunfish species were considered to represent several possible *Lepomis* species. More Sunfish Species and Yellow Perch larvae were collected in the first year (1978) than in subsequent years. Gizzard Shad, however, were collected in relatively greater numbers in 1979 and 1981. White Perch numbers generally increased over the study period. Black Crappie numbers are considered too low for any meaningful comparisons.

Table 4-1. Master Species List for Fish Taxa Collected During Impingement, Entrainment, and Ambient Studies Conducted at North Anna Power Station

Common Name	Scientific Name	1978-1983 Entrainment (VEPCO 1985)	1978-1983 Impingement (VEPCO 1985)	1984-1985 Ambient Ichthyoplankton (VEPCO 1986)	2005-2006 Impingement (EA 2007)	1981-2005 Ambient Fish (Dominion 2005a)	2016-2017 Entrainment (HDR 2018)	2016 Ambient Fish (Dominion 2017)
American Eel	*Anguilla rostrata*		X			X		
Banded Killifish	*Fundulus diaphanous*				X	X		
Bass and Sunfish	Centrarchidae				X		X	
Black Crappie	*Pomoxis nigromaculatus*	X	X	X	X	X		X
Blueback Herring	*Alosa aestivalis*		X		X	X	X	X
Blue Catfish	*Ictalurus furcatus*					X		
Bluegill	*Lepomis macrochirus*		X		X	X	X	X
Bluntnose Minnow	*Pimephales notatus*		X					
Brown Bullhead	*Ameiurus nebulosus*		X			X		X
Chain Pickerel	*Esox niger*		X			X		
Channel Catfish	*Ictalurus punctatus*	X	X		X	X	X	X
Common Carp	*Cyprinus carpio*					X		X
Common Shiner	*Notropis cornutus*		X					
Crappie Species	*Pomoxis* spp.						X	
Creek Chubsucker	*Erimyzon oblongus*		X			X		
Cutlips Minnow	*Exoglossum maxillingua*		X					
Darter spp	*Etheostoma* spp.						X	
Eastern Mosquitofish	*Gambusia holbrooki*					X		

Common Name	Scientific Name	1978-1983 Entrainment (VEPCO 1985)	1978-1983 Impingement (VEPCO 1985)	1984-1985 Ambient Ichthyoplankton (VEPCO 1986)	2005-2006 Impingement (EA 2007)	1981-2005 Ambient Fish (Dominion 2005a)	2016-2017 Entrainment (HDR 2018)	2016 Ambient Fish (Dominion 2017)
Eastern Mudminnow	*Umbra pygmaea*		X					
Gizzard Shad	*Dorosoma cepedianum*	X	X	X	X	X	X	X
Golden Shiner	*Notemigonus crysoleucas*		X			X	X	X
Grass Carp	*Ctenopharyngodon idella*					X		X
Green Sunfish	*Lepomis cyanellus*				X	X		X
Herrings and Shad	Clupeidae				X		X	
Largemouth Bass	*Micropterus salmoides*	X	X	X	X	X	X	X
Minnow	Cyprinidae						X	
Mountain Redbelly Dace	*Phoxinus oreas*		X					
Mud Sunfish	*Acantharchus pomotis*		X					
Mummichog	*Fundulus heteroclitus*		X					
Pirate Perch	*Aphredoderus sayanus*		X			X		
Pumpkinseed	*Lepomis gibbosus*		X		X	X		X
Quillback	*Carpiodes cyprinus*					X		X
Redear Sunfish	*Lepomis microlophus*		X		X	X		X
Redbreast Sunfish	*Lepomis auritus*		X			X		X
Satinfin Shiner	*Notropis analostanus*		X			X		X
Sea Lamprey	*Petromyzon marinus*		X					
Shad Species	*Dorosoma* spp.						X	
Shorthead Redhorse	*Moxostoma macrolepidotum*					X		X

Common Name	Scientific Name	1978-1983 Entrainment (VEPCO 1985)	1978-1983 Impingement (VEPCO 1985)	1984-1985 Ambient Ichthyoplankton (VEPCO 1986)	2005-2006 Impingement (EA 2007)	1981-2005 Ambient Fish (Dominion 2005a)	2016-2017 Entrainment (HDR 2018)	2016 Ambient Fish (Dominion 2017)
Spottail Shiner	*Notropis hudsonius*				X	X	X	X
Striped Bass	*Morone saxitilis*		X		X	X		
Sunfish Species	*Lepomis* spp.	X		X		X	X	
Swallowtail Shiner	*Notropis procne*					X		
Tessellated Darter	*Etheostoma olmstedi*		X		X	X		
Threadfin Shad	*Dorosoma petenense*		X		X	X	X	X
Walleye	*Stizostedion vitreum (=Sander vitreus)*		X			X		
Walleye/ Sauger Hybrid	*Sander vitreus X canadense*							X
Warmouth	*Lepomis gulosus*		X		X	X		X
White Bass/ Striped Bass Hybrid	*Morone chrysops X saxitilis*							X
White Catfish	*Ictalurus catus*		X		X	X	X	X
White Perch	*Morone americana*	X	X	X	X	X	X	X
White Sucker	*Catostomus commersoni*		X			X		X
Yellow Bullhead	*Ictalurus natalis*		X			X		X
Yellow Perch	*Perca flavescens*	X	X	X	X	X	X	X

Table 4-2. Annual Total and Percent Composition of Fish Larvae Collected in Entrainment Samples at North Anna Power Station from 1978-1983 (VEPCO 1985)

Species	1978		1979		1980		1981		1982		1983		Total Collected	Percent (%)
	#	%	#	%	#	%	#	%	#	%	#	%		
Gizzard Shad	514	43.2	1,397	87.9	941	73 6	1,126	64.2	471	51.1	733	62.3	**5,182**	**65.5**
Channel Catfish	-	0	-		-	0	-	0	-	0	1	0.1	**1**	**0**
White Perch	3	0.3	56	3.5	91	7.1	391	22.3	293	31.8	361	30.7	**1,195**	**15.1**
Sunfish	531	44.6	112	7	161	12.6	117	6.7	114	12.4	28	2.4	**1,063**	**13.4**
Largemouth Bass	1	0.1	-	0	-	0	-	0	-	0	-	0	**1**	**0**
Black Crappie	12	1	6	0.4	13	1	16	0.9	6	0 7	29	2.5	**82**	**1**
Yellow Perch	130	10.9	18	1.1	72	5.6	103	5.9	37	4	24	2	**384**	**4.9**
Total	**1,191**	**100**	**1,589**	**100**	**1,278**	**100**	**1,753**	**100**	**921**	**100**	**1,176**	**100**	**7,908**	**100**

Note: Hyphens indicate no catch.

With the exception of 1978, the changes in total numbers entrained from year to year are generally reflected in the numbers of Gizzard Shad, Sunfish species and White Perch collected. The percentage of the total larvae collected represented by Gizzard Shad had remained high and stable for each year, whereas the percentage of White Perch increased each year.

No fish eggs were collected during the sample years 1978-1983, and the presence of juveniles was not reported. Most species of reproducing fish in Lake Anna produced demersal, adhesive eggs which significantly reduced potential entrainment (VEPCO 1985).

4.2.2 Historical Impingement Studies

Impingement studies were conducted at NAPS for a period of five years and nine months, April 1978 through December 1983 on a four-week cycle (VEPCO 1985). The sampling schedule for the first three weeks of a four-week cycle consisted of two 24-hour samples per week collected on non-consecutive days. During the fourth week, a composite sample was taken consisting of 12 continuous two-hour samples. For each sample collection, each screen was washed for 10 minutes and the fish were washed into a catch basket at the end of the debris sluiceway and were removed and transported to the laboratory. A total of 34 species of fish within 13 families was collected throughout the study period (Table 4-1), with the most commonly impinged fish (all years combined) consisting of Gizzard Shad (61.4%), followed by Yellow Perch (15.8%), Black Crappie (15.7%), Bluegill (3.9%), White Perch (1.4%), and Striped Bass (*Morone saxatilis*; 1.0%). Combined, these species accounted for 99.2 percent of all impinged fish. All remaining species each comprised less than 1 percent of the total collection.

Impingement sampling at NAPS was also conducted from June 2005 through May 2006 (EA 2007). Sampling events occurred twice per month for 12 months and 10-minute screen-wash samples were collected each hour during a 24-hr sample period. Samples were collected in a single net, consisting of ¼-inch mesh, downstream of all traveling screens in the screen-wash trough. The master species list for the fish collection resulting from this impingement study is presented in Table 4-1. A total of 1,386 fish, representing 18 species (distinct taxa[10]) were collected from the NAPS traveling screens. Bluegill, Threadfin Shad (*Dorosoma petenense*), Gizzard Shad, and Blueback Herring collectively comprised 83.8 percent of the impingement total (EA 2007).

4.2.3 Historical Ambient Fish Sampling

The fish community of Lake Anna has been monitored since it was created; information on the fish community in the vicinity of NAPS is available from studies conducted in 1984-1985 (VEPCO 1986), and by a summary of annual monitoring provided by Dominion for the period

[10] When counting the number of distinct taxa collected, general taxonomic designations at the genus, family, and higher taxonomic levels were dropped if there was one, valid lower-level designation for that group. For example, because *Lepomis* spp. and *Lepomis macrochirus* were identified in the collections, *Lepomis* spp. was not counted in the total number of distinct taxa

1981 to 2005 (Dominion 2005b). Results of the most recent annual monitoring (Dominion Energy 2017) is discussed in 4.2.1.4.

Ichthyoplankton sampling was conducted on a bi-weekly basis at six locations in Lake Anna source waters from 1984 to 1985 using a side-towed plankton net (VEPCO 1986). Species collected are listed in Table 4-1. The egg and larval presence follows the spawning patterns of each individual species and is consistent between 1984 and 1985 (Jenkins and Burkhead 1994). Yellow Perch eggs and larvae were first to appear in both collection years, generally in early April, when water temperatures approached 12°C. White Perch eggs and larva appeared in April when the temperature approached 14°C and peaked in numbers by mid-May. Both White and Yellow Perch typically spawn in the spring. Gizzard Shad eggs and larvae generally were first collected in late April to early May at water temperatures between 14°C and 18°C and peaked in numbers in mid-May to early June. Gizzard Shad typically spawn in late spring/early summer. Sunfish eggs and larvae were the last group to occur in samples (May-June) and were first collected when water temperatures rose to 19°C. Both Gizzard Shad and Sunfish were collected in relatively fewer numbers in July. The most commonly caught sunfish, Bluegill, typically spawn during early summer.

A review of Lake Anna adult and juvenile fish community data for the period 1981 to 2005 (Dominion 2005b) is summarized as follows. Results of electrofishing and gill net sampling on Lake Anna concluded that a stable assemblage of fishes inhabited the lake. During the 25-year period from 1981 to 2005, seven species showed an increase in abundance, including Bluegill, Redear Sunfish (*Lepomis microlophus*), Redbreast Sunfish (*Lepomis auritus*), Largemouth Bass, Channel Catfish, White Catfish (*Ictalurus catus*), and Striped Bass (*Morone saxatilis*). Gizzard Shad and Black Crappie were the only two species showing decreasing abundances. The 30 species captured from ambient gill net samples and 31 species captured from ambient electrofishing samples throughout Lake Anna totaled 36 distinct species. The comprehensive list of species is provided in Table 4-1. The most abundant species and relative abundance (percent composition) for the 1981 to 2005 period based on gill net sampling consisted of Gizzard Shad (31.3%), White Perch (14.0%), Black Crappie (12.5%), Channel Catfish (9.6%), Threadfin Shad (*Dorosoma petenense*; 8.8%), Striped Bass (7.5%), and White Catfish (4.9%). Based on the electrofishing sampling, the most abundant species was Bluegill (75.5%). Additional species accounting for more than one percent of the collection each consist of Largemouth Bass (4.5%), Redbreast Sunfish (4.3%), Black Crappie (3.6%), Redear Sunfish (3.2%), Warmouth (*Lepomis gulosus*; 2.7%), and Green Sunfish (*Lepomis cyanellus*; 1.2%).

4.2.4 Recent Ambient Fish Sampling

The fish community in Lake Anna is monitored annually using consistent methodologies of electrofishing and gill netting. The most recent data available at the time of this report are for 2016 (Dominion 2017).

Consistent with past monitoring efforts, surveys were conducted quarterly in March, May, August, and November. Gill netting efforts resulted in the collection of 361 fish represented by 17 species and two hybrids in 7 families. The dominant species were Channel Catfish (40%), Gizzard Shad (26%), White Perch (12%), Largemouth Bass (6%), and Common Carp (*Cyprinus*

carpio; 4%). Combined, these species accounted for 88 percent of the number of fish collected. Long-term monitoring data (1996 to 2016) indicate Channel Catfish, Striped Bass and White Perch catch rates have been increasing in the lake. The Striped Bass population in Lake Anna is maintained through a stocking program, which has been supplemented with hybrid White Bass/ Striped Bass since 2014. Channel Catfish and White Perch reproduce naturally in the Lake, as do Gizzard Shad and Threadfin Shad which show high annual variability.

Electrofishing sampling in 2016 resulted in the collection of 23 species of fish representing 7 families (Dominion 2017). The most abundant species collected was Bluegill (66%), followed distantly by Gizzard Shad (6%), Largemouth Bass (5%), Redbreast Sunfish (5%), Green Sunfish (4%), and White Perch (4%). Together these five species represented 90 percent of the total electrofishing catch by number. Based on the electrofishing monitoring data over the past 25 years, the catch rates of Green Sunfish, Bluegill, and Redbreast Sunfish have been highly variable while Largemouth Bass and Gizzard Shad catch rates have been more consistent. The full species list for the combined electrofishing and gill netting monitoring in 2016 is provided in Table 4-1.

4.2.5 Recent Entrainment Studies

A two-year entrainment study was conducted at NAPS from April through September 2016 and March through September 2017 (HDR 2018). Pumped entrainment samples were collected from intake piping installed along the front of the trash racks from near-surface, mid-water, and near-bottom depths and filtered through 335-µm mesh hoop plankton nets. Each sampling event lasted 24 hours subdivided into four, 6-hour subsampling periods. Sample duration was approximately 100 minutes (min) per depth per 6-hour sample (or the time required to sample 100 m^3 per depth per 6-hour sample).

During the first year of sampling, and excluding non-viable eggs (NVE; i.e. unfertilized or dead/decaying eggs), a total of 522 finfish were collected distributed among 12 distinct taxa. The total number of organisms collected during the second year of sampling was 760 finfish distributed among 10 distinct taxa. Table 9-4 (refer to Section 9.2.1) presents a list of all taxa and life stages collected each year of study. In general, the species lists were consistent during the two years of sampling with minor differences associated primarily with the variation that occurs when species are collected in small numbers (HDR 2018). Post yolk sac larvae dominated the entrainment sample collections, accounting for 83 percent of Year 1 total and 96 percent of the Year 2 total. Herrings and Shad (Clupeidae; 37%) and Sunfish species (*Lepomis spp.*; 33%) post yolk sac larvae were the most abundant fish taxa and life stage collected during the first year of entrainment sampling. White Perch post yolk sac larvae (4%), Herrings unidentified life stage larvae (4%), Threadfin/Gizzard Shad (*Dorosoma* spp.) post yolk sac larvae (3%), and Herrings and Shad yolk sac larvae (3%) were collected in relatively low abundance during the first year. The remaining fish taxa each accounted for two percent or less of the total collection.

During the second year of entrainment sampling (2017), Herrings and Shad (68%), Threadfin/Gizzard Shad (13%), and Sunfish Species (9%) post yolk sac larvae were the most abundant fish taxa collected (Table 9-4 in Section 9.2.1). Threadfin/Gizzard Shad post yolk sac

larvae (13%) and Threadfin Shad post yolk sac larvae (2%) were collected in relatively higher abundance than the first year, while White Perch post yolk sac larvae (2%), Herrings and Shad unidentified life stage larvae (<1%), and Herrings and Shad yolk sac larvae (<1%) were collected in relatively low abundance during the second year when compared to Year 1. The remaining fish taxa each accounted for one percent or less of the total catch in Year 2.

In general, the entrainment taxa composition collected in 2016-2017 compares well with the entrainment study data conducted in the period from 1978-1983 and described in Section 4.2.1. The three most abundant species, Gizzard Shad, White Perch, and Sunfish species, were similar between studies. The historical data identified Gizzard Shad as the most abundant species while the recent study grouped most clupeid larvae into the higher taxonomic group Herrings and Shad (Clupeidae) that may have contained clupeid species other than Gizzard Shad, such as Threadfin Shad.

4.3 Identification of Species and Life Stages Susceptible to Impingement and Entrainment [§122.21(r)(4)(iii)]

The withdrawal of cooling water from waterbodies has the potential to impact fishes and aquatic organisms through impingement and entrainment.

The degree of vulnerability to impingement exhibited by adult and juvenile fish species depends upon biological and behavioral factors including seasonal fish community structure, swimming speed, spawning effects on distribution, habitat surrounding intake structures, high flow events, fish health, and attraction to the flow associated with the intake structures themselves. In addition, intake velocity, screen mesh size, trash rack spacing, and other intake design components will also affect the susceptibility of fishes to impingement and entrainment. For example, clupeids have high susceptibility to impingement based on multiple factors such as schooling behavior, distribution in the water column, negative rheotactic response to intake flows, and poor swimming performance in winter months due to physiological stress owing to lower water temperatures (Loar et al. 1978).

As mentioned in Section 1 of this document, NAPS's cooling system, which comprises the 9,600 freshwater lake and the WHTF, meets the definition of a CCRS as defined at 40 CFR §125.92(c)(2). Given that the CCRS provisions of the Rule were clearly intended to allow continued operation of reservoirs created as CCRS (as the Rule states "EPA does not intend to eliminate the use of such lawfully created impoundments for their intended purpose, as doing so could result in a large number of stranded assets."[11]), NAPS CWIS meets BTA Compliance Alternative 1 (§125.94(c)(1)) for impingement mortality reduction in the Rule and this is Dominion Energy's chosen method for compliance with impingement BTA as specified in 40 CFR §122.21(r)(6).

[11] Federal Register / Vol. 79, No. 158 / Friday, August 15, 2014 / Rules and Regulations. 48345p.

For entrainment, life history characteristics can influence the vulnerability of a fish species to entrainment. For example, broadcast spawners with non-adhesive, free-floating eggs can drift with water currents and may become entrained in a CWIS, while nest-building species or species with adhesive, demersal eggs are less susceptible to entrainment during early life stages. Susceptibility of larval life stages of fishes to entrainment depends on body morphometrics and swimming ability. Therefore, an organism will spend only a short portion of its life cycle susceptible to entrainment, as larger juvenile and adult life stages are not entrainable.

The potential for entrainment of species known to occur in the vicinity of NAPS was assessed based on life history characteristics for individual species, and their presence in the most recent entrainment and ambient fish studies conducted at NAPS (Table 4-3). Fish eggs and larvae are vulnerable to unfavorable conditions because they lack mobility. Therefore, the nature of the spawning site can dictate the impact of hazardous conditions (Wootton 1990). Pelagic or mid-water broadcast spawners were considered to be more susceptible to entrainment because their eggs can drift downstream in the current (Table 4-3). After hatching, early larvae may be vulnerable until they make their way to nursery areas such as the margins of the river, backwaters, and side lakes (Wootton 1990).

Fish that broadcast or scatter their eggs over vegetation or substrates are not considered likely to be entrained as eggs (it was assumed that these types of species are near the bottom or in waters that are shallower than the NAPS CWIS), but may be vulnerable as larvae or older life stages. In addition to this life history information, species that were entrained during recent studies were considered to have potential for entrainment. Many factors have affected finfish community structure in Lake Anna over the years, including stocking of a variety of non-native fish species and the introduction of species such as Green Sunfish with the potential to have negative effects and outcompete native species. Thus, the recent entrainment study data collected at NAPS are believed to represent the best available information on current species and expected relative abundance in the vicinity of NAPS as well as their susceptibility to entrainment and impingement. Similarly, the potential for impingement is based on species known to occur in the vicinity of NAPS as evidenced by recent ambient fish studies and their collection in the most recent historical impingement data collected in 2005-2006 (Table 4-1). Based on this information, 18 taxa (17 species and the genus *Etheostoma*) were found to be possibly susceptible to impingement or entrainment. These are identified in Table 4-3.

The potential risk of impingement and entrainment is also related to the relative abundance of susceptible species. The majority of the species listed in Table 4-3 are expected to occur in the vicinity of the NAPS CWIS in low abundances. Fish species that are expected to be the most abundant include Blueback Herring, Gizzard Shad, White Perch, Bluegill, Yellow Perch, and Black Crappie. Additional species may occur in the vicinity of NAPS based on ambient fish information; however, those species were collected as larger juvenile and adult finfish of sufficient size not to be susceptible to entrainment (larger than screen mesh opening size), and thus were not considered at risk for entrainment as identified in Table 4-3. The determination of 'unlikely to be entrained' in Table 4-3 is further supported by the fact that they were not collected in the two years of entrainment sampling.

Table 4-3. Entrainment Potential for Fish Species to Occur near North Anna Power Station CWIS

Family	Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
Catfish	Channel Catfish	*Ictalurus punctatus*	Potentially – cavity nesters but larvae were collected in recent entrainment study	Potentially	Potentially
	White Catfish	*Ameiurus catus*	Potentially – cavity nesters but larvae were collected in recent entrainment study.	Potentially	Potentially
	Brown Bullhead	*Ameiurus nebulosus*	Unlikely – cavity nesters; collected in recent ambient studies but not in recent entrainment study.	Unlikely	Unlikely
	Yellow Bullhead	*Ameiurus natalis*	Unlikely – cavity nesters; collected in recent ambient studies but not in recent entrainment study.	Unlikely	Unlikely
Herrings and Shad	Blueback Herring	*Alosa aestivalis*	Potentially – broadcast spawners with adhesive eggs but larvae are free swimming; larvae collected in recent entrainment study.	Potentially	Potentially
	Gizzard Shad	*Dorosoma cepedianum*	Potentially – broadcast spawners; larvae collected in recent entrainment study	Potentially	Potentially
	Threadfin Shad	*Dorosoma petenense*	Potentially – broadcast spawners; larvae collected in recent entrainment study.	Potentially	Potentially
Minnow	Golden Shiner	*Notemigonus crysoleucas*	Potentially – spawning occurs in streams over vegetation, gravel and nests of other fish but larvae are free swimming; larvae collected in recent entrainment study.	Potentially	Unlikely
	Spottail Shiner	*Notropis hudsonius*	Potentially – eggs deposited in various habitats; larvae collected in recent entrainment study.	Potentially	Potentially
	Satinfin Shiner	*Notropis analostanus*	Potentially – eggs are deposited in crevices between structures; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
	Common Carp	*Cyprinus carpio*	Potentially – broadcast spawners; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
	Grass Carp	*Ctenopharyngodon idella*	Potentially – broadcast spawners; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely

Family	Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
Perch	Yellow Perch	*Perca flavescens*	Potentially – eggs are laid in gelatinous bands over vegetation or logs but larvae may be free swimming; larvae collected in recent entrainment study.	Potentially	Potentially
	Darters	*Etheostoma* spp.	Potentially – spawning occurs in shallow waters near cover; larvae collected in recent entrainment study.	Potentially	Unlikely
	Walleye/ Sauger Hybrid	*Sander vitreus X canadense*	Unlikely – They are stocked into the lake and are sterile, collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
Sucker	Shorthead Redhorse	*Moxostoma macrolepidotum*	Potentially – spawning occurs in riffles and runs usually over gravel; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
	Quillback	*Carpoides cyprinus*	Potentially – eggs are broadcast in shallow waters over sand and mud; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
	White Sucker	*Catostomus commersoni*	Unlikely – eggs are broadcast in flowing waters, sink to bottom and adhere to objects, collected in recent ambient study but not in recent entrainment study	Unlikely	Unlikely
Sunfish	Black Crappie	*Pomoxis nigromaculatus*	Potentially – Males build nests in shallow protected waters near shoreline and vegetation but larvae are free swimming; *Pomoxis* spp. larvae were collected in recent entrainment study and this species is the species identified in recent and historical ambient studies.	Potentially	Potentially
	Bluegill	*Lepomis macrochirus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; larvae collected in recent entrainment study.	Potentially	Potentially
	Redbreast Sunfish	*Lepomis auritus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; collected in recent ambient study and may be included within *Lepomis* spp. collected in entrainment study.	Potentially	Unlikely
	Redear Sunfish	*Lepomis microlophus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; collected in recent ambient study and may be included within *Lepomis* spp. larvae collected in entrainment study.	Potentially	Potentially
	Green Sunfish	*Lepomis cyanellus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; collected in recent ambient study and may be included within *Lepomis* spp. larvae collected in entrainment study.	Potentially	Potentially

Family	Common Name	Scientific Name	Potential to Occur Near the Intake	Potential for Entrainment of Early Life Stages	Potential for Impingement of Adults and Juveniles
	Pumpkinseed	*Lepomis gibbosus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; collected in recent ambient study and may be included within *Lepomis* spp larvae collected in entrainment study.	Potentially	Potentially
	Warmouth	*Lepomis gulosus*	Potentially – nest generally constructed in shallow waters but larvae are free swimming; collected in recent ambient study and may be included within *Lepomis* spp. larvae collected in entrainment study.	Potentially	Potentially
	Largemouth Bass	*Micropterus salmoides*	Potentially – nest constructed in shallow areas of one to six feet but larvae are free swimming; larvae collected in recent entrainment study.	Potentially	Potentially
Temperate Bass	White Perch	*Morone americana*	Potentially – broadcast spawners with adhesive eggs but larvae are free swimming; larvae collected in recent entrainment study.	Potentially	Potentially
	Striped Bass	*Morone saxatilis*	Unlikely – They are stocked into the lake; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely
	White Bass/ Striped Bass Hybrid	*Morone chrysops X saxitilis*	Unlikely – They are stocked into the lake and are sterile; collected in recent ambient study but not in recent entrainment study.	Unlikely	Unlikely

4.4 Identification and Evaluation of Primary Growth Period [§122.21(r)(4)(iv)]

The primary growth period for the majority of fishes directly follows the spring hatch. Growth rates are highest in early spring and tend to decline throughout the summer along with total fish abundance. Fish are cold blooded, thus primary growth occurs when water temperatures are 50 degrees Fahrenheit (°F) (10 degrees C) or above. The mean water temperature near NAPS was above 50°F between April and October (Table 2-1). The generally held view on seasonal variation in fish growth in North America is that growth is fastest in the spring and early summer, slows in the late summer and fall, and virtually stops in the winter (Gebhart and Summerfelt 1978). The majority of fishes will have their highest densities shortly after the hatch occurs when larvae are concentrated. Feeding competition is especially important during late spring through early summer when the bulk of fish are in their early life stages. During this time, they are more susceptible to starvation (May 1974). This is a critical stage in development, where larval fish have a short time period to initiate exogenous feeding before starving (Ehrlich 1974; Miller et al. 1988).

4.4.1 Reproduction

Fish species in the vicinity of NAPS utilize external fertilization, which is principally controlled by water temperatures. Fish reproduction has the potential to produce high yields; however, natural mortality rates are also high regardless of whether the fish reside in Lake Anna or another freshwater lake environment. The number of eggs a female produces (fecundity) can vary widely depending on the relative success of the various types of spawning behavior and the amount of parental investment. Based on data collected in the recent entrainment studies, fish with the highest potential for entrainment are in the Clupeidae family (Blueback Herring, Gizzard Shad, and Threadfin Shad), Centrarchidae species such as Bluegill, and White Perch. Clupeid species are primarily schooling species and broadcast spawners during spring months. Centrarchid species present near NAPS consist of nest builders. The eggs and yolk-sac larvae of Centrarchid species are usually contained within the nest area, but post yolk-sac larvae and early stage juveniles may be vulnerable to entrainment during the period when they are moving from the nest or spawning areas in search of nursery habitat. This is supported by the collection of sunfish larvae in the recent entrainment study and sunfish juveniles and adults in historical impingement studies, and their continued abundance in Lake Anna.

4.4.2 Larval Recruitment

Peak larval recruitment for most Lake Anna fish would be expected to occur during the spawning season of the fish, after eggs hatch. For Lake Anna, this generally occurs between April and July. As a result, peak larval fish entrainment would be expected to occur during the same period. The two-year entrainment study recently conducted at NAPS provides relevant information on peak larval recruitment. Based on two years of entrainment data, peak entrainment densities occurred in May, June, and July and were attributed primarily to post yolk sac larval Clupeid species (Herrings and Shad) (HDR 2018). Lower densities of Clupeids extended to include April and August. Sunfish Species (*Lepomis* spp.) and Bluegill post yolk sac larvae occurred primarily during the summer months from June to August. Low densities of

White Perch and Yellow Perch yolk sac and post yolk sac larvae occurred in early spring months of March and April.

4.4.3 Period of Peak Abundance for Relevant Taxa

Fish spawning is a direct function of water temperature, constraining most activity to the spring and early summer months. This results in the influx of larval and juvenile fishes into Lake Anna each year when water temperatures begin to rise. Peak abundance for most early life stage and juvenile fishes, in the vicinity of NAPS, occurs between April and July depending on each species' unique spawning habits.

In Dominion Energy's 2016–2017 entrainment study results, depth-averaged entrainment densities were highest during spring to summer months from April and extending to August (Figure 4-1). In general, the two years of sampling exhibited similar trends for finfish entrainment, with the highest depth-averaged entrainment densities in May, June and July of both years. These peak densities were attributed primarily to post yolk sac larval Herrings and Shad (May to July), Common Sunfishes (June and July, extending into August of the first year of sampling), and Threadfin/Gizzard Shad (May to July of second year of sampling). The lowest depth-averaged monthly densities generally occurred during early spring (March and April) and September. White Perch contributed to the early spring densities (April) primarily during the first year of sampling. The Herrings taxa group includes Threadfin Shad and Gizzard Shad and Blueback Herring that have been identified to different taxonomic levels. Analysis of diel densities indicates entrainment densities were higher at night in near-bottom samples, and lowest in early morning in near-surface samples.

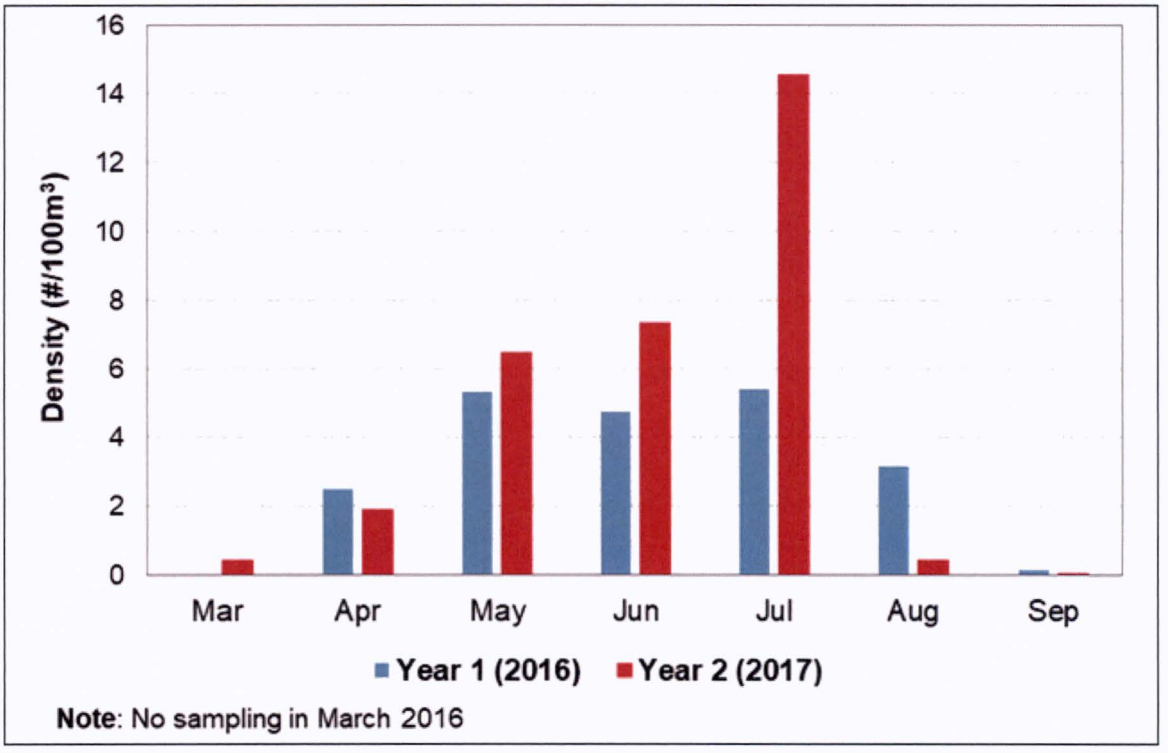


Figure 4-1. Depth-averaged Total Entrainment Density (#/100 m^3) for All Finfish Life Stage Combined at North Anna Power Station, 2016-2017

4.5 Data Representative of Seasonal and Daily Activities of Organisms in the Vicinity of CWIS [§122.21(r)(4)(v)]

The typical habitat preferred by littoral zone species includes vegetated areas, submerged woody debris (roots, logs), boulders, rocks, and artificial structure such as docks and piers. Pelagic species, such as clupeids, form large schools in mid-water column in the open water. Some predators (i.e., Largemouth Bass) are found to utilize both the littoral and pelagic zones (Matthias et al. 2014).

Daily migrations, such as diel vertical migration (or water column migration), are typical for fish species that inhabit lacustrine environments. During a daily cycle, zooplankton and fish exhibit synchronized movements up and down in the water column (Brierley 2014). Diel vertical migration in freshwater fish is primarily triggered by the diel change in light intensity. Declining light at dusk triggers the ascent to the surface, and increasing light at dawn triggers the return to deeper water (Mehner 2012). This is the typical pattern for many species; however, reverse migration can also occur. Additional triggers for vertical migration include hydrostatic pressure and water temperature, which may guide fish into particular limnological zones at night, particularly during the season of stratification (Mehner 2012). Pelagic (open water) organisms use diel vertical migration to balance the competing objectives of growing quickly and minimizing predation risk. Most fish species that perform diel vertical migration are planktivorous, require cold or cool water, and live primarily in the pelagic zone of thermally-stratified lakes (Mehner 2012).

In Lake Anna, diel vertical migration can be considered characteristic of many freshwater fish species, particularly during larval or juvenile life stages, or species that are small in adulthood. Based on the results of the recent entrainment study conducted at NAPS (HDR 2018), entrainment densities were highest at night and early morning in near-bottom samples and highest during daylight hours in mid-depth samples, suggesting organisms are moving from the bottom during nighttime to mid-depths during daylight. Densities were lowest overall in near-surface samples

Variation in seasonal behavior is primarily associated with spawning activities. Most species undergo short or local migrations for spawning and/or overwintering, such as pelagic species moving to the shoreline, or crappie species moving upstream (Rohde et al. 2009). White Perch and Yellow Perch may undergo short or local migrations for spawning and/or overwintering. Based on the recent entrainment study conducted at NAPS (HDR 2018), early life stage finfish densities were highest during spring months (April, May, and June). This can be attributed to spawning activities of the major taxa, specifically fish in the Clupeidae family, in the spring, followed by early spring spawning by White Perch and Yellow Perch, and summer spawning activities for sunfish species during summer months of June, July, and August.

Information on the most recent impingement study conducted at NAPS (EA 2007) indicates that impingement rates were dramatically higher at night and early morning hours compared to day time hours. Additionally, approximately three quarters of the fish were collected during summer and fall months, June through October, and the lowest numbers during the winter months of December to March (EA 2007).

Information from recent quarterly gill net sampling (Dominion 2017) demonstrates higher collections during spring and fall sampling, most notably for Channel Catfish, White Perch, and shad species (Gizzard Shad and Threadfin Shad) in the month of May and White Perch and shad species in the fall. Electrofishing results demonstrate higher numbers of Bluegill, and to a lesser degree Gizzard Shad, Largemouth Bass, Redear Sunfish, Redbreast Sunfish, Green Sunfish, and Warmouth in March and November.

Information on seasonal and daily activities for species that may be present in the vicinity of NAPS and assessed as having potential to be impinged or entrained is summarized in Table 4-4.

Table 4-4. Seasonal and Daily Activities of Organisms in the Vicinity of the North Anna Power Station Cooling Water Intake Structure

Family	Common Name	Scientific Name	Seasonal Activities / Spawning Migration	Daily Activities / Migration / Habitat
Catfish	Channel Catfish	*Ictalurus punctatus*	Move into shallows or tributaries to spawn. Begin spawning when water temperatures reach 70°F (21°C). They use natural cavities, undercut banks and as nests.	Prefer areas with deep water, clean gravel or boulder substrates, and low to moderate current. Tendency to move toward shallow waters at dusk where they feed.
	White Catfish	*Amelurus catus*	Spawning occurs May into July when water temperature reaches 70°F (21°C). Nesting is in depressions and natural cavities similar to other bullheads. Both sexes participate in the preparation of the nest, which is a fairly large depression scoured out over sand or gravel. Eggs are guarded and kept clean by one or both parents.	Found in a variety of habitats from warm ponds and lakes, medium to large rivers, and sometimes small streams. They avoid deep swift channels that are favored by Channel Catfish and are most abundant in slow moving currents and dead end sloughs.
Herring	Blueback Herring	*Alosa aestivalis*	Spawning occurs in spring or early summer. Optimal spawning temperature range appears to be 70 to 77°F (21 to 25°C). Spawning activity is highest from late afternoon into evening when a female and two or more males swim in circles increasing their speed to a point when they dive to the bottom and the gametes are released. The eggs are adhesive but become detached after the water hardening period.	Diel vertical migrations, moving downward during daylight along with the zooplankton. Landlocked populations move inshore at night to feed
	Gizzard Shad	*Dorosoma cepedianum*	Gizzard Shad are prolific spawners from March through August. Spawning begins at night in shallow water when they gather in large schools to broadcast their adhesive eggs over bottom substrates.	Inhabits slow moving or standing waters where they school in shoreline and open water areas. It is relatively tolerant of turbidity, as long as its prey is plentiful. May become lethargic or moribund when water temperatures drop below 59°F (15°C).
	Threadfin Shad	*Dorosoma petenense*	Migrate to areas of submerged objects such as rocks or logs in May or June where they broadcast spawn eggs in shallow water	Groups of Threadfin Shad apparently synchronize their spawning closely, releasing gametes simultaneously for a short time in the early morning. It is hypothesized that such early morning spawning reduces predation pressure, while synchronous gamete release increases the incidence of successful fertilizations.
Minnow	Golden Shiner	*Notemigonus crysoleucas*	Golden Shiners spawn from April to October when water temperatures reach the high 60s°F (18-21°C). Golden Shiners spawn over a wide variety of materials, including sand, gravel, and aquatic vegetation. They will spawn over the nest of a sunfish and leave behind their eggs to be guarded by the male. Eggs are adhesive.	This species prefers clean, clear water with an abundance of aquatic vegetation. They are common in slow moving streams, wetlands, and lakes.
	Spottail Shiner	*Notropis hudsonius*	Spawns in spring or early summer. Spawns in aggregations over areas of gravelly riffles near mouths of brooks, or along sandy shoals of lakeshores. May migrate up tributary streams to spawn.	Found in shallow water in large sluggish coastal rivers and brackish water to small clear rapidly flowing montane streams. Omnivorous.

Family	Common Name	Scientific Name	Seasonal Activities / Spawning Migration	Daily Activities / Migration / Habitat
Perch	Yellow Perch	*Perca flavescens*	Run in schools up tributaries to spawn in early spring, from February to April when water temperatures reach 45 to 50°F (7 2 to 10°C). Occurs in water 5 to 10 feet (1.5 to 3 meters) deep and over sand, gravel, rubble, or vegetation. Eggs are laid in gelatinous bands draped over logs or vegetation.	Found mainly in piedmont and coastal plain waters, where they thrive in tidal rivers and streams, extending into brackish water. Adults occupy deeper waters than juveniles Yellow Perch young primarily feed on insect larvae and microcrustaceans, while larger adults prefer crayfish and fishes. Feel most actively during the day and often rest motionless at night.
	Darters	*Etheostoma* spp.	Based on information for only darter species identified in ambient fish sampling, the Tessellated Darter (*E. olmstedi*), spawning occurs spring and early summer when male fans away sand to prepare a nest under a flat rock, stick. Log, or other cover where eggs are deposited. No parental care after hatching in about one week.	Inhabit sand and mud-bottomed pools of headwaters, creeks, small to medium-sized rivers, and shores of lakes.
Sunfish	Black Crappie	*Pomoxis nigromaculatus*	Spawning occurs in the spring and early summer Males build nests in shallow protected waters near shoreline and vegetation. Hatchlings stay in the nest protected by males for several days before moving into shallow areas of cover.	Feed early in the morning and habitat includes lakes, reservoirs, and pools in large rivers. In rivers they prefer areas with little to no current and abundant cover.
	Bluegill	*Lepomis macrochirus*	Bluegills spawn multiple times between May and August and typically build nests in large groups, or colonies Peak spawning usually occurs in June. Males select an area in one to four feet of water and sweep out a saucer shaped nest with their tails.	Tolerant of many conditions, natural habitats are pools of creeks and rivers, swamps, oxbow lakes, ponds, and vegetated shores of impoundments. Also found in man-made lakes, ponds, and retention basins.
	Green Sunfish	*Lepomis cyanellus*	Green sunfish are communal spawners with males constructing nests in shallow water from mid-May to August. Green sunfish tend to spawn in shallower water, and dig deeper nests than bluegill. Once hatched, larvae and fry stay close to the nest in shallow waters for protection.	This species is very tolerant of poor water quality and are often the only sunfish found in very muddy waters. They do have a strong preference to hide around structures such as rocks, logs, or brush piles.
	Redear Sunfish	*Lepomis microlophus*	Like most other sunfish, they are communal nest spawners and are often built near aquatic vegetation. Spawning normally occurs in May or June but may extend throughout the warm season.	Redear sunfish prefer clear waters with more rooted aquatic vegetation than that of the Bluegill Redear Sunfish inhabit ponds, lakes, and slow streams and is usually associated with aquatic vegetation.
	Redbreast Sunfish	*Lepomis auritas*	Spawn from April to June on a sand bottom, often after an upstream migration. It builds a nest similar to that of the Bluegill, but nests are in smaller groups and further apart The nest is located near shelter, such as stumps and logs	Found primarily in running water in streams from mountain foothills to the coast.

Family	Common Name	Scientific Name	Seasonal Activities / Spawning Migration	Daily Activities / Migration / Habitat
	Pumpkinseed	*Lepomis gibbosus*	Spawning occurs early May to early July in water 64.4 to 73.9°F (18 to 23.3°C).Males build nests in shallow areas by making a hole in sand or gravel. Pumpkinseeds often build nests in colonies. Once hatched, fry swim into the shallows with aquatic vegetation for cover.	Prefers quiet, slow-moving freshwater habitat with vegetation and sandy, muddy or gravel bottom. Usually stays close to the shoreline; will school in deeper river channels in winter.
	Warmouth	*Lepomis gulosus*	Spawning occurs from May through July. Warmouth do not spawn in colonies like other sunfish species. Males fan out a nest, usually near a rock, stump, clump of vegetation, or other large object. The male guards the eggs and young until they disperse from the nest.	Warmouth are typically found in clear shallow waters with dense rooted aquatic vegetation and often hide in cover such as stumps, brush, or vegetation. They feed on crayfish, large aquatic insect larvae, and small fish.
	Largemouth Bass	*Micropterus salmoides*	Largemouth bass usually spawn between mid-April and mid-June. Nests are constructed by the male in 1 to 6 feet of water. Males guard the nest. Larvae and fry remain in cover.	Largemouth bass can adapt to many environments but prefer relatively clear non-flowing waters with some aquatic vegetation.
Temperate Bass	White Perch	*Morone americana*	White perch spawn in tributaries of larger water bodies in April and May. They release their adhesive eggs randomly into shallow water.	Inhabit brackish tidal rivers and streams and freshwater impoundments of formerly tidal waters During most of the year this species is found in shallow and moderate depths; it occupies deep water in winter. They are schooling fish, tending to spend daylight hours in deep water, moving into the shallows at dusk to feed.

Source: MD DNR 2018, Froese and Pauly 2018, NatureServe 2017.

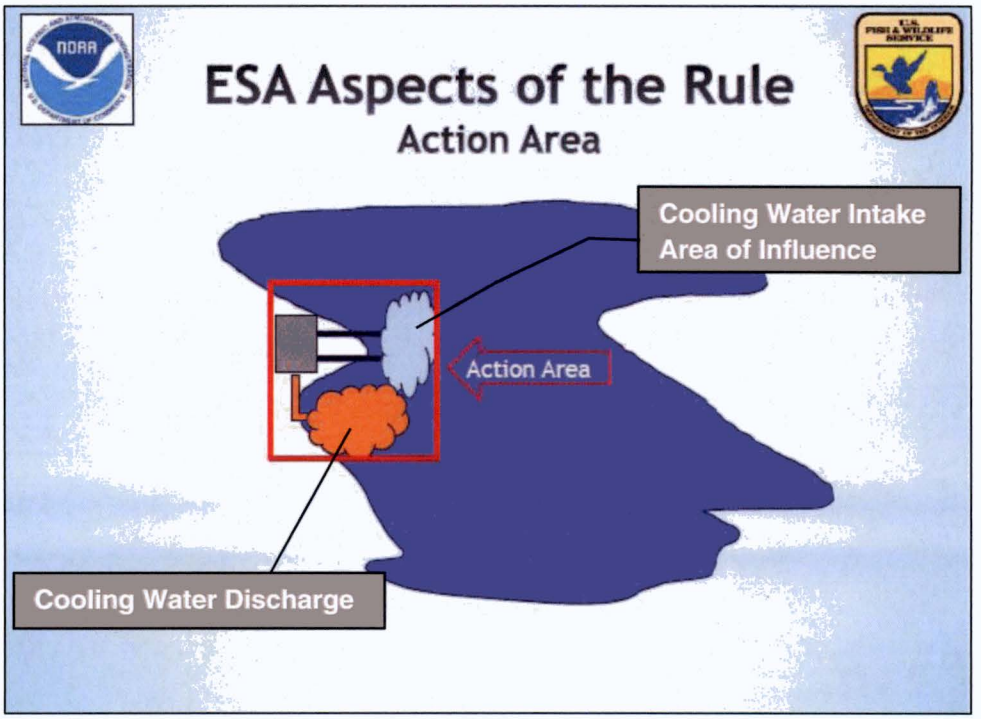
4.6 Identification of Threatened, Endangered, and Other Protected Species Susceptible to Impingement and Entrainment at CWIS [§122.21(r)(4)(vi)]

The Rule requires the permittee to document the presence of federally listed species and designated critical habitat in the Action Area (see 40 CFR 125.95[f]). The USEPA consulted with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) (or together, the Services) under the Endangered Species Act (ESA) during development of the existing facilities §316(b) Rule and 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 (USFWS and NMFS 2014). 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). This section provides a review of listed species associated with NAPS.

The Rule states that the Action Area can "generally be considered the area in the vicinity of impingement and entrainment at the cooling water intake structure" (79 Federal Register 48363) (e.g., an area analogous to the zone of hydraulic influence of the intake structure). Under the ESA, the Action Area is defined more expansively, and in their Biological Opinion on the Rule (USFWS and NMFS 2014), the Services included areas indirectly affected by the CWIS. This document will use the Services' broader definition as the Action Area to identify the full set of federally listed species that might be directly or indirectly affected by the CWIS, the cooled water discharge from the WHTF at Dike 3 near the North Anna Dam, CWIS AOI, and the power station footprint/property boundary. This is consistent with the Action Area defined by Services' representatives at a §316(b)-focused conference held in 2014 (Figure 4-2; Tortorici and Ashfield 2014).

Based on the Services' guidance, the Action Area is defined as all areas potentially directly or indirectly affected by the NAPS CWIS, and the CWIS AOI, the cooling water discharge and the facilities upland boundaries. These are described in the following paragraphs.

The CWIS AOI has been calculated as a conservative zone of hydraulic influence (i.e., it errs on the side of overestimating the size of the AOI) and is used to define the Action Area but not necessarily the area of direct impacts on fish. Fish can occur in the AOI and avoid the CWIS or not be withdrawn by the facility. The AOI is calculated based on conservative assumptions including that ambient velocity is zero and low water depth, and thus represents the maximum areal extent associated with the evaluated thresholds velocities described below. Based on these conservative calculations, the impingement AOI can be represented as a quarter circle area with a radius of 211 feet originating at the center of the CWIS (see Section 2.2.3). The entrainment AOI of non-motile and limited mobility life stages such as eggs and larvae is represented as a quarter circle area ranging from 351-foot to 1,054-foot radius originating at the center of the CWIS (see Section 2.2.3).



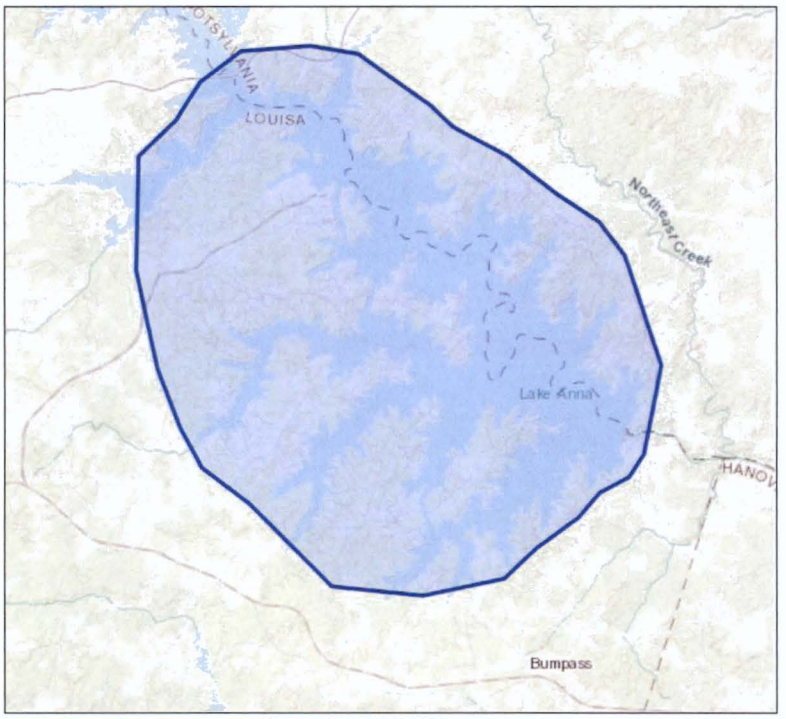
Source: Tortorici and Ashfield 2014

Figure 4-2. Service-Defined Action Area

The AOI provided above does not represent an area of potential direct impact, but a conservative estimate of the potential area of hydraulic influence of the NAPS CWIS. The AOI is included in a conservative definition of the Action Area according to the Services' approach (Tortorici and Ashfield 2014). However, AOI relevance does not extend beyond this aspect of the areal extent of the Action Area.

The cooled water is discharged from the third cooling facility to a point approximately one mile upstream of the North Anna Dam. The NAPS upland boundary includes a radius of 5,000 feet from the abandoned Unit 3 containment structure (Dominion 2015).

Virginia Department of Game and Inland Fisheries (VDGIF) recommends a default listed species search area of a circle with a two-mile radius centered at the point of action (VDGIF undated). However, a conservative search area was used that exceeds that default recommendation and exceeds the Action Area. The VDGIF Virginia Fish and Wildlife Information System (VAFWIS) and the USFWS Information, Planning, and Consultation (IPAC) database search areas presented in Figures 4-3 and 4-4, respectively, were selected as representative of the Action Area for purposes of conducting the species search. The conservative search areas encompass the AOI, cooled water discharge from the WHTF and the NAPS property boundaries. In order to encompass these areas, the search radius was expanded from the two-mile search radius recommended by VDGIF.



Source: USFWS 2018b

Figure 4-3. Information for Planning and Conservation Database Search Area



Source: VDGIF 2018

Figure 4-4. Virginia Fish and Wildlife Information System Database Search Area

To develop a list of federally listed species and critical habitat under USFWS jurisdiction that are known or likely to occur within the Action Area of the NAPS CWIS, the IPAC System was consulted on June 7, 2018 (USFWS 2018b; see Appendix D and Table 4-5). Because of the NAPS location in freshwater, marine and anadromous federally listed species under NMFS jurisdiction were eliminated.

The VAFWIS database was consulted on April 12, 2018 (VDGIF 2018) to determine the state-listed species that have the potential to occur in the Action Area (Appendix D and Table 4-5). Note that only federal and state threatened and endangered species were included in Table 4-5. Federal species of concern and candidate species (i.e., plants and animals for which USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities; these species receive no statutory protection under the ESA [USFWS 2017]) were omitted from the list (unless they were also listed as state threatened or endangered), because there are no requirements to address those species under the Section 316(b) rule or Section 7 of the ESA.

A review of the following resources was used to develop the species list in Table 4-5:

- VAFWIS (http://vafwis.org/fwis/) (VDGIF 2018)
- IPAC (http://ecos.fws.gov/ipac/) (USFWS 2018b)
- Biological Assessment of the North Anna Early Site Permit (ESP) Application (NRC 2005)
- A Survey for the Discovery of Freshwater Mussel Populations in Lake Anna, Louisa County and Hanover County, Virginia, (Dominion 2009)
- Letter of concurrence from Mr. John Wolflin, USFWS, to Mr. Pao-Tsin Kuo, Nuclear Regulatory Commission, that ESP Activities would not impact Dwarf Wedgemussel (*Alasmidonta heterodon*), May 20, 2005 (USFWS 2005).
- Supplemental Environmental Impact Statement for the Combined License for NAPS Unit 3 (NRC 2010)
- Draft Supplemental Information to the Biological Assessment NAPS Combined License Application (NRC 2013)

The majority of the species listed in Table 4-5 are terrestrial species and would not be subject to potential entrainment or impingement at the facility. The IPAC query indicated that the only federally listed aquatic species with the potential to occur in Lake Anna area is the Dwarf Wedgemussel. The VAFWIS query indicated that the only aquatic state-listed species with the potential to occur there is the Green Floater; however, results of a desktop review of prior evaluations indicate that these species do not occur in Lake Anna or the WHTF. The VAFWIS indicated that the federally proposed Yellow Lance (*Elliptio lanceolata*) has the potential to occur within the Action Area; however, this species was excluded from Table 4-5 because it was not included in the IPAC list and because it was not collected during the 2008 mussel survey of Lake Anna (Dominion 2009).

Table 4-5. Federal- and State-Threatened and Endangered with the Potential to Occur within the North Anna Action Area

Common Name	Scientific Name	Status*	Tier**	Potential to Occur in the Action Area	Potential for Impacts
INVERTEBRATES					
Dwarf Wedgemussel[a,b]	*Alasmodonta heterodon*	FE, SE	II	No. Pre- and post-impoundment surveys and more recent site-specific surveys did not identify this species.	No potential for impingement or entrainment impacts
Green Floater[a]	*Lasmigona subviridis*	ST	II	No. Pre- and post-impoundment surveys and more recent site-specific surveys did not identify this species; no nexus with the CWIS or thermal discharge.	No potential for impingement or entrainment impacts
BIRDS					
Loggerhead Shrike[a]	*Lanius ludovicianus*	ST	I	No nexus with the CWIS or thermal discharge; suitable habitat includes short grasses and forbs interspersed with perching locations for hunting and shrubs/small trees for nesting.	Limited to upland projects[1]
Migrant Loggerhead Shrike[a]	*Lanius ludovicianus migrans*	ST		No nexus with the CWIS or thermal discharge; suitable habitat includes short grasses and forbs interspersed with perching locations for hunting and shrubs/small trees for nesting.	Limited to upland projects[1]
MAMMALS					
Northern Long-eared Bat[a,b]	*Myotis septentrionalis*	FT	I	No nexus with the CWIS or thermal discharge; this species primarily flies through the understory of forested areas feeding on invertebrates.	Limited to upland projects[1]
Tri-colored Bat	*Perimyotis subflavus*	SE	I	No nexus with the CWIS or thermal discharge; terrestrial species that hibernates in caves, and feeds on insects at tree tops.	Limited to upland projects[1]

Common Name	Scientific Name	Status*	Tier**	Potential to Occur in the Action Area	Potential for Impacts
Little Brown Bat	*Myotis lucifugus*	SE	I	No nexus with the CWIS or thermal discharge. This is a terrestrial species that hibernates in caves, navigates migration, sometimes using waterways and highways and feeds on insects such as mosquitoes and moths.	Limited to upland projects[1]

Status*	**Tier****
FE = Federally Endangered	I = VA Wildlife Action Plan - Tier I – Critical Conservation Need
SE = State Endangered	II = VA Wildlife Action Plan - Tier II –Very High Conservation Need
FT = Federally Threatened	
ST = State Threatened	
FS = Federal Species of Concern	

Source: [a]VDGIF 2018, [b]USFWS 2018b

Note: [1]While not associated with the NAPS CWIS, land clearing associated with construction and maintenance has the potential to impact this species and its habitat if present in the Action Area.

The Dwarf Wedgemussel has historically ranged in distribution in Atlantic slope drainages from New Brunswick, Canada, through North Carolina. It has been documented in a variety of habitats, including small creeks and deep rivers in stable substrates that range from mixed sand, pebble and gravel, to clay and silty sand (USFWS 2007). Master (1986 as cited in Michaelson and Neves 1995) indicated that Dwarf Wedgemussels are absent from impoundments. Nedeau (2009) also noted the Dwarf Wedgemussel did not occur in lake habitats, though it has been observed in Vermont and New Hampshire in the upper end of run-of-river reservoirs where residual river velocities remain relatively strong.

USFWS (2007) indicates that the Dwarf Wedgemussel occurred in 70 sites at 15 major drainages. In Virginia, these drainages include the Middle Potomac River in Stafford County (Aquia Creek), the York River in Louisa (South Anna River) and Spotsylvania (Po River) counties, and Chowan River in Sussex, Nottoway, and Lunenburg counties (Nottoway River) (USFWS 2007). While part of the York River watershed, the South Anna River and Po River are in different subwatersheds than Lake Anna. The South Anna River is a tributary of the Pamunkey River downstream of Lake Anna (i.e., the confluence of the North Anna and South Anna rivers forms the Pamunkey River downstream of Lake Anna). The Po River is a tributary of the Mattaponi River, which enters the York River downstream of Lake Anna.

The Green Floater (*Lasmigona subviridis*) is a state-threatened species, currently under review for listing under the ESA, which has been collected from the York River Watershed upstream of the NAPS CWIS in Lake Anna, including in the North Anna River – Mountain Run, Hickory Creek, and North Anna River-Lake Anna-Christopher Creek watersheds (VDGIF 2018). 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 are not known, but the species has been reported as a long-term brooder (Terwilliger 1991). The Green Floater is also 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).

Mussel surveys were conducted in 1972–1973, 1991, and 2004–2005 in the North Anna (downstream and upstream of Lake Anna), South Anna, and Pamunkey rivers (Lees 2005). The Dwarf Wedgemussel was present at two South Anna sites in 1973, but was not encountered in the 1991[12] and 2004–2005 surveys; nor was it encountered during other, less extensive surveys that evaluated some of the same sites between 1991 and 2002 (Lees 2005). The Green Floater was present at two of the South Anna sites in 1973, as well as a Middle Pamunkey site, but was not encountered in the 1991 and 2004–2005 surveys (Lees 2005). NRC (2010) also notes that the Dwarf Wedgemussel and Green Floater were not observed in the North Anna River in pre-impoundment surveys.

[12] Not all sites were surveyed in 1991. One of the two sites where Dwarf Wedgemussel and Green Floater was observed in 1973 was surveyed in 1991. Both sites where Dwarf Wedgemussel was initially observed in 1973 were surveyed in 2004–2005.

Dominion Energy conducted a site-specific survey in 2008 at 22 sites on Lake Anna Reservoir (located at upper, mid, lower, and Paumunkey Arm zones) and at the WHTF (in each of the three facilities) (Dominion 2009). Three species of freshwater mussels were observed: Eastern Floater (*Pyganodon cataracta*), Eastern Elliptio (*Elliptio complanata*), and Pond Papershell (*Utterbackia imbecilis*) (Dominion 2009). No Dwarf Wedgemussels or Green Floaters were found during these surveys.

Based on the evidence provided, Dwarf Wedgemussel and Green Floater do not occur within the NAPS Action Area. USFWS supported this determination for Dwarf Wedgemussel and Green Floater in the 2005 letter of concurrence (USFWS 2005), stating:

> "There are no federal or state-listed species that potentially occur within the action area, therefore were will be no further discussion on species descriptions or potential impacts to listed-species."

Additional listed species are noted for potential occurrence in the Action Area, but most are terrestrial with no nexus with the CWIS. Based on site-specific surveys, the two listed aquatic species do not occur in the Action Area. USFWS has documented agreement with the conclusion that no federal- or state-listed species occur in the Action Area (USFWS 2005).

4.7 Documentation of Consultation with Services [§122.21(r)(4)(vii)]

U.S. Nuclear Regulatory Commission (NRC) has initiated ESA Section 7 consultation for several actions related to the construction and operation of a third nuclear power plant (Unit 3) at NAPS; these are summarized in Table 4-6.

Table 4-6. Summary of U.S. Nuclear Regulatory Commission's ESA Section 7 Consultations with USFWS Related to Construction and Operation of North Anna Power Station Unit 3

Date Initiated	Purpose	Species	Effect Determination	Outcome
January 2005	North Anna Early Site Permit (ESP) Application	Dwarf Wedgemussel	No effect	USFWS concurrence with no effect determinations on May 20, 2005.
		Bald Eagle	No effect	
		Sensitive Joint-Vetch*	No effect	
		Small Whorled Pogonia	No effect	
		Swamp Pink	No effect	
November 2013	North Anna 3 Combined License (COL) Application (Consulting on Draft Supplemental Biological Assessment (BA) - updated for events following the Early Site Permit BA in 2005)	Dwarf Wedgemussel	No effect	During the course of the review, identified need to consider Northern Long-Eared Bat (NRC 2013). Led to the final BA (NRC 2016b).
		James Spinymussel	No effect	
		Sensitive Joint-Vetch	No effect	
		Small Whorled Pogonia	No effect	
		Swamp Pink	No effect	
December 2016	North Anna 3 COL Application (Consulting on Final Supplemental BA)	Dwarf Wedgemussel	No effect	USFWS concurrence with Supplemental BA February 22, 2017, no further comments (USFWS 2017)
		James Spinymussel	No effect	
		Sensitive Joint-Vetch	May affect, not likely to adversely affect*	
		Small Whorled Pogonia	No effect	
		Swamp Pink	No effect	
		Northern Long-Eared Bat	May affect, not likely to adversely affect**	

* The Sensitive Joint-Vetch inhabits tidal river systems - only part of the Unit consultations because of the Walkerton roll-off facility on the Mattaponi River.
** No Northern Long-Eared Bats were identified during focused surveys of forested areas that would be disturbed during construction of Unit 3.

4.8 Methods and QA Procedures for Field Efforts [§122.21(r)(4)(viii)]

Methods and quality assurance (QA) procedures for the biological baseline characterization data referenced in Section 4 are documented in each of the relevant reports.

4.9 Definition of Source Water Baseline Biological Characterization Data [§122.21(r)(4)(ix)]

Data were provided to address §122.21(r)(4)(i) – (viii) and (x) – (xii), and there is no required submittal under subsection §122.21(r)(4)(ix).

4.10 Identification of Protective Measures and Stabilization Activities [§122.21(r)(4)(x)]

Fish stocking and enhancement activities have occurred since the initial construction of Lake Anna with the intent of providing a stable recreational fish community. Initially Largemouth Bass, Bluegill, Redear Sunfish and Channel Catfish were stocked in 1972 followed by stockings of Walleye and Striped Bass. Threadfin Shad and Blueback Herring were successfully introduced in the 1980s. Most recently, one-time stockings of hybrid Striped Bass and saugeye (hatchery cross between male Sauger and female Walleye) were made in 2014 and 2013, respectively. To further enhance fish populations, artificial structures or 'fishing reefs' have been installed in the lake. The VDGIF regularly assesses the fish populations in Lake Anna, and considers these data in regular reviews of recreational fishing regulations applicable to Lake Anna. Commercial fishing is not allowed on Lake Anna.

4.11 List of Fragile Species [§122.21(r)(4)(xi)]

In the Rule, USEPA identifies 14 species (§125.92(m)) as fragile or having post-impingement survival rates of less than 30 percent, including:

- Alewife
- American Shad
- Atlantic Herring
- Bay Anchovy
- Blueback Herring
- Bluefish
- Butterfish
- Gizzard Shad
- Grey Snapper
- Hickory Shad
- Menhaden
- Rainbow Smelt

- Round Herring
- Silver Anchovy

Based on recent studies, two species from the fragile species list are found in Lake Anna, comprising Blueback Herring and Gizzard Shad. Additionally, Threadfin Shad, a closely related species to Gizzard Shad, is likely to have similar survival rates.

4.12 Information Submitted to Obtain Incidental Take Exemption or Authorization from Services [§122.21(r)(4)(xii)]

NAPS is not believed to have any impacts on federally listed species. For this reason Dominion Energy has not sought or obtained an incidental take exemption or authorization for its CWIS from the USFWS.

5 Cooling Water System Data [§122.21(r)(5)]

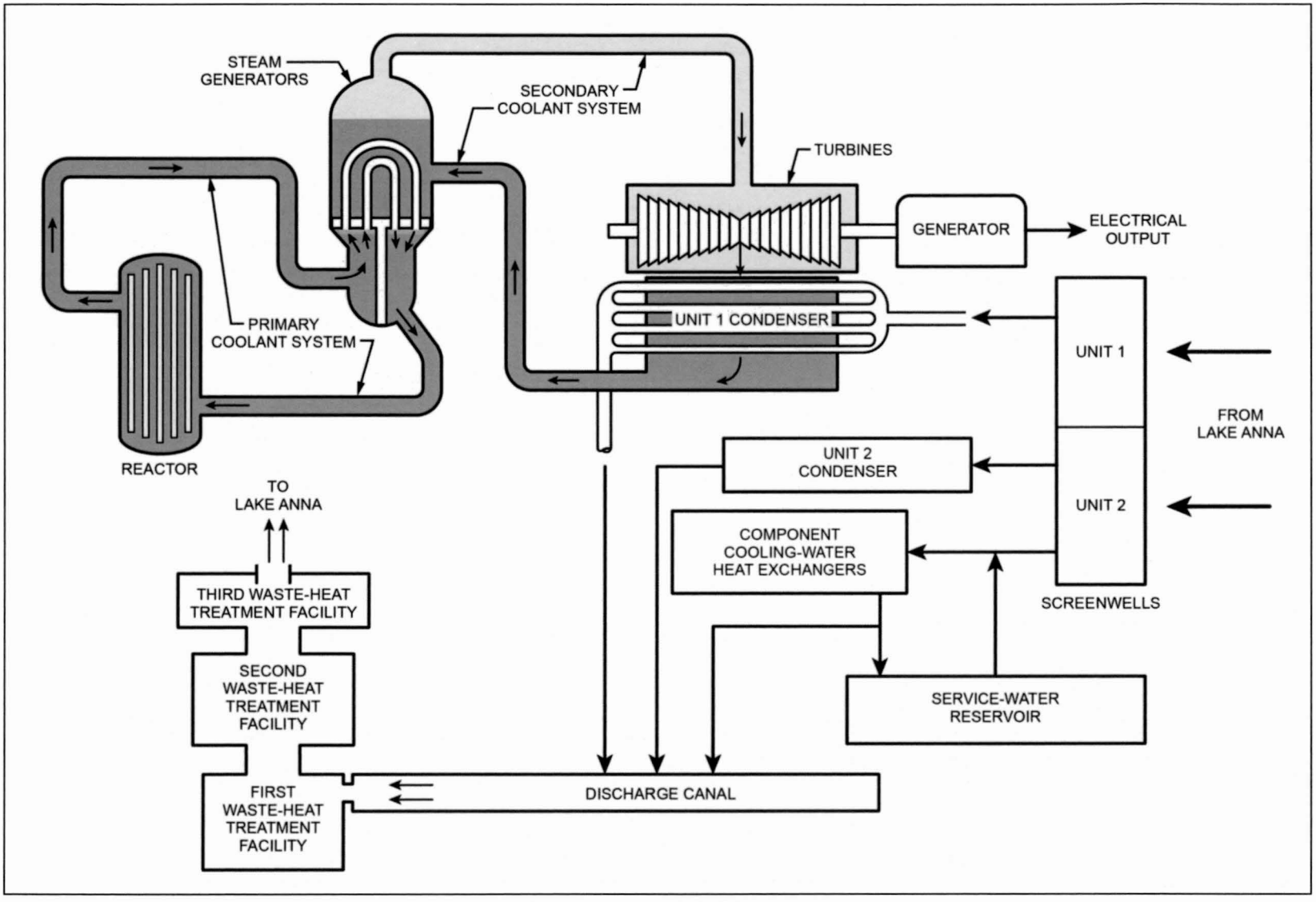
5.1 Description of Cooling Water System Operation [§122.21(r)(5)(i)]

Make-up water to the NAPS cooling water system is obtained from the North Anna River, which was impounded specifically for the purpose of creating the CCRS that provides a source of cooling water and waste heat treatment for NAPS. Lake Anna covers a surface area of 13,000 acres and contains approximately 100 billion gallons of water. The larger portion of the lake consists of approximately 9,600 acres and functions as a storage impoundment to ensure adequate water for condenser cooling. The smaller portion of Lake Anna, the WHTF, has an area of about 3,400 acres and is separated from the larger portion of the lake by dikes. The first of the WHTF's three cooling facilities receives the heated condenser cooling water after its passage through the units. The heated water transfers most of its heat to the atmosphere as it moves (via canals) to the second and third cooling facilities. The cooled water is discharged from the third cooling facility to the North Anna Reservoir at a point immediately upstream of the dam.

5.1.1 Operation of Cooling Water System

Figure 5-1 presents a diagram of steam-electric and waste-heat-dissipation system at NAPS. During generator operation, the heat generated in each reactor is transferred through the primary-coolant system to the steam generators. Unit 1 and 2 each has three separate closed-cycle loops with one turbine-generator per loop. The steam generators transfer the heat from the primary-coolant system to produce steam at a constant pressure in the secondary system. This steam is transferred through the closed-cycle secondary loops to the steam turbines, which drive the generators to produce electricity. After passing though the turbines, the spent steam is condensed and returned to the secondary sides of the steam generators to repeat the cycle (NRC 2016a).

Circulating water is withdrawn from the North Anna Reservoir at the screenwell near the station and, from there, is pumped through the condenser and discharged through circulating water discharge tunnels into the circulating water discharge canal, which terminates at the head of the WHTF (see Figure 2-2 in Section 2.1.1). The circulating water then flows through sections of the WHTF and through interconnecting canals to the easternmost dike. This dike contains the circulating water outlet works, which are essentially low-level outlets designed to cause the effluent from the WHTF to thoroughly mix with the residual water in the North Anna Reservoir. The WHTF outlet has a skimmer wall structure designed to cause the WHTF discharge to enter Lake Anna as a submerged jet having an initial velocity of about eight fps. The top of the outlet is submerged at least 10 feet below the minimum lake level.



Source: Modified VEPCO 1985

Figure 5-1. Diagram of Steam-electric and Waste-heat-dissipation System at North Anna Power Station

Discharge from the WHTF to the Lake Anna is permitted as Outfall 001 in the station's VPDES Permit (VA0052451). While flowing through the WHTF, the circulating water loses a large portion of its heat to the atmosphere. During this process, water is also lost to the system through evaporation. The evaporative loss resulting from the heat added by the station is termed forced evaporation. The forced evaporative losses to the system are replaced by make-up water from the North Anna River. Further temperature reduction is achieved as the circulating water is mixed with water from the larger segment of Lake Anna.

The WHTF and North Anna Reservoir were originally sized to transfer the heat loading produced by a four-unit power station having a full-load heat rejection rate of 28 × 109 British Thermal Units (BTU) per hour. NAPS currently operates under a §316(a) thermal variance and a heat rejection limit of 13.54 x 10^9 BTU/hr for the two existing units. Four dikes and three canals are required to form and interconnect the three cooling facilities of the WHTF (Figure 2-2).

Hydraulic losses of circulating water as it flows through the canals and the circulating water outlet cause the WHTF elevation to be about 1.5 feet higher at the station discharge than the normal Lake Anna pool level (NRC 2016a).

5.1.2 Temporal Characteristics of Cooling Water System Operation

The generating units at NAPS are base-loaded units and operation of the cooling water system results in cooling water demand and, consequently, operation of circulating water pumps. The cooling water system at NAPS is intended for year-round, 24 hours/day operation, with the exception of down time due to refueling outages. Unit refueling outages are generally scheduled for the winter, late fall, and/or early spring months.

5.1.3 Proportion of Design Flow Used in the Cooling Water System

The proportion of the design flow used in the cooling system was calculated based on monthly average daily intake flows during 2015-2017 (Table 3-3). The 2015-2017 actual intake flows withdrawn from Lake Anna on a monthly basis were compared with the maximum design flow of 2,749.3 MGD (see Table 3-1). The proportion of the maximum design flow used in the cooling system ranged from 30.3 percent to 85.7 percent with an average of 67.2 percent on a monthly basis during 2015-2017.

Table 5-1. Percent (%) of North Anna Power Station Design Flow used In Cooling Water System during 2015-2017

Month	Year			2015-2017 Average
	2015	2016	2017	
January	49.0	50.4	48.3	49.3
February	48.1	48.7	48.7	48.5
March	32.0	30.3	67.3	43.2
April	57.7	56.7	73.7	62.7
May	81.0	80.8	80.7	80.8
June	83.8	81.7	85.0	83.5
July	85.3	83.0	85.7	84.6

August	84.5	81.7	85.3	83.8
September	85.2	56.7	56.9	66.3
October	81.0	63.0	76.2	73.4
November	68.8	76.5	76.7	74.0
December	62.8	49.9	55.0	55.9
Annual Average	**68.3**	**63.3**	**70.0**	**67.2**

5.1.4 Distribution of Water Reuse

NAPS's cooling system is a CCRS as defined at 40 CFR §125.92(c)(2) and, as such, the facility reuses cooling and process water as a part of its configuration and operations. Most of the station's process wastewater discharges mix with the once-through cooling water and the combined flow is then directed to the WHTF (see Figure 3-5). As a result, with the exception of water lost to evaporation and that which passes through the North Anna Dam, all cooling water and process wastewater are cycled back to the facility and reused by NAPS. As noted in Section 2.2.1, the mean annual river flow in the North Anna River at Partlow was 264.8 cfs (171.1 MGD) for the period 1979-2017, which was approximately 9.3 percent of the average withdrawal by NAPS of 1,846.7 MGD for the period 2015-2017 (Section 3.4). While not a direct measure of the amount of recycling that occurs, and not accounting for evaporative losses from the CCRS system, the large difference between the amount of water the North Anna River can provide and the water used by NAPS illustrates the recirculating nature of water reuse.

5.1.5 Description of Reductions in Total Water Withdrawals

NAPS has not made changes to operations resulting in withdrawal reductions in the last three years. This sub-section is not applicable.

5.1.6 Description of Cooling Water Used in Manufacturing Process

NAPS is not a manufacturing facility. This sub-section is not applicable for NAPS.

5.1.7 Proportion of Source Waterbody Withdrawn

The percent of a source waterbody withdrawn for cooling purposes is calculated differently for riverine and lacustrine source waterbodies. For riverine source waterbodies, the calculation is a straightforward comparison of two volumetric rates with shared units:

$$\text{Percent of source waterbody withdrawn (\%)} = DIF / Q_r$$

where, DIF = Design Intake Flow in MGD
Q_r = Mean annual river flow measured in cfs and converted to MGD

For lacustrine source waterbodies, the same comparison cannot be made because the cooling water is a volumetric rate while the source waterbody is a volume. The Rule defines a lake or reservoir as follows[13]:

[13] Federal Register / Vol. 66, No. 243 / Tuesday, December 18, 2001 / Rules and Regulations. pp. 65339

Lake or reservoir means any inland body of open water with some minimum surface area free of rooted vegetation and with an average hydraulic retention time of more than 7 days. Lakes or reservoirs might be natural water bodies or impounded streams, usually fresh, surrounded by land or by land and a man-made retainer (e.g., a dam). Lakes or reservoirs might be fed by rivers, streams, springs, and/or local precipitation. Flow-through reservoirs with an average hydraulic retention time of 7 days or less should be considered a freshwater river or stream.

For these cases, rather than calculate the percent of source waterbody withdrawn which would require an arbitrary time interval for the calculation (e.g., minute, day, week, etc.), the value to be estimated is Cooling Water Retention Time (CWRT). The CWRT is defined as an estimated time required for cooling water that exits the discharge to be drawn in by the intake structure in the recirculation process, assuming it is a completely mixed reservoir, and is calculated as:

$$\text{CWRT in days} = V_L / \text{DIF}$$

where, V_L = Lacustrine source waterbody volume in million gallons (MG)
DIF = Design Intake Flow in MGD

The normal pool of Lake Anna, created by the dam on the North Anna River, is maintained at El. 250 feet msl most of the time; however, during extreme droughts, it is expected that the pool could be drawn down to a lake level before power generation would be impacted.

Lake Anna conservation and active storage volume at El. 250 feet msl is estimated to be 305,000 acre-feet (99,384 MG) (NRC 2016a). The maximum design flow at NAPS is 2,749.3 MGD. NAPS CWRT is calculated conservatively using the conservation pool volume of 305,000 acre-feet as follows:

$$\text{NAPS CWRT} = 99{,}384 \text{ MG} / 2{,}749.3 \text{ MGD} = 36.2 \text{ days}$$

The estimated cooling water retention time is 36.2 days, which means it would take approximately 36.2 days for the entire volume of the reservoir to be circulated through the plant's cooling water intake system.

It should be noted that the above analysis assumes a steady state condition with no inflow to, or releases from, the Lake Anna system. In reality, the NAPS is required by its discharge permit to maintain a minimum release of 40 cfs from the dam, which has been shown to be sufficient to maintain beneficial uses in the North Anna River downstream of the dam while providing a sufficient lake volume to supply the NAPS's water needs and for maintenance of other beneficial uses in Lake Anna. Under drought conditions, NAPS is required to reduce the release from the dam to 20 cfs. The 20 cfs minimum release was established with substantial stakeholder input in order to maintain beneficial uses in the North Anna River downstream of the dam while minimizing the impact to beneficial uses in the lake. Creation of Lake Anna not only provided a source of cooling water to NAPS, but also created an excellent resource for other beneficial uses such as recreational fisheries, flood control, and low stream flow augmentation, which were not possible previously before the creation of the Lake Anna.

5.2 Design and Engineering Calculations [§122.21(r)(5)(ii)]

The engineering calculations of through-screen velocity for the traveling screen design prepared by a qualified professional are provided in Appendix E.

5.3 Description of Existing Impingement and Entrainment Reduction Measures [§122.21(r)(5)(iii)]

NAPS's cooling system and Lake Anna meet the definition of a CCRS as defined in the Rule (see Section 6). Given that the CCRS provisions of the rule were clearly intended to allow continued operation of reservoirs created as CCRS, NAPS CWIS meets BTA Compliance Alternative 1 (§125.94(c)(1)) for impingement mortality reduction.

There are several other operation measures that contribute to reduction in impingement mortality and entrainment at NAPS. The NAPS follows the operating guidelines for circulating water pumps and pump throttling criteria based on condenser pressures and lake temperature, which results in reduction in water withdrawal. This practice provides reductions in water withdrawal and in turn, measurable reduction in impingement mortality and entrainment can be achieved when coupled with pump throttling and larval peak abundance in early spring. Additionally, unit refueling outages are generally scheduled for the winter, late fall, and/or early spring months. Because reduction in entrainment can be assumed to be commensurate with reductions in flow, use of operating guidelines for circulating water pumps, pump throttling and scheduled unit refueling outages at NAPS during periods of peak larval abundance would also reduce entrainment.

The CCRS at NAPS also supports a robust recreational fishery and forage base even though Lake Anna was built for the primary purpose of providing cooling water to support the NAPS needs. The following summarizes a set of observations provided in a summary of VDGIF's 2014 fisheries management report for Lake Anna (Odenkirk 2015). Taken together, the references listed below strongly support that the fishery of Lake Anna is successfully stocked and managed by VDGIF to meet its goals of maintaining a robust recreational fishery and its forage base[14].

- Largemouth Bass abundance, as indicated by electrofishing surveys, and the stock structure of Largemouth Bass were rated as "outstanding". Catch rates for all size classes of Largemouth Bass exceeded those obtained through the period of record (21 years). VDGIF hypothesized the increased abundance of fish may be related to increased lake productivity, stable water levels and consistent recruitment of young fish into the larger size categories. Structural indices were above average, and were likely related to two strong (record) cohorts and the stability of the Largemouth Bass population over time.

[14] Lake Anna successfully supports numerous fishing tournaments for different marinas located on the lake:
- Sturgeon Creek Marina (http://sturgeoncreekmarina.com/tournaments.htm);
- Anna Point Marina (http://annapointmarina1.blogspot.com/p/fishing-tournaments.html);
- High Point Marina (http://www.highpointmarina.com/2015/05/tournament-info.html); and
- An overview of fishing in Lake Anna developed by Lake Anna Online is available at http://www.lakeannaonline.com/fishing.html.

- Gill net surveys were used to monitor Striped Bass (consistently stocked since the early 1980s) and hybrid Striped Bass (one-year experimental stocking in 2014). The combined Striped Bass and hybrid Striped Bass gill net catch was near average for Lake Anna. Results indicate fishing success for Striped Bass should continue to be good.

- VDGIF monitoring of predator and prey fishes in Lake Anna is expected to continue and provide information that will allow VDGIF to make adjustments to its management strategy as needed. The 2014 management recommendations for Lake Anna included continued monitoring via electrofishing and gill netting, continued stocking of Striped Bass, and continued evaluation of Striped Bass hybrids and Saugeye for several years.

6 Chosen Method(s) of Compliance with Impingement Mortality Standard [§122.21(r)(6)]

By letter dated September 9, 2015, Dominion Energy provided VDEQ with information documenting that the cooling water system at NAPS meets the definition of a CCRS found in 40 CFR §125.94(c)(2) of the Rule. After consultation with the USEPA (Region 3), the VDEQ concurred on April 5, 2017 that the NAPS cooling system meets the administrative criteria of a CCRS as defined in the Rule (see Appendix A).

The NAPS CCRS was created by impounding the North Anna River, clearing, excavating, and grading the terrain encompassed by the CCRS, and engineering a series of berms and canals that direct the water through a circulatory pathway that allows dissipation of heat and reuses the cooling water. Construction and filling of Lake Anna and the WHTF was completed in 1972. The permitting record is clear that the regulatory agencies understood that the lake would be created for this purpose. Therefore, CCRS meets BTA Compliance Alternative 1 (§125.94(c)(1)) for impingement mortality reduction in the Rule and is Dominion Energy's chosen method of compliance.

7 Entrainment Performance Studies [§122.21(r)(7)]

There have been neither site-specific entrainment performance studies conducted at NAPS, nor relevant studies from other facilities identified for inclusion in this report.

8 Operational Status [§122.21(r)(8)]

8.1 Description of Operating Status [§122.21(r)(8)(i)]

NAPS has two baseload nuclear power generating units (Units 1 and 2) with a combined generating capacity of 2,046 megawatts (MW).

8.1.1 Individual Unit Age

Fuel was loaded in Unit 1 in December 1977, with commercial operation commencing in June 1978. Fuel was loaded in Unit 2 in April 1980, with commercial operation commencing in December 1980.

8.1.2 Utilization for Previous 5 Years

Table 8-1 presents monthly capacity factors from 2013 to 2017. The annual net generation for 2013 to 2017 is shown in Table 8-2.

Table 8-1. Capacity Factors at North Anna Power Station from 2013-2017

Year	Capacity Factors (%)	
	Unit 1	Unit 2
2013	90.0	86.0
2014	96.8	89.0
2015	88.9	99.4
2016	89.5	87.9
2017	99.6	89.5

Table 8-2. Annual Net Generation at North Anna Power Station During 2013-2017

Year	Annual Gross Generation in Megawatt Hours	
	Unit 1	Unit 2
2013	8,068,218	7,708,554
2014	8,702,072	7,997,492
2015	7,968,744	8,911,486
2016	8,021,476	7,877,830
2017	8,924,689	8,024,145

8.1.3 Major Upgrades in Last 15 Years

Each reactor unit was originally designed for a licensed core power output of 2,775 megawatt thermal (MWt) (this corresponds to a nuclear steam supply system (NSSS) rating of 2,785

MWt). This core power would result in a gross electrical output of approximately 947 megawatt electrical MWe. In 1986, both units were uprated to a core power output of 2,893 MWt (NSSS rating of 2,905 MWt) each with an expected gross electrical output of 982 MWe each. In 2010, both units were again uprated to a core power output of 2,940 MWt (2,952 MWt NSSS power rating) with each expected gross electrical output of 1,023 MWe.

8.2 Descriptions of Consultation with Nuclear Regulatory Commission [§122.21(r)(8)(ii)]

NAPS operations are regulated by the Nuclear Regulatory Commission (NRC). The NRC licenses for Units 1 and 2 were renewed on March 20, 2003. Each unit has had a stretch power uprate approved on August 25, 1986 and a measurement uncertainty recapture power uprate on October 22, 2009. Please see Table 8-3 for the NAPS Relicensing Status and Approved Uprates.

Table 8-3. North Anna Power Station's Relicensing Status and Approved Uprates

	Unit 1	Unit 2
Docket Number	50-338	50-339
Operation License Date	April 1, 1978	August 21, 1980
Renewed License Date	March 20, 2003	March 20, 2003
License Expiration	April 1, 2038	August 21, 2040
Stretch Power Uprate	Approved: August 25, 1986 Percent Uprate (%): 4.2 Megawatt Thermal Increase: 118	Approved: August 25, 1986 Percent Uprate (%): 4.2 Megawatt Thermal Increase: 118
Measurement Uncertainty Recapture Power Uprate	Approved: October 22, 2009 Percent Uprate (%): 1.6 Megawatt Thermal Increase: 47	Approved: October 22, 2009 Percent Uprate (%): 1.6 Megawatt Thermal Increase: 47
Source: NRC 2018a, NRC 2018b, NRC 2018c		

8.3 Other Cooling Water Uses for Process Units [§122.21(r)(8)(iii)]

NAPS does not use cooling water for process units. This sub-section is not applicable.

8.4 Descriptions of Current and Future Production Schedules [§122.21(r)(8)(iv)]

NAPS is not a manufacturing facility. This sub-section is not applicable.

8.5 Descriptions of Plans or Schedules for Any New Units Planned within the Next 5 Years [§122.21(r)(8)(v)]

There are no plans for decommissioning, replacing, or adding of new units at this plant over the next five years.

9 Entrainment Characterization Study [§122.21(r)(9)]

9.1 Entrainment Data Collection Method [§122.21(r)(9)(i)]

9.1.1 Sampling Gear

Pumped entrainment samples were collected using 94 by 102-centimeter (cm), 335-µm mesh hoop plankton nets with a PVC cod-end bucket (Figure 9-1). Intake water from three depths (near-surface, mid-depth and near-bottom) was pumped through the separate nets using gas-powered 4-inch diameter centrifugal trash pumps and 4-inch PVC pipelines. To minimize organism damage, the water was pumped into 200-gallon polyethylene water-filled sample buffering tanks (one for each depth), where the plankton net was suspended. The samples were collected concurrently using three pairs of pumps and buffering tanks (Figure 9-1). The sample duration was approximately 100 minutes per depth or the time required to sample a minimum of 100 cubic meters (m^3) (0.0264 million gallons) of water.

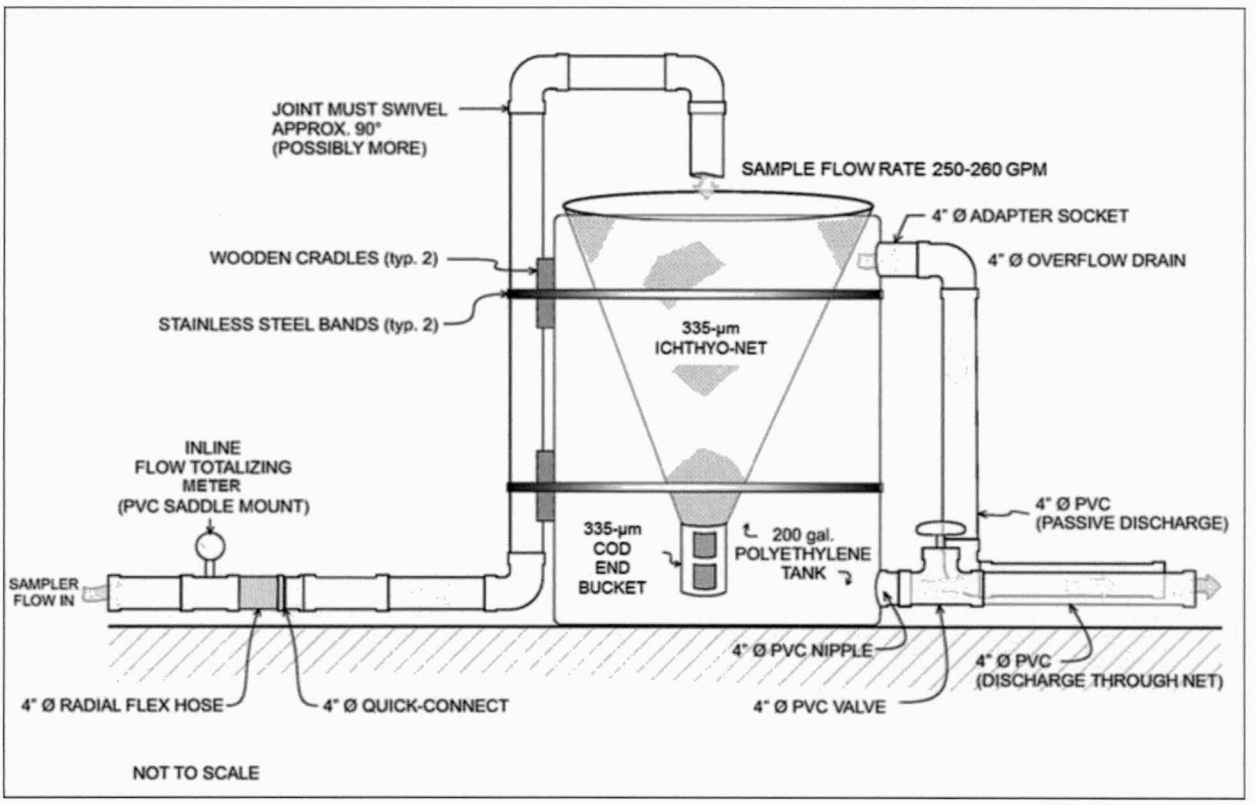


Figure 9-1. Entrainment Pump Sampling System Configuration

9.1.2 Sampling Location

Total volume of water withdrawal was similar between Unit 1 and Unit 2. Unit 2 was selected as the primary sampling location, while Unit 1 was used as the secondary location in the event that Unit 2 was not operating. Entrainment samples were collected in front of trash racks at the

CWIS from near-surface, mid-water, and near-bottom depths. Table 9-1 presents the sampling depths for NAPS relative to Normal Water Elevation, which is El. 250 feet msl. Figure 9-2 presents the design of intake piping for entrainment sampling at NAPS.

Table 9-1. Sampling Depths Relative to Normal Water Level at North Anna Power Station

Sampling Location	Sampling Depth	Sampling Depth from Intake Deck Level (+15 feet to Normal Water Level)
Near Surface (Normal water level – 4.5 feet)	-4.5 feet	-19.5 feet
Mid-depth (Mid-point of normal water level and bottom of intake)	-14.5 feet	-29.5 feet
Near Bottom (Bottom of intake + 3 feet)	-26.0 feet	-40.5 feet

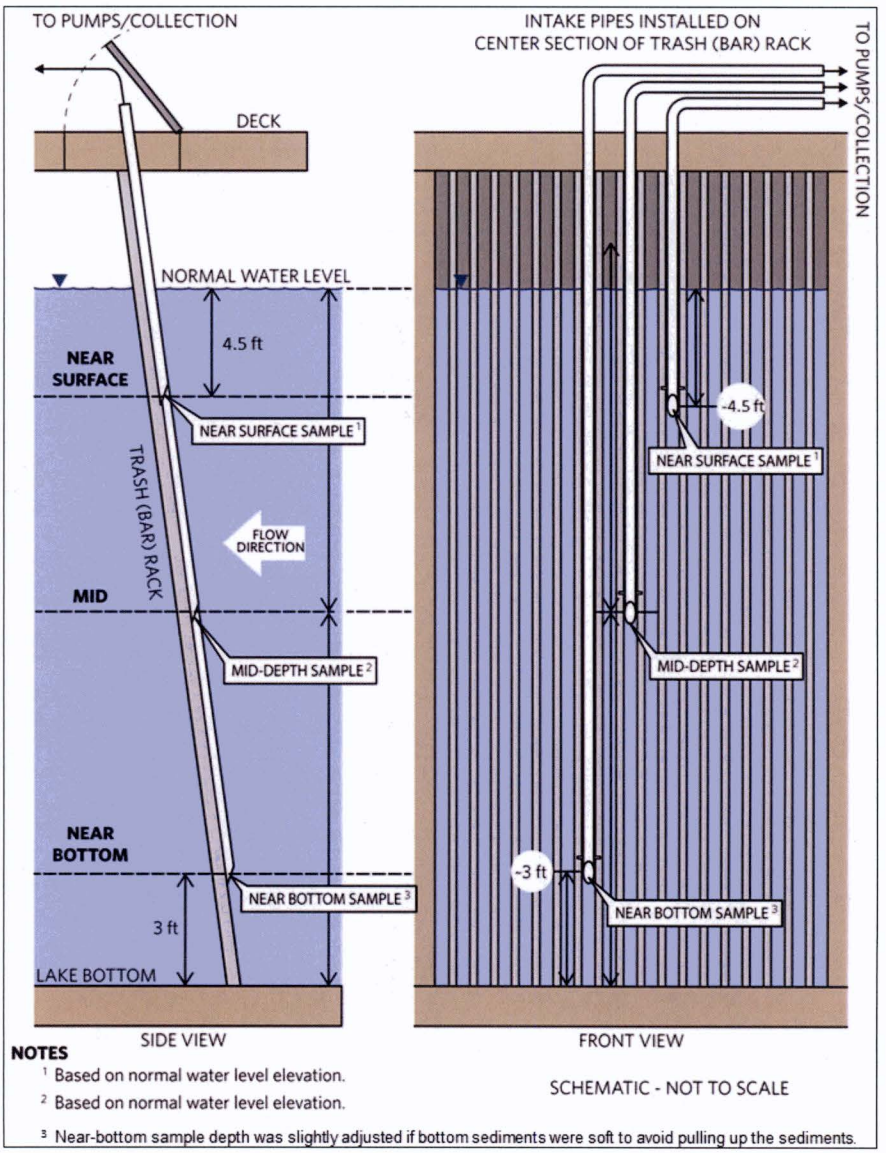


Figure 9-2. Design of Intake Piping for Entrainment Sampling

9.1.3 Sample Collection Period and Frequency

Entrainment samples were collected twice a month (generally within the second and fourth week of each month) for 5.5 consecutive months from April 2016 through September 2016, and 6.5 consecutive months from March 2017 to September 2017 for a total of 24 sampling events. Each sampling event lasted 24 hours subdivided into four, six-hour subsampling periods. Sample duration was approximately 100 minutes per depth per six-hour sample (or the time required to sample 100 m^3 per depth per six-hour sample). Specific details of the 2016-2017 entrainment sampling program are presented in Table 9-2.

Table 9-2. North Anna Power Station Entrainment Sampling Details, 2016-2017

Entrainment	Details
Units to be Sampled	Unit 2 (Primary Location) and Unit 1 (Secondary Location)
Sampling Events during April – early September 2016 and March – early September 2017	Twice per month sampling events (within the second and fourth week of each month) for 5 5 months in 2016 and 6.5 months in 2017 (2/month x 12 months = 24 sampling events)
Daily Collection Schedule	Samples collected every 6 hours in a 24-hour period (4 collections / 24-hour 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 were 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)
Proposed Number of Samples per Sampling Event	4 collections/survey x 3 depths/collection x 1 sample/depth = 12 samples/survey
Proposed Total Number of Samples	12 samples/survey x 2 surveys/month x 12 months = 288 samples
Water Quality Measurements	Temperature, DO, pH, salinity, and conductivity approximately every six hours in the entrainment sampling buffering tanks for near-surface, mid-depth, and near-bottom depths

9.1.4 Laboratory Analysis

After sample collection, each sample was washed through a 335-µm sieve in the laboratory to remove the excess formalin that was used in the field to preserve the sample. Each sample was then sorted in a glass sorting tray, which was placed on a light box. The aquatic fauna was sorted into groups of fish eggs, larvae and later life stages. Each group was preserved in 5 percent formalin, placed in separate, labeled glass vials, and stored.

After sorting, the fish eggs, larvae, and later life stages were identified to the lowest practical taxon and enumerated. All ichthyoplankton was assigned a life stage: viable egg, N, yolk sac larvae, post yolk sac larvae, juvenile, or unidentified larval stage. Also, morphometric data (such as minimum and maximum egg diameter; total length and notochord length, maximum body depth and width, head capsule depth and width for each fish taxon and life stage) were collected and recorded for each life stage of fish. Organisms subject to the morphometric

evaluation were selected at random from within each taxonomic category (i.e., each taxon and life stage).

9.1.5 Identification of Species Susceptible to Entrainment

A total of 986 organisms were collected during the first year of entrainment sampling and included finfish distributed among 12 distinct taxa. A number of fish eggs (464) collected primarily in April, were considered non-viable (NVE) (e.g., unfertilized or dead/decaying); therefore, they would not have contributed to future fish populations. As such, these NVE were excluded from further entrainment analysis. Removing the total number of NVE reduced the total number of organisms considered for entrainment to 522 during Year 1 (2016) entrainment sampling. During the second year of entrainment sampling (2017), after removing the total number of NVE eggs (35) which were collected entirely in May, the total number of organisms considered for entrainment during the second year was 760. Table 9-3 presents the complete list of species by common name and scientific name.

Overall, taxonomic diversity was low in entrainment samples with the number of distinct taxa ranging from a monthly low of one in September of each year to a high of seven in May 2016. The most taxonomically rich samples were collected in spring: April (5 of each year) and May (7 and 5 in 2016 and 2017, respectively).

Table 9-3. Master Species List of All Distinct Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017

Common Name	Scientific Name	Year 1 (Apr 2016 – Sep 2016)	Year 2 (Mar 2017 – Sep 2017)
Blueback Herring	*Alosa aestivalis*	X	X
Bluegill	*Lepomis macrochirus*	X	X
Channel Catfish	*Ictalurus punctatus*	X	X
Common Sunfishes	*Lepomis* spp.	X	X
Crappie	*Pomoxis* spp.	X	
Darters	*Etheostoma* spp.	X	X
Gizzard Shad	*Dorosoma cepedianum*	X	X
Threadfin/Gizzard Shad	*Dorosoma* spp.	X	X
Golden Shiner	*Notemigonus crysoleucas*	X	
Herrings and Shad	Clupeidae	X	X
Largemouth Bass	*Micropterus salmoides*	X	X
Minnow	Cyprinidae	X	X
Spottail Shiner	*Notropis hudsonius*		X
Sunfish	Centrarchidae	X	
Threadfin Shad	*Dorosoma petenense*	X	X
Unidentified Finfish	Unidentified	X	X
White Catfish	*Ameiurus catus*	X	
White Perch	*Morone americana*	X	X
Yellow Perch	*Perca flavescens*	X	X

9.1.6 Identification of Protected Species

There were no protected species identified under Federal, State, or Tribal law, including threatened or endangered species, collected as part of 2016-2017 entrainment samples.

9.2 Biological Entrainment Characterization [§122.21(r)(9)(ii)]

Finfish species comprised 100 percent of the total entrainment sample collection for both years of the study. Post yolk sac larvae dominated the entrainment sample collections, accounting for 83 percent of Year 1 total and 96 percent of the Year 2 total. Yolk sac larvae comprised 6 percent of the sample collection for Year 1 and 2 percent of the sample collection for Year 2. Very few eggs, juveniles, or adult fish were collected, with each comprising five percent or less of the total collection for both years of entrainment sampling. Refer to Appendix F (North Anna Power Station 2016-2017 Entrainment Characterization Study Report) of this document for more details.

9.2.1 Species Abundance

Table 9-4 presents the total number of organisms collected by taxa and life stage for the first and second year of entrainment sampling. Herrings and Shad (Clupeidae; 37%) and Common Sunfishes (*Lepomis spp.*; 33%) post yolk sac larvae were the most abundant fish taxa and life stage collected during the first year of entrainment sampling. White Perch post yolk sac larvae (4%), Herrings unidentified life stage larvae (4%), Threadfin/Gizzard Shad (*Dorosoma* spp.) post yolk sac larvae (3%), and Herrings and Shad yolk sac larvae (3%) were collected in relatively low abundance during the first year. The remaining fish taxa each accounted for two percent or less of the total collection.

During the second year of entrainment sampling, Herrings and Shad (68%), Threadfin/Gizzard Shad (13%), and Common Sunfishes (9%) post yolk sac larvae were the most abundant fish taxa collected (Table 9-4). Threadfin/Gizzard Shad post yolk sac larvae (13%) and Threadfin Shad post yolk sac larvae (2%) were collected in relatively higher abundance than the first year, while White Perch post yolk sac larvae (2%), Herrings and Shad unidentified life stage larvae (<1%), and Herrings and Shad yolk sac larvae (<1%) were collected in relatively low abundance during the second year when compared to Year 1. The remaining fish taxa each accounted for one percent or less of the total catch in Year 2.

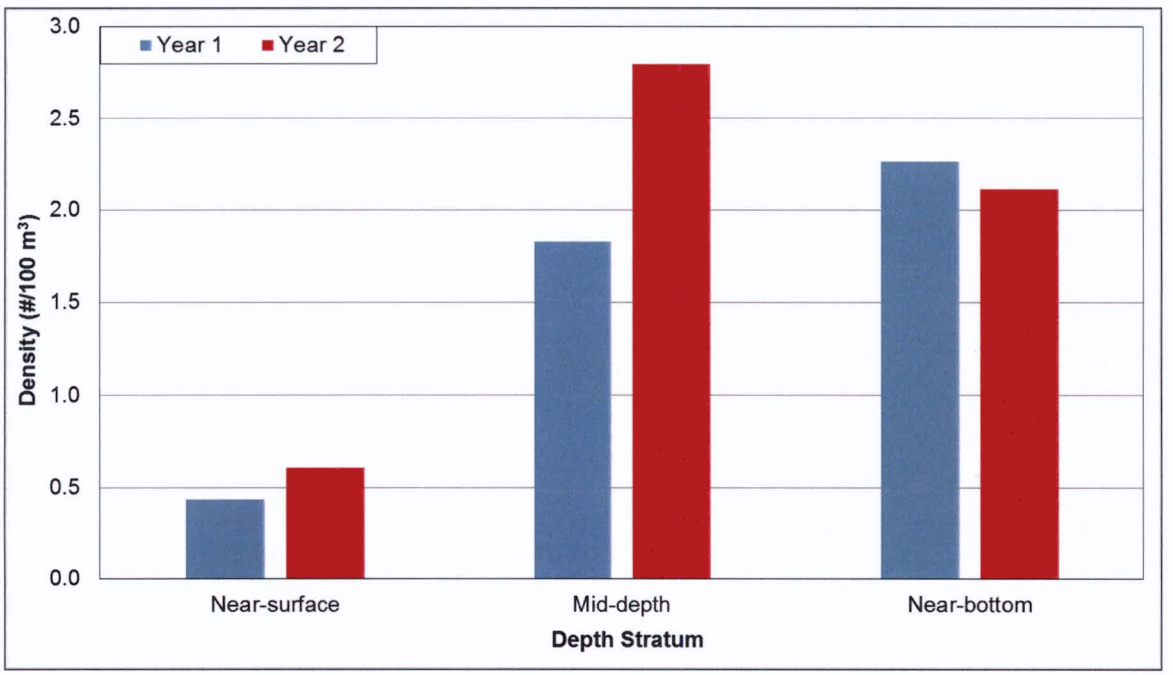
Table 9-4. Total Number of Fish by Taxa and Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling

Taxa	Life Stage	Year 1 (Apr 2016 - Sep 2016)		Year 2 (Mar 2017 - Sep 2017)	
		Total Number of Organisms Collected	Percent Total (%)	Total Number of Organisms Collected	Percent Total (%)
Finfish					
Herrings and Shad	PYSL	191	37	519	68
Common Sunfishes	PYSL	172	33	65	9
White Perch	PYSL	23	4	14	2
Herrings and Shad	UIDL	19	4	3	<1
Threadfin/Gizzard Shad	PYSL	15	3	98	13
Herrings and Shad	YSL	14	3	1	<1
Largemouth Bass	Juv	11	2	3	<1
Unidentified Finfish	UIDL	10	2	5	1
Gizzard Shad	YSL	9	2	1	<1
Gizzard Shad	PYSL	7	1	1	<1
Threadfin Shad	PYSL	7	1	18	2
Channel Catfish	PYSL	6	1	4	1
Blueback Herring	Juv	5	1	-	
Bluegill	Juv	5	1	1	<1
Common Sunfishes	Juv	5	1	-	
Yellow Perch	YSL	5	1	4	1
Crappie	PYSL	4	1	-	
Sunfish	PYSL	4	1	-	
White Perch	YSL	3	1	4	1
Darters	PYSL	2	<1	-	
Golden Shiner	PYSL	1	<1	-	
Herrings and Shad	Egg	1	<1	5	1
Largemouth Bass	PYSL	1	<1	-	
Minnow	PYSL	1	<1	3	<1
White Catfish	PYSL	1	<1	-	
Blueback Herring	Adult	-		1	<1
Blueback Herring	PYSL	-		2	<1
Darters	YSL	-		2	<1
Gizzard Shad	Juv	-		1	<1
Spottail Shiner	PYSL	-		1	<1
Threadfin Shad	Juv	-		1	<1
Yellow Perch	PYSL	-		3	<1
Total		**522**	**100**	**760**	**100**

Note:
YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

9.2.2 Spatial Characteristics

The entrainment densities were evaluated for trends associated with depth strata, which varied by year, taxa, and month. Overall, mid-depth and near-bottom samples accounted for the majority of entrained organisms; however, the contribution of each varied by year (Figure 9-3). During the first year of sampling, slightly more organisms were collected mid-depth (48%) compared to near-bottom (46%). Similarly, during the second year of sampling, more organisms were collected at the mid-depth (56%) compared to near-bottom (33%). Nearly all taxa and life stages were collected at all three depth strata and there were few consistent trends of entrainment rates by depth, with high variability by taxa and by month to month within the same taxa and life stage. For example, highest densities of post yolk sac Herrings and Shad were collected at mid-depth in May and July but in near-bottom samples in June and August during the first year of sampling. During the second year of sampling, post yolk sac Herrings and Shad were collected at greatest densities in mid-depth samples for nearly all months. Threadfin/Gizzard Shad were collected at similar densities in mid-depth and near-bottom samples and at lowest densities at near-surface. Post yolk sac larval Common Sunfishes were collected primarily in near-bottom samples of both years, which accounted for the peak densities in near-bottom samples in August.

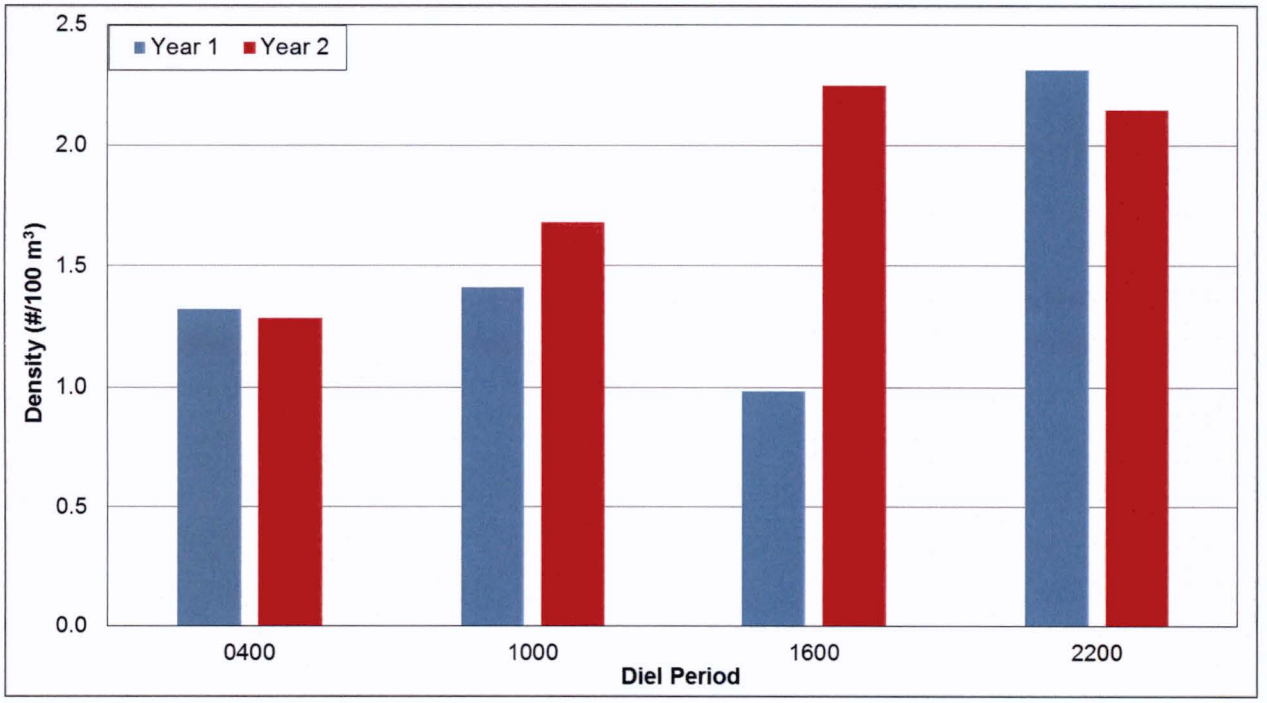


Note: The numbers reported in this figure do not include NVE.

Figure 9-3. Baseline Entrainment Density (#/100 m^3) by Depth Stratum at North Anna Power Station, 2016-2017

9.2.3 Temporal Characteristics

Entrainment densities of finfish were evaluated for trends associated with diel variations and were higher at night (2200 hours) during the first year of sampling. During the second year of sampling, entrainment of finfish was similarly high late afternoon (1600 hours) and at night (2200 hours) (Figure 9-4).

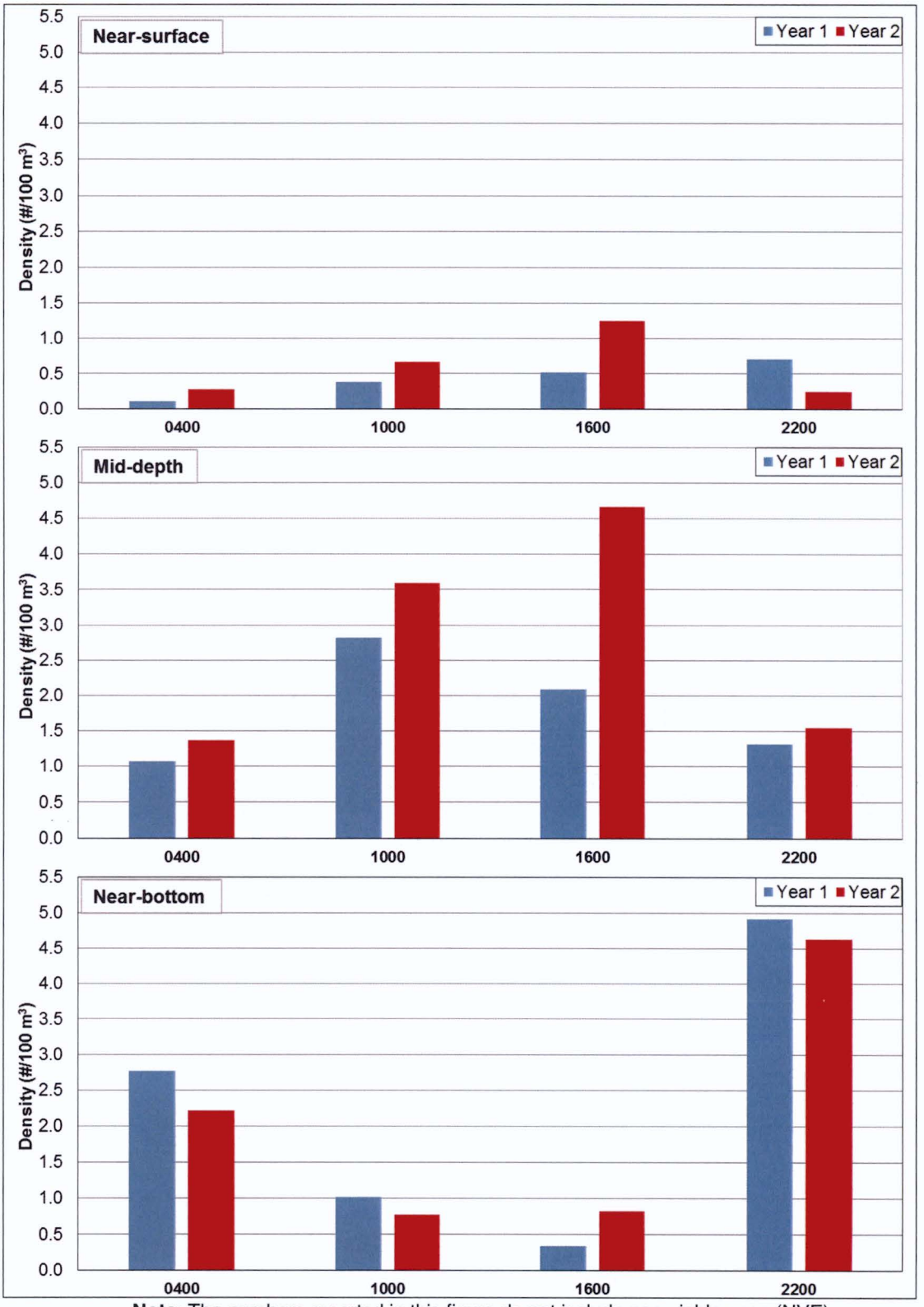


Note: The numbers reported in this figure do not include NVE.

Figure 9-4. Average Baseline Entrainment Density (#/100 m^3) During Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017

The diel pattern was inconsistent by depth strata. Entrainment densities were highest at night and early morning in near-bottom samples and highest during daylight hours in mid-depth samples, suggesting organisms are moving from the bottom during nighttime to mid- depths during daylight. Densities were lowest overall in near-surface samples (Figure 9-5).

Entrainment densities of finfish were evaluated for trends associated with seasonal variations. In general, the two years of sampling exhibited similar trends for finfish entrainment, with the highest depth-averaged entrainment densities in May, June and July of both years (Table 9-5). These peak densities were attributed primarily to post yolk sac larval Herrings and Shad (May to July), Common Sunfishes (June and July, extending into August of the first year of sampling), and Threadfin/Gizzard Shad (May to July of second year of sampling). The lowest depth-averaged monthly densities generally occurred during early spring (March and April) and September. White Perch contributed to the early spring densities (April) primarily during the first year of sampling.



Note: The numbers reported in this figure do not include non-viable eggs (NVE).

Figure 9-5. Average Baseline Entrainment Density (#/100 m^3) during Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017

Table 9-5. Monthly Average Baseline Density (#/100 m^3) of Finfish by Depth Stratum at North Anna Power Station, 2016-2017

Month>>	Mar	Apr	May	Jun	Jul	Aug	Sep
Year 1 (April 2016 – September 2016)							
Near-surface	-	0.22	1.77	1.50	0.84	0.49	0.00
Mid-depth	-	5.77	8.90	3.55	10.30	1.61	0.00
Near-bottom	-	1.46	5.36	9.21	5.10	7.43	0.48
Depth-Averaged	**-**	**2.49**	**5.34**	**4.75**	**5.41**	**3.18**	**0.16**
Year 2 (March 2017 – September 2017)							
Near-surface	0.12	1.11	5.92	1.49	1.61	0.24	0.00
Mid-depth	0.49	2.21	10.28	14.64	24.45	0.00	0.00
Near-bottom	0.73	2.35	3.10	6.03	17.72	1.12	0.25
Depth-Averaged	**0.45**	**1.89**	**6.43**	**7.39**	**14.59**	**0.45**	**0.08**

9.3 Analysis and Supporting Documentation [§122.21(r)(9)(iii)]

9.3.1 Representative Operational Flows

Using daily heat rejection (i.e., delta T) values, the daily average actual intake flows were calculated by unit-specific pump for each month. Throughout the two-year entrainment study, the actual intake flows at Units 1 and 2 were higher during late spring and summer months (May to August), but slightly lower during March, April, and September (Figure 9-6).

By comparing the flows during the latest three years from 2015 to 2017 (see Tables 3-3 and 3-4 in Section 3.4), the two-year average total intake flow of 2,062.4 MGD during those sampling months and years is comparable to that of the same months of sampling during the latest three years (1,983.3 MGD). Therefore, the current 2016-2017 entrainment data were collected during periods of representative operational flows for the cooling water intake structure.

9.3.2 Latent Mortality

The latent mortality for all taxa and life stages of organisms entrained was conservatively assumed to be 100 percent.

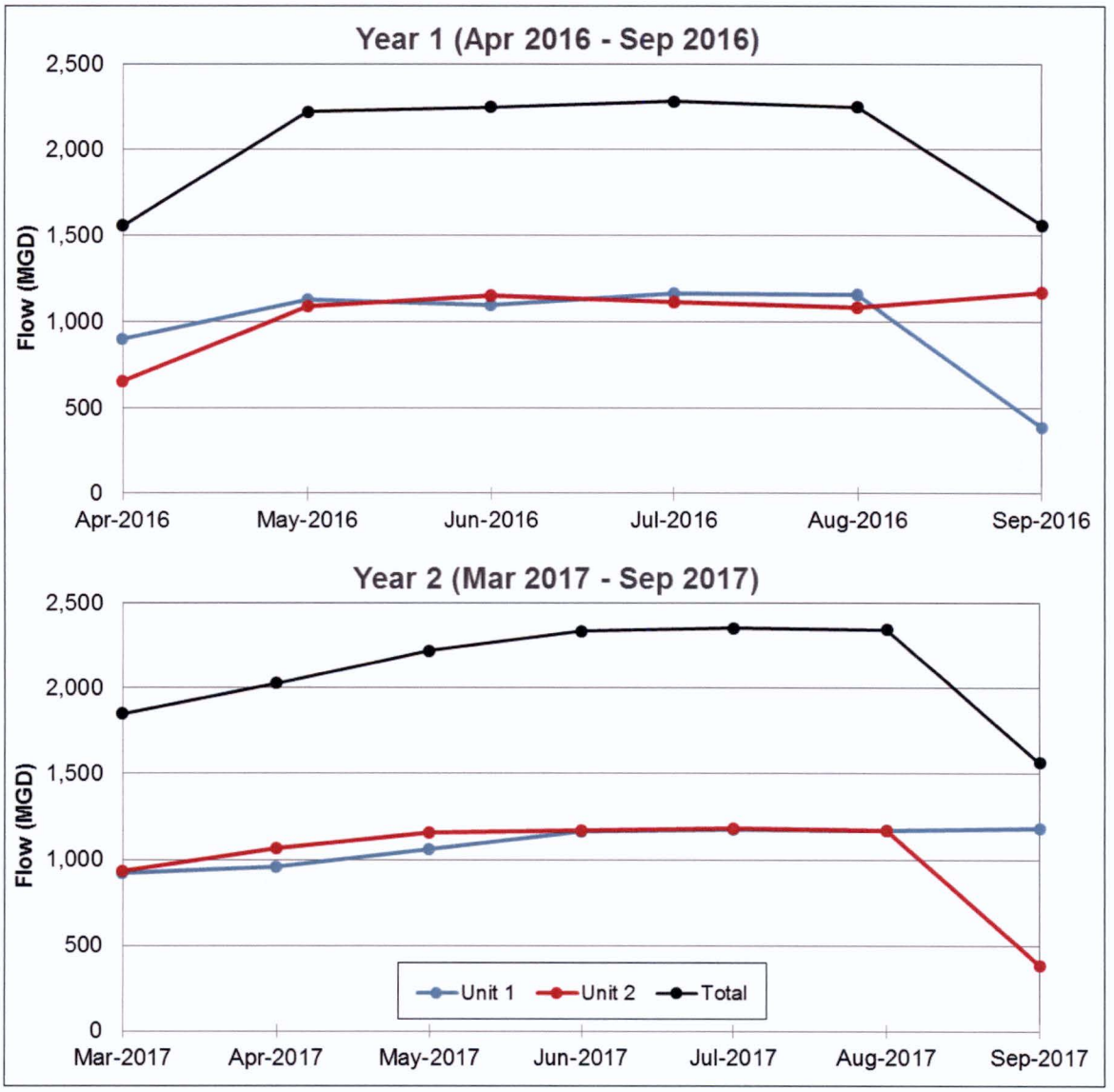


Figure 9-6. Monthly Average Actual Intake Flows by Unit at North Anna Power Station, during 2016-2017 Entrainment Sampling

9.3.3 Total Entrainment

This sub-section below documents all assumptions and calculations used to determine total entrainment for NAPS together with all methods and quality assurance/quality control procedures for data collection and data analysis.

Assumptions

Non-viable Eggs (NVE)

A large number of fish eggs collected primarily in April of the first year sampling, with smaller numbers in May of the second year sampling, were identified as NVE and therefore would not have contributed to future fish populations. As such, NVE were excluded from further entrainment analysis. Even though NVE were excluded from entrainment estimates, they would continue to contribute to forage base after being returned to the source waterbody.

Exclusion Fraction

Figure 9-7 illustrates the process of estimating entrainment based on the exclusion method described below. The entrainment sampling at NAPS used pumped samplers withdrawing water directly from in front of the trash rack. The orifices of the sample pipes were much larger than existing intake screen mesh openings at NAPS. As a result, during sampling impingeable-sized organisms were collected in the entrainment samples. The maximum opening allowed by the USEPA in discerning between impingement and entrainment, which is called "baseline screen" in Figure 9-7, is 0.56 inches, however, the TWS's at NAPS have a finer sized 1/8- x ½-inch mesh screen.

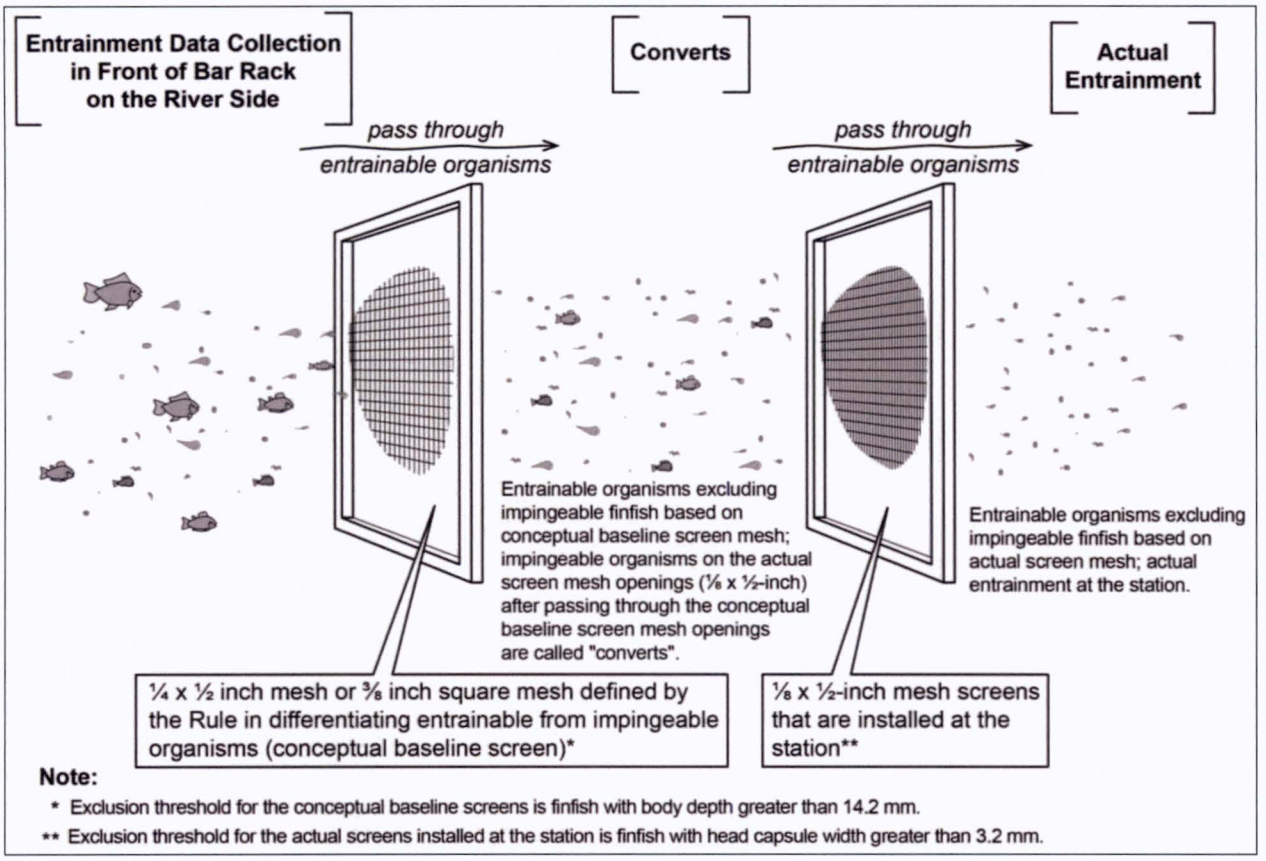


Figure 9-7. Summary of the Step-Wise Process Used to Estimate Entrainment based on the Rule and Existing Screens Installed at North Anna Power Station

Therefore, there is potential for some organisms that may pass through the baseline screen, but be retained on the finer NAPS screen, i.e. organisms may be retained rather than entrained. Organisms that are retained by the NAPS screen but would have been entrained (pass through) based on the Rule's mesh size (¼- x ½-inch) are termed 'converts'. There is no fish return system at NAPS, such that the converts would not be re-directed from the intake system; therefore, only organisms that would pass through the Rule's prescribed mesh size were used to estimate the regulatory definition of entrainment, which is called "baseline entrainment". Because very few, if any, of these larger organisms would be entrained through the 0.56 inch opening, exclusion methods were developed to separate these impingeable-size organisms

from the others in the data and then exclude them from the calculation of densities and numbers entrained.

To account for the exclusion of impingeable organisms based on the baseline screen and to provide an accurate estimate of entrainment, exclusion fractions were estimated based on morphometric data collected on the sampled organisms. This was done for consistency with the Rule (which defines an entrainable organism as one that would pass a 0.56-inch sieve opening), and to avoid underestimation of entrainment. Table 9-6 presents the percentage of each species/life stage excluded.

Table 9-6. Excluded Impingeable Finfish (i.e. Percent of Finfish that Measured Greater than 14.2-mm Body Depth) at North Anna Power Station (Years 1 and 2 Combined)

Taxa	Juveniles	Adults
Blueback Herring	-	100%
Bluegill	100%	-
Unidentified Finfish	16%	-

Calculation Methods

Monthly Density

Monthly densities ($De_{m,h}$) of entrainment accounting for exclusion and expressed as number per 100 m^3, are calculated as the average of all 6-hour interval sample densities ($D_{t,h}$) in each calendar month for each species and life stage for the relevant stratum (h) multiplied by the fraction of organisms not excluded, i.e., the fraction of organisms projected to pass through the intake screens.

$$De_{m,h} = \frac{1}{n_m}\sum_{j=1}^{n_m}\{D_{t,h}(j)\cdot(1-Fe)\}$$

where:

$De_{m,h}$ = monthly density (#/100 m^3) for the h^{th} stratum with exclusion

$D_{t,h}(j)$ = j^{th} six-hour sample density within a calendar month for the h^{th} stratum

n_m = total number of six-hour samples within a calendar month (e.g., typically 8 valid samples) for the h^{th} stratum

m = calendar month

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Fe = fraction excluded where:

- $Fe = F_{ei}$ *(FF)* for each identified finfish species and life stage
- $Fe = F_{eUIDL}$ *(FF)* for unidentified life stage larvae of an identified finfish species
- $Fe = F_{eUID}$ *(FF)* for unidentified finfish species

Annual Total Entrainment

Monthly entrainment densities are used to estimate the year- specific total number of organisms entrained (E_{ai}) for each species and life stage under actual flow rates as:

$$E_{ai} = \sum_{m=1}^{M} [\sum_{h=1}^{H} \{\frac{De_{m,h}(i)}{100} \cdot \frac{V_{a,m}}{H}\}]$$

where:

E_{ai} = annual entrained for the i^{th} species and life stage under actual intake flows

$De_{m,h}(i)$= monthly density (#/100 m^3) for the h^{th} stratum with exclusion for the i^{th} species and life stage

$V_{a,m}$ = monthly total volume (m^3) of water withdrawn by the station based on actual operations

h = stratum (e.g., near-surface, mid-depth or near-bottom)

H = total number of strata sampled (e.g., 3 for North Anna Power Station)

m = calendar month

M = total number of months in a year

The yearly total number of organisms entrained (E_a) is then estimated by summing the total numbers of organisms entrained (E_{ai}) for all species and life stage under actual flow rates as:

$$E_a = \sum_{i=1}^{NN} E_{ai}$$

where:

E_a = annual entrained of all species and life stage under actual intake flows

E_{ai} = annual entrained for the i^{th} species and life stage under actual intake flows

NN = total number of all species and life stages collected.

Quality Assurance/Quality Control (QA/QC) Procedures

Adherence to sample collection and lab analysis Standard Operating Procedures was observed and documented through regular technical assessments/audits. These technical assessments/audits were conducted by a QA officer, who was independent of those individuals collecting and generating the data during the study and had experience in performing QA/QC programs for aquatic monitoring surveys.

For QA/QC procedures for the laboratory analysis of entrainment samples, quality control methods for split, sort and identification of ichthyoplankton were checked using a continuous sampling plan to assure an Average Outgoing Quality Limit of 0.1 (≥90% accuracy). Specific methods for quality control were provided in the Standard Operating Procedures developed by the party performing the work. Quality control checks were recorded on appropriate datasheets and these records were maintained for review.

Annual Total Entrainment

Monthly entrainment densities were used to estimate the year-specific total number of organisms entrained for each species and life stage. The two-year entrainment sampling study was conducted during April 2016 – September 2016 (Year 1) and March 2017 – September 2017 (Year 2), which covers the period of peak entrainment abundance; therefore, the resulting entrainment estimates based on AIF are considered representative of annual total entrainment. To characterize inter-annual variability in entrainment, the two years of entrainment data were treated separately to estimate annual total entrainment based on sampling year specific intake flows as Year 1 (April 2016 – September 2016) or Year 2 (March 2017 – September 2017) as well as AIF as defined by the Rule, which is the average volume of water withdrawn by the CWIS over the previous three years from 2015 to 2017 (see Table 3-4) for NAPS. As mentioned in Section 3.4, NAPS withdraws service water in addition to circulation water withdrawal; however, the service water flow (estimated to be approximately 0.016 percent of circulating water flows based on 2016-2017 plant operation) is insignificant so that it was not included in the estimate of total entrainment.

Table 9-7 presents estimated annual entrainment based on year-specific densities with sampling year-specific flows and Rule-defined AIF. The total entrainment ranged from 53,593,333 to 83,421,119 finfish organisms over the study period. No shellfish were collected during the two-year entrainment sampling.

Table 9-7. Estimated Annual Entrainment Based on Year-specific Densities with Sampling Year-specific Flows and Rule-defined AIF

Taxon	Scientific Name	Life Stage	Total Entrainment Excluding Impingeable Sized Organisms			
			Sampling Year 1 Density and Flow	Sampling Year 1 Density and Rule-defined AIF	Sampling Year 2 Density and Flow	Sampling Year 2 Density and Rule-defined AIF
Finfish						
Blueback Herring	*Alosa aestivalis*	PYS	-	-	188,656	160,408
		Juv	529,870	530,284	-	-
Channel Catfish	*Ictalurus punctatus*	PYS	657,642	673,865	458,461	452,336
Common Sunfishes	*Lepomis* spp.	PYS	18,576,046	19,019,503	7,290,097	7,222,922
		Juv	536,828	550,571	-	-
Crappie	*Pomoxis* spp.	PYS	383,429	391,252	-	-
Darters	*Etheostoma* spp.	YS	-	-	190,379	161,874
		PYS	213,696	213,864	-	-
Gizzard Shad	*Dorosoma cepedianum*	YS	937,037	945,083	107,943	108,112
		PYS	750,834	766,959	114,673	113,280
		Juv	-	-	114,781	113,387
Golden Shiner	*Notemigonus crysoleucas*	PYS	66,007	72,991	-	-
Herrings and Shad	Clupeidae	Egg	108,097	108,181	536,756	537,595
		YS	1,235,293	1,297,914	107,494	107,662
		PYS	20,276,410	20,642,505	57,056,877	56,066,514

Taxon	Scientific Name	Life Stage	Total Entrainment Excluding Impingeable Sized Organisms			
			Sampling Year 1 Density and Flow	Sampling Year 1 Density and Rule-defined AIF	Sampling Year 2 Density and Flow	Sampling Year 2 Density and Rule-defined AIF
		UIDL	1,767,519	1,830,032	310,189	296,406
Largemouth Bass	*Micropterus salmoides*	PYS	100,376	100,454	-	-
		Juv	1,130,569	1,133,726	322,916	321,280
Minnow	Cyprinidae	PYS	71,631	79,210	331,503	325,597
Spottail Shiner	*Notropis hudsonius*	PYS	-	-	89,595	76,180
Sunfish	Centrarchidae	PYS	424,748	432,138	-	-
Threadfin Shad	*Dorosoma petenense*	PYS	769,285	784,991	2,062,885	2,037,833
		Juv	-	-	114,933	113,537
Threadfin/Gizzard Shad	*Dorosoma* spp.	PYS	1,620,776	1,653,221	11,153,969	11,011,082
Unidentified Finfish	Unidentified	UIDL	922,339	954,354	511,562	479,885
White Catfish	*Ameiurus catus*	PYS	111,407	113,644	-	-
White Perch	*Morone americana*	YS	216,976	239,933	376,372	301,291
		PYS	1,833,833	1,971,714	1,342,639	1,155,013
Yellow Perch	*Perca flavescens*	YS	352,685	389,999	368,159	276,193
		PYS	-	-	270,280	173,530
Finfish Total			**53,593,333**	**54,896,388**	**83,421,119**	**81,611,915**

Note:
YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

10 References

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.

Brierley, A. S. 2014. Diel vertical migration, Curr. Biol., 24(22), R1074–R1076, doi:10.1016/j.cub.2014.08.054.

Dominion Energy, Inc. (Dominion). 2005a. Proposal for Information Collection, Final Rule for Phase II Facilities Cooling Water Intake Structures, North Anna Power Station. Prepared by Dominion Resources Services, Inc. Submitted to Virginia Department of Environmental Quality. 8 February 2005.

_____. 2005b. Environmental Study of Lake Anna and the Lower North Anna River. Annual Report for 2004. Dominion Electric Environmental Services.

_____. 2009. A Survey for the Discovery of Freshwater Mussel Populations in Lake Anna, Louisa County and Hanover County, Virginia.

_____. 2015. Response to Request for Information (RFI) dated June 4, 2015.

_____. 2017. Environmental Study of Lake Anna, Waste Heat Treatment Facility and the Lower North Anna River – Annual Report for 2016. Electric Environmental Services. 47p.

EA Engineering, Science, and Technology, Inc. (EA). 2007. Impingement Mortality Characterization Report North Anna Power Station July 2005 – July 2006. Prepared for Dominion Resources Services, Inc., Gen Allen, Virginia. 44p.

Ehrlich, K. F. 1974. Chemical Changes during Growth and Starvation of Herring Larvae. Pages 301-323 in J. H. S. Blaxter, editor. The Early Life History of Fish. Springer-Verlag, New York.

Electric Power Research Institute (EPRI). 2004. Technical Evaluation of the Utility of Approach Velocity as an Indicator of Potential Adverse Environmental Impact under Clean Water Act Section 316(b). 1000731. EPRI, Palo Alto, CA.

EPRI. 2007. Cooling Water Intake Structure Area-of-Influence Evaluations for Ohio River Ecological Research Program Facilities. 1015322. EPRI, Palo Alto, CA.

Froese, R. and D. Pauly (Editors) 2018. FishBase World Wide Web electronic publication. www.fishbase.org

Gebhart, G.E. and R.C. Summerfelt. 1978. Seasonal Growth of Fishes in Relation to Conditions of Lake Stratification. Oklahoma Cooperative Fishery Research Unit 58 (1978): 6-10. Oklahoma State University, Stillwater, Oklahoma.

Golder Associates. 2005. Crystal River Energy Complex Proposal for Information Collection. NPDES Permit No. FL0000159. Prepared for Progress Energy.

HDR Engineering, Inc. (HDR). 2018. Draft 2016-2017 Entrainment Characterization Study. Prepared for Dominion Energy, Inc.

Jenkins, R.E. and N.M. Burkhead, 1994. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland. 1079p.

Lake Anna Special Area Plan Committee. 2000. Lake Anna Special Area Plan. Louisa County. Accessed on February 19, 2018 at: https://www.louisacounty.com/ArchiveCenter/ViewFile/Item/54

Lees, W.R. 2005. An investigation of the changes of species richness and distribution of the unionidae (Bivalvia: Mollusca) within the Pamunkey Watershed.

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

Leonard, P. M. and D.J. Orth. 1988. Use of Habitat Guilds of Fishes to Determine Instream Flow Requirements. North American Journal of Fisheries Management 8: 399-408p.

Loar, J.M., J.B. Griffith, and K.D. Kumar. 1978. An analysis of factors influencing the impingement of Threadfin Shad (Dorosoma pretenense) at Power Plants in the Southeastern United States. Oak Ridge National Laboratory. Online. Accessed April 6, 2018. https://www.nrc.gov/docs/ML1802/ML18023A192.pdf

Matthias, B.G., Allen, M.S., Ahrens, R.N.M., Beard, T.D., Jr., and J.A. Kerns. 2014. Hide and Seek: Interplay of Fish and Anglers Influences Spatial Fisheries Management. Fisheries 39: 261-269.

May, R.C. 1974 Larval mortality in marine fishes and the critical period concept. Pages 3-19 in J.H.S. Blaxter, editor. The early life history of fish. Springer-Verlag, New York.

MD DNR 2018. Maryland Fish Facts. Available online. Accessed March 21, 2018. http://dnr.maryland.gov/Fisheries/Pages/fishfacts-index.aspx.

Mehner, T. 2012. Diel vertical migration of freshwater fishes – proximate triggers, ultimate causes and research perspectives. Freshwater Biology (2012) 57, 1342–1359.

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.

Miller, T.J., L.B. Crowder, J.A. Rice, and E.A. Marshall. 1988 Larval Size and Recruitment Mechanisms in Fishes: Toward a Conceptual Framework. Canadian Journal of Fisheries and Aquatic Sciences 45:1657-1670p.

NatureServe. 2017. NatureServe Explorer: An Online Encyclopedia of Life. Version 7.1. NatureServe, Arlington, Virginia. Web application. [http://explorer.natureserve.org] Accessed: March 2018.

Nedeau, E. 2009. Distribution, Threats, and Conservation of the Dwarf Wedgemussel (Alasmidonta heterodon) in the Middle and Northern Macrosites of the Upper Connecticut River. Report prepared for Vermont Fish and Wildlife Department and New Hampshire Fish and Game Department.

U.S. Nuclear Regulatory Commission (NRC). 2005. Biological Assessment for the Early Site Permit (ESP) of the North Anna ESP Site and a Request for Informal Consultation.

_____. 2010. Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3.

_____. 2013. Draft Supplemental Information to the Biological Assessment North Anna Power Station Combined License Application. Docket No. 52-017. September 2013.

_____. 2016a. North Anna Power Station Updated Final Safety Analysis Report. Revision 52-09/26/2016.

_____. 2016b. Supplemental Biological Assessment North Anna Power Station Combined License Application. Docket No. 52-017. December 2016.

_____. 2018a. Approved Applications for Power Uprates. Available online. Accessed 26 Apr 2018. https://www.nrc.gov/reactors/operating/licensing/power-uprates/status-power-apps/approved-applications.html

_____. 2018b. North Anna Power Station, Unit 1. Available online. Accessed 26 Apr 2018. https://www.nrc.gov/info-finder/reactors/na1.html

_____. 2018c. North Anna Power Station, Unit 2. Available online. Accessed 26 Apr 2018. https://www.nrc.gov/info-finder/reactors/na2.html

Odenkirk, J. 2015. Email from John Odenkirk, Fisheries Biologist, VDGIF to Bob Graham of Dominion Energy of August 17, 2015 providing a summary of the Lake Anna management recommendations and supporting observations.

Rohde F. C, R. G. Arndt, J. W. Foltz, and J. M. Quattro. 2009. Freshwater Fishes of South Carolina. University of South Carolina, Columbia, SC.

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

Tortorici, C. and P. Ashfield. 2014. 316(b) and the Endangered Species Act. EUCI Conference: EPA 316(b) Fish Impingement in Power and Industrial Plants. Providence, RI. October 8-9, 2014.

U.S. Fish and Wildlife Service (USFWS). 2005. Letter of concurrence from Mr. John Wolflin, USFWS, to Mr. Pao-Tsin Kuo, Nuclear Regulatory Commission, that ESP Activities would not impact Dwarf Wedgemussel, May 20, 2005.

_____. 2007. Dwarf Wedgemussel, Alasmidonta heterodon, 5-Year Review: Summary and Evaluation.

_____. 2017. Letter of concurrence from Cindy Schulz, USFWS, to Joseph E. Donoghue, Nuclear Regulatory Commission, Re: Supplemental Biological Assessment of North Anna Power Station, Unit 3 Combined License Application, Luisa County, VA, Project # 2017-SLI-0073.

_____. 2018a. Candidate Species, Section 4 of the Endangered Species Act. Accessed on June 7, 2018 at: https://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf.

_____. 2018b. IPAC Trust Resource Report [for the area surrounding North Anna Power Station in Louisa and Spotsylvania counties, Virginia]. Accessed June 7, 2018. https://ecos.fws.gov/ipac/

USFWS and National Marine Fisheries Service (NMFS). 2014. Endangered Species Act Section 7 Consultation, Programmatic Biological Opinion on the U.S. Environmental Protection Agency's Issuance and Implementation of the Final Regulations Section 316(b) of the Clean Water Act. Accessed June 7, 2018. https://www.epa.gov/sites/production/files/2015-04/documents/final_316b_bo_and_appendices_5_19_2014.pdf.

U.S. Geological Survey (USGS). 2018. USGS 01670400 North Anna River near Partlow, VA. Accessed on June 8, 2018. https://waterdata.usgs.gov/nwis/inventory/?site_no=01670400&agency_cd=USGS.

Virginia Electric and Power Company (VEPCO). 1985. Impingement and Entrainment Studies for North Anna Power Station 1978-1983. Virginia Power Water Quality Department.

_____. 1986. North Anna Power Station Section 316 (a) Demonstration. Virginia Power Corporate Technical Assessment, Water Quality Department. Page 229. June.

Virginia Department of Environmental Quality (VDEQ). 2016. Draft 2016 305(b)/303(d) Water Quality Assessment Integrated Report. Accessed February 19, 2018. http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2016305b303dIntegratedReport.aspx

Virginia Department of Game and Inland Fisheries (VDGIF). 2016. Virginia Wildlife and Information Service Search Report [for a 2-mile radius surrounding North Anna Power Station]. Accessed June 2, 2016. https://vafwis.dgif.virginia.gov/fwis/?Menu=Home

_____. 2018. Virginia Wildlife and Information Service Search Report [for an area surrounding North Anna Power Station]. Accessed April 12, 2018. https://vafwis.dgif.virginia.gov/fwis/?Menu=Home

_____. Undated. VaFWIS Coordination Recommendations. Accessed June 27, 2015. http://www.dgif.virginia.gov/environmental-programs/files/VaFWIS-Coordination-Recommendations.pdf

Wiegel, R.L. 1964. Oceanographic Engineering, Prentice-Hall, Inc. Englewood Cliffs, NJ.

Wootton, R.J. 1990. Ecology of Teleost Fishes. London; New York: Chapman and Hall, 1990. 404 pp.

Appendix A

Dominion Energy's Report "North Anna Power Station as Closed-Cycle Recirculating System with Stocked and Managed Fisheries" and Personal E-mail Correspondence with Virginia Department of Environmental Quality

Dominion Resource Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
dom.com

BY U.S. MAIL
RETURN RECEIPT REQUESTED

September 9, 2015

Ms. Susan Mackert
Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, Virginia 22193

RE: Dominion North Anna Power Station VPDES Permit No. VA0052451
316(b) Regulation Implementation Request for Concurrence

Dear Ms. Mackert:

As you are aware, on October 14, 2014, the Environmental Protection Agency finalized regulations for cooling water intake structures at existing facilities pursuant to Section 316(b) of the Clean Water Act (CWA) (316(b) Rule). Virginia Electric and Power Company's (VEPCO or Dominion) North Anna Power Station (Station) is subject to the 316(b) Rule as a facility that uses cooling water intake structures with a design intake flow of greater than 2 MGD and uses more that 25% of the water for cooling purposes. The purpose of this letter is to:

1. Seek concurrence from DEQ regarding the application of the definition of "closed-cycle recirculating system" (CCRS) in the 316(b) Rule to the Station, and
2. Request waivers from certain studies (i.e., those defined at 40 CFR 122.21(r)(9) to (13)) as allowed by the 316(b) Rule.

The attached report provides the technical basis for our request. Thank you for your review and consideration of our request. Please contact Ken Roller at (804) 273-3494 or by email at

kenneth.roller@dom.com should you have any questions or concerns with this request and the submitted information.

Sincerely,

Cathy C. Taylor
Director, Electric Environmental Services

Attachment

North Anna Power Station as Closed-Cycle Recirculating System with Stocked and Managed Fisheries

Prepared for:
Dominion Resources Services, Inc.

Prepared by:
HDR Engineering, Inc.

September 9, 2015



Contents

1 Introduction 1
1.1 Background on the Facility and the Rule 1
2 North Anna Power Station as a Closed-Cycle Recirculating System 4
3 Walvers from Aspects of 40 CFR 122.21(r) 6
3.1 CCRS as a Basis for Entrainment Best Technology Available 7
3.2 Review of Lake Anna as a Stocked and Managed System 7
3.3 Review of the Federally Listed Species in Lake Anna 9
4 Precedent for Designation of WOUS as CCRS 12
5 Summary, Conclusions, and Request 12
6 References 13
7 Appendix A – Documents Related to Permitting of Lake Anna as Part of a Cooling Water System ... 14

Tables

Table 2.1 Inventory of Documents Related to Permitting of Lake Anna as Part of the Cooling Water System 5
Table 3.1 Recent DGIF Documents on the Fishery of Lake Anna and its Management 8

1 Introduction

The Environmental Protection Agency's final regulations for cooling water intake structures at existing facilities pursuant to Section 316(b) of the Clean Water Act (CWA) (316(b) Rule) became effective on October 14, 2014. Virginia Electric and Power Company's (VEPCO or Dominion) North Anna Power Station (Station) is subject to the 316(b) Rule as a facility that uses cooling water intake structures with a design intake flow of greater than 2 MGD and uses at least 25% of the water exclusively for cooling purposes. The purpose of this report is to provide the basis for Dominion to:

1. Seek concurrence from Virginia Department of Environmental Quality (DEQ) regarding the application of the definition of "closed-cycle recirculating system" (CCRS) in the 316(b) Rule to the Station, and
2. Request and provide justification for waivers from certain studies as allowed by the 316(b) Rule.

The remainder of Section 1 of this report will provide a brief introduction to the Station and relevant portions of the 316(b) Rule. Section 2 will summarize the permitting and construction of the Station and of Lake Anna as a CCRS. A summary of the stocking and management of the fisheries of Lake Anna is provided in Section 3. Section 4 summarizes some recent precedent for the designation of Waters of the United States (WOUS) as CCRS.

1.1 Background on the Facility and the Rule

The Station utilizes a CCRS which is comprised of Lake Anna and the Waste Heat Treatment Facility (WHTF[1]). The CCRS was created by impounding the North Anna River, clearing, excavating and grading the terrain encompassed by the CCRS, and engineering a series of berms and canals that direct the water through a circulatory pathway that allows dissipation of heat and reuses the cooling water. Construction and filling of Lake Anna and the WHTF was completed in 1972.

This discussion of the cooling water system for the Station under the 316(b) Rule is relevant to the two existing units. The designation of Lake Anna and the WHTF as CCRS does not change Dominion's plans for the cooling system (including the cooling water intake structure and the use of closed-cycle recirculating cooling towers) for North Anna Unit 3 as permitted through Virginia Water Protection (VWP) Permit 10-2001. The VWP Permit conditions for Unit 3 include 2 mm or less screen size, maximum through-screen velocity of 0.5 fps (feet per second), and operation of an evaporative (hybrid wet and dry) cooling tower.

[1] The WHTF is separated from Lake Anna by dikes and a spill way and is considered by the Virginia Department of Environmental Quality (VDEQ) to be a thermal effluent treatment system distinct from the lake. The routing of thermal effluent through the WHTF does not affect the status of Lake Anna as a CCRS under the Rule. The cooling water intake structure is located on Lake Anna.

The Station withdraws water from Lake Anna for condenser cooling and other Station processes through its cooling water intake structure located on Lake Anna. The cooling water exits the Station through a canal into the WHTF and there are no cooling water intake structures located in the WHTF. The WHTF is comprised of three lagoons which allow the water to cool prior to being recirculated to Lake Anna at Dike 3. Cooling water is recirculated, and eventually brought back into the Station for cooling through the cooling water intake structure. Aside from water losses from the CCRS (i.e., downstream discharges from the Lake Anna Dam, evaporation from the lake surface, and evaporation by the Station's Bearing Cooling Tower) cooling water flows are recirculated through Lake Anna for reuse in the Station. Releases from the Lake Anna Dam are regulated by the Station's Virginia Pollutant Discharge Elimination System (VPDES) permit No. VA0052451 through the "Lake Level Contingency Plan" and are controlled to target a lake level of 250.0 ft MSL for the operation of the Station. Such losses from CCRS that are WOUS are anticipated by the 316(b) Rule (see below).

The 316(b) Rule establishes information requirements and processes for determination of the Best Technology Available (BTA) to reduce impingement and entrainment associated with cooling water intake structures. Entrainment BTA decisions are made by the permitting agency (DEQ) based on information provided by the applicant and a series of 11 factors (see 40 CFR 125.98(f)(2) and (3)). For impingement compliance, the applicant must select from seven BTA options defined at 40 CFR 125.94(c).

CCRSs are established as BTA and a compliant technology for impingement compliance (40 CFR 125.94(c)(1)) and are identified as a potential technology for complying with entrainment BTA standards. The definition of CCRS includes impoundments of WOUS (40 CFR 125.92(c)(2)):

> *"Closed-cycle recirculating system also includes impoundments of water of the U.S., where the impoundment was constructed before October 14, 2014 and created for the purpose of serving as part of the cooling water system as documented in the project purpose statement for any required Clean Water Act section 404 permit obtained to construct the impoundment. In the case of an impoundment whose construction pre-dated the CWA requirement to obtain a section 404 permit, documentation of the project's purpose must be demonstrated to the satisfaction of the Director. This documentation could be some other license or permit obtained to lawfully construct the impoundment for the purposes of a cooling water system, or other such evidence as the Director finds necessary. For impoundments constructed in uplands or not in waters of the United States, no documentation of a section 404 or other permit are required. If waters of the United States are withdrawn for the purposes of replenishing losses to a closed cycle recirculating system other than those due to blowdown, drift, and evaporation from the cooling system, the Director may determine a cooling system is a closed-cycle recirculating system if the facility demonstrates to the satisfaction of the Director that make-up water withdrawals attributed specifically to the cooling portion of the cooling system have been minimized."*

Therefore, this definition provides two criteria for impounded WOUS to meet to be considered CCRS:

- Criterion #1: The impoundment was constructed prior to October 14, 2014; and
- Criterion #2: The impoundment was "created for the purpose of serving as part of the cooling water system" as documented in the Clean Water Act Section 404 permit or otherwise demonstrated to the satisfaction of the NPDES Director (i.e., DEQ as the VPDES Director).

In addition, the definition provides a clarification that is applicable when "waters of the United States are withdrawn for purposes of replenishing losses to a closed-cycle recirculating system other than those due to blowdown, drift, and evaporation from a cooling system". Based on review of documents related to the rule-making, the intention of this clarification is to allow the NPDES Director to focus on the cooling water portion of an impoundment's water balance in the case that water is pumped into the impoundment for other purposes such as agriculture, water level maintenance for habitat, manufacturing, etc. Given that Lake Anna does not rely on make-up water that is pumped from any other WOUS and is replenished solely from watershed runoff and direct precipitation, this clarification of the definition does not apply.

The preamble to the 316(b) Rule (i.e., the narrative that precedes the rule's changes to the Code of Federal Regulation) provides perspective on USEPA's decision to include some WOUS as CCRS. The preamble is unambiguous that the rule intends to include WOUS among CCRS and also explains how impounded WOUS reuse cooling water by their nature and consistent with their design. The preamble also states that USEPA has included this provision to allow "use of such lawfully created impoundments for their intended purpose" and avoid "a large number of stranded assets"[2]

The preamble's discussion of impounded WOUS as CCRS[3] is consistent with the construction and operation of Lake Anna:

> *"Impoundments are surface waterbodies that serve as both a source of cooling water and a heat sink. As with cooling towers, impoundments rely on evaporative cooling to dissipate the waste heat; a facility withdraws water from one part of the impoundment and then discharges the heated effluent back to the impoundment, usually in another location to allow the heated water time to cool. Depending on local hydrology, impoundments may also require makeup water from another waterbody. Impoundments can be man-made or natural, and can be offset from other water bodies or as part of a "run of the river" system (the latter are sometimes referred to as cooling lakes)."*

[2] 79 FR 48345. VI. Basis for the Final Regulation. G. Final Rule BTA Performance Standards. 1. Impingement Mortality Controls for Existing Units at Existing Facilities for the Final Rule. a. Closed-cycle Recirculating Systems.

[3] 79 FR 48333. VI. Basis of the Final Regulation. C. Technologies Considered To Minimize Impingement and Entrainment. f. Closed-Cycle Cooling Systems. iv. Impoundments.

The 316(b) Rule also establishes the availability of waivers from application information requirements in 40 CFR 122.21(r) that apply to certain impoundments:

- 40 CFR 122.21(r)(1)(ii)(B)[4] allows the permitting agency to waive information required under 40 CFR 122.21(r)(9) through (13) for facilities that intend to comply with BTA standards for entrainment using a CCRS, and
- 40 CFR 125.95(a)(3)[5] allows the permitting agency to waive some or all information required in 40 CFR 122.21(r) if the intake for a facility is (1) located in a manmade lake, (2) the lake's fisheries are stocked and managed and (3) the lake does not contain federally listed threatened and endangered species or designated critical habitat.

2 North Anna Power Station as a Closed-Cycle Recirculating System

The Station meets the definition of CCRS in the 316(b) Rule. As discussed above, the definition of CCRS in the 316(b) Rule includes impoundments of WOUS that were created for the purpose of serving as part of a cooling water system and where that purpose is documented by appropriate environmental approvals. Because the CCRS was constructed prior to the CWA requirement to obtain a section 404 permit, the 316(b) Rule requires VEPCO to provide alternate documentation that the impoundment was built for cooling purposes as described in the 316(b) Rule. Accordingly, the following attached documents are provided as documentation to demonstrate that the CCRS was lawfully constructed for the purpose of a cooling water system:

1) Submittals to and Approvals by the Virginia State Corporation Commission (SCC):
   a) VEPCO Application to SCC for the construction of the Lake Anna Dam and Impoundment: The application specifically states that the purpose of the impoundment is to provide for cooling water to the Station.
   b) SCC permit issued on June 12, 1969: Permit for dam and impoundment construction pursuant to the VEPCO application.

---

[4] *"Existing facilities greater than 125 mgd AIF. In addition, the owner or operator of an existing facility that withdraws greater than 125 mgd actual intake flow (AIF), as defined at 40 CFR 125.92 (a), of water for cooling purposes must also submit to the Director for review the information required under paragraphs (r)(9), (10), (11), (12), and (13) of this section. If the owner or operator of an existing facility intends to comply with the BTA (best technology available) standards for entrainment using a closed-cycle recirculating system as defined at 40 CFR 125.92(c), the Director may reduce or waive some or all of the information required under paragraphs (r)(9) through (13) of this section."*

[5] *"The Director may waive some or all of the information requirements of 40 CFR 122.21(r) if the intake is located in a manmade lake or reservoir and the fisheries are stocked and managed by a State or Federal natural resources agency or the equivalent. If the manmade lake or reservoir contains Federally-listed threatened and endangered species, or is designated critical habitat, such a waiver shall not be granted."*

c) SCC certificate issued January 5, 1970: Certificate for construction of the dam and Station.

2) Submittals to and Approvals by the Virginia State Water Control Board (SWCB):
   a) Memo presented to the SWCB at the June 4, 1968 meeting: provides a description of the proposed Station including the construction of the impoundment and WHTF for the purpose of serving as a cooling water system.
   b) VEPCO application for SWCB dated March 5, 1969: application details the purpose of the impoundment and WHTF for cooling purposes.
   c) SWCB Water Quality Certificates dated November 23, 1970, February 11, 1972, and August 29, 1973: Certificates issued pursuant to the above referenced application certifying that the project will not violate water quality standards.

Relevant descriptions and/or excerpts of these documents are provided in Table 2.1 while the complete documents are provided as part of Attachment A to this report.

Table 2.1 Inventory of Documents Related to Permitting of Lake Anna as Part of the Cooling Water System

Document	Attachment	Description and/or Excerpts
Virginia Electric and Power Company. Application for License to Construct Dam. Case No. 18669	A-1	"2 The Company hereby applies for a license to construct a dam across the North Anna River In Louisa and Spotsylvania Counties, Virginia, and associated dikes, approximately four miles north of the Town of Bumpass, Virginia, and approximately one-half mile upstream from the point at which Virginia 601 crosses the North Anna River .. 4. The dam will create a reservoir to provide cooling water for the North Anna Power Station to be constructed by the Company on the southern shore of the reservoir about 5 7 miles upstream from the dam, as shown on Exhibit 1 5 Reservoir water will be used primarily as a coolant to condense turbine exhaust steam, but will also be used for other miscellaneous station water requirements. . 9 The North Anna Power Station will be a nuclear generating station having an ultimate capacity of at least 4,000,000 KW . " *(Note. Capacity referenced is for original Units 1-4)*
Virginia SCC 1969 Application of Virginia Electric and Power Company. Case No. 18669. June 12, 1969	A-2	"It is therefore ordered that Virginia Electric and Power Company be licensed and authorized to construct, operate, and maintain a dam across the North Anna River between Louisa and Spotsylvania Counties and associated dikes substantially in accordance with general and preliminary maps, plans, and specifications provided in evidence in this proceeding ."
Virginia SCC 1970 Application of Virginia Electric and Power Company. Case No 18669. January 5, 1970.	A-3	"It is ordered· ... (b) That amended certificates of public convenience and necessity be issued to Virginia Electric and Power Company as follows . . (2) Certificate No ET-118c, for Louisa County, to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, including a proposed nuclear generating station and associated dam, . . ."
VA SWCB. Virginia Electric and Power Company Application for a Certificate for the Proposed North Anna Power Station. June 3,	A-4	"2. Treatment facilities to prevent thermal pollution of the North Anna River include the construction of an 11,000 acre impoundment on the North Anna River with three separate interconnected, heat dissipation impoundments being created by diking of three southwestern arms of the reservoir containing 3500 acres. Water will be withdrawn from the main reservoir, passed through the condenser tubes, discharged into the western most cooling reservoir, passed

Document	Attachment	Description and/or Excerpts
1968		through the other two cooling reservoirs and ultimately discharged into the main reservoir again." "On the basis of the Company's application and detailed review of the technical information with the Company's consultant, the staff recommends that the application submitted by Virginia Electric and Power Company, be approved and that the staff be directed to prepare a certificate for the Chairman's signature." *(Note: Acreage of Lake Anna is approximately 9,600 acres)*
Virginia Electric and Power Company North Anna Nuclear Generating Facility. Application to the VA SWCB for Certification of Project March 5, 1969.	A-5	The application describes the position and configuration of the WHTF and the reservoir
VA SWCB Water Quality Certifications Issued to Virginia Electric Power Company on November 23, 1970, February 11, 1972, and August 29, 1973. North Anna Nuclear Power Station	A-6	Water Quality Certifications that find that North Anna Units 1 and 2 including the WHTF and Lake Anna will protect VA water quality standards

As noted above, the definition of CCRS for impoundments of waters of the United States also includes a statement that the applicant must demonstrate that "make-up water withdrawals attributed specifically to the cooling portion of the cooling system have been minimized." However, the reference to "make-up water" in the definition of CCRS refers to facilities that "require make-up water from another waterbody" (Preamble, 79 FR 48333) and does not refer to condenser cooling water circulation such as occurs at the Station's cooling water intake structures. The Station does not withdraw water from another waterbody for make-up to the system. Therefore, the clarification regarding potential "make-up water" is not relevant to the designation of CCRS at the Station.

3 Waivers from Aspects of 40 CFR 122.21(r)

The 316(b) Rule establishes information requirements to support impingement and entrainment BTA decisions by the NPDES Director (e.g., the DEQ) in 40 CFR 122.21(r)(2)-(13). As discussed above, 40 CFR 125.95(a)(3) allows the permitting agency to waive some or all information required in 40 CFR 122.21(r) if the intake for a facility is (1) located in a manmade lake, (2) the fisheries are stocked and managed by a state or federal resource agency or equivalent and (3) the lake does not contain federally listed threatened and endangered species or critical habitat. As discussed below, the Station meets all of these requirements.

Lake Anna is a manmade lake and the fish populations in the lake have been established by stocking programs conducted by the Virginia Department of Game and Inland Fisheries (DGIF), the state fisheries resource agency, since 1972. DGIF has conducted stocking programs for various species over the years including largemouth bass, striped bass, hybrid striped bass, walleye, saugeye, channel catfish, blueback herring and threadfin shad. Currently, DGIF stocks Lake Anna with striped bass, hybrid striped bass and saugeye on an annual basis. In addition to the stocking program, DGIF actively manages the lake through harvest regulations informed by periodic creel surveys, electrofishing sampling, gill net sampling and other studies.

In addition to the DGIF stocking and management program, Dominion conducts aquatic studies in Lake Anna, the WHTF, and the North Anna River in accordance with VPDES permit requirements. Dominion's studies are conducted in accordance with a study plan that has been approved by DGIF. Additionally, Dominion provides annual data to DGIF for their use and coordinates regularly with DGIF staff on a variety of issues associated with the Lake Anna fishery. Additional information on the stocking and management of the fishery of Lake Anna is provided in Section 3.2.

There are no federally listed threatened or endangered species nor designated critical habitat in Lake Anna (see Section 3.3).

In addition to the allowance of waivers for a stocked and managed fishery, the 316(b) Rule also allows waiver of the information required under 40 CFR 122.21(r)(9) through (13) for facilities that intend to comply with BTA standards for entrainment using a CCRS. The Station intends to comply with BTA standards for entrainment as CCRS.

Based on both of the referenced waiver provisions, Dominion is seeking a waiver from the entrainment specific studies in 122.21(r)(9)-(13) as allowed under the rule's provisions at 40 CFR 122.21(r)(1)(ii)(B) and 125.95(a)(3). Dominion proposes to provide the information required in 122.21(r)(2)-(8) and plans to submit this information with Dominion's next VPDES permit application on or before November 8, 2018.

The following two subsections provide additional information relevant to the waiver requests.

3.1 CCRS as a Basis for Entrainment Best Technology Available

As discussed in Section 2, Lake Anna and the WHTF meet the rule's requirements for CCRS that is also a WOUS. Given that the CCRS provisions of the rule were clearly intended to allow continued operation of reservoirs created as CCRS, Dominion intends to pursue BTA for impingement mortality under 40 CFR 125.94(c)(1), use of a closed-cycle recirculating system, and pursue compliance with BTA standards for entrainment using a CCRS. Waivers for the analyses and reports defined at 40 CFR 122.21(r)(9) to (13) are consistent with Dominion's intent to comply with BTA standards for entrainment using the CCRS. Compliance with BTA standards for entrainment is also supported by the fact that Lake Anna is successfully stocked and managed by DGIF (see Section 3.2).

3.2 Review of Lake Anna as a Stocked and Managed System

This section provides additional details on the fisheries management efforts at Lake Anna by the DGIF and evidence that the fishery management program is successful. Evidence includes recent information published by DGIF itself, as well as data developed by Dominion, and

evidence of the public use of the resource. It should be noted that the use of Lake Anna as a recreational fishery was anticipated during the permitting of the system (see Attachment A5, page 3).

Table 3.1 presents documentation (in the form of DGIF websites) that summarizes the current status of the fishery of Lake Anna and the conformance of the fishery with DGIF's management goals.

Table 3.1 Recent DGIF Documents on the Fishery of Lake Anna and its Management

Document (Title Text is a URL)	Summary
Lake Anna - General Information[6] DGIF, 2015	An overview of the history of Lake Anna including its creation in 1972 with initial fish stockings in the same year. Initial stockings were of largemouth bass, redear sunfish, and channel catfish Subsequent stockings of channel catfish, largemouth bass (northern and southern strains), redear, striped bass, and walleye were made to improve and diversify the fishery Blueback herring and threadfin shad were successfully introduced in the 1980's to provide additional forage for pelagic (open-water) predators. Annual stockings of striped bass continue in order to maintain these fisheries (other species are self-sustaining)
Lake Anna - Fishing Opportunities[7] *DGIF, 2015*	Summary of the fishing opportunities for seven game species that are managed by DGIF. For example: "Lake Anna is a top bass fishing destination for anglers residing in central and northern Virginia This reservoir frequently is host to local and regional fishing tournaments, and for good reason, Anna consistently ranks in the top three statewide for numbers of citation largemouth bass Intensive fishing pressure is the norm at Anna, but this reservoir maintains very high catch rates and good numbers of fish in the 4-6-pound range "
Lake Anna 2013 Fishing Forecast[8] DGIF, 2015	This most recent fishing forecast indicates that 2012 surveys found record catch rates for largemouth bass and striped bass
Lake Anna - Biologist Reports[9] DGIF Reports for 2007 and 2010	Reports on the stocking and management activities as well as population metrics for several game and forage fish in Lake Anna.

Dominion contributes to information used by DGIF in the management of the Lake Anna's fishery. As required by the VPDES permit for the station, quantitative surveys of game and forage fish are performed and compared to historical averages (see, for example, Dominion 2015).

[6] http://www.dgif.virginia.gov/fishing/waterbodies/display.asp?id=11 (accessed August 15, 2015)

[7] http://www.dgif.virginia.gov/fishing/waterbodies/display.asp?id=11&section=fishing (accessed August 15, 2015)

[8] http://www.dgif.virginia.gov/fishing/waterbodies/display.asp?id=11&section=news (accessed August 15, 2015)

[9] http://www.dgif.virginia.gov/fishing/waterbodies/display.asp?id=11&section=reports (accessed August 15, 2015)

The following summarizes a set of observations provided in a summary of DGIF's 2014 fisheries management report for Lake Anna (Odenkirk, 2015):

- Largemouth Bass abundance, as indicated by electrofishing surveys, and the stock structure of Largemouth Bass were rated as "outstanding". Catch rates for all size classes of Largemouth Bass exceeded those obtained through the period of record (21 years). DGIF hypothesized the increased abundance of fish may be related to increased lake productivity, stable water levels and consistent recruitment of young fish into the larger size categories. Structural indices were above average, and were likely related to two strong (record) cohorts and the stability of the Largemouth Bass population over time.
- In contrast to the Largemouth Bass population, forage fish catch rates were low as indicated by gill net surveys. The abundance of Gizzard Shad was at an all-time low for the period of record (18 years). Catch rates for Threadfin Shad and Blueback Herring were also low, indicating predator stockings and abundance may be at or near saturation. Gill net surveys were also used to monitor Striped Bass (consistently stocked since the early 1980s) and hybrid Striped Bass (one-year experimental stocking in 2014). The combined Striped Bass and hybrid Striped Bass gill net catch was near average for Lake Anna. Results indicate fishing success for Striped Bass should continue to be good.
- DGIF monitoring of predator and prey fishes in Lake Anna is expected to continue and provide information that will allow DGIF to make adjustments to its management strategy as needed. The 2014 management recommendations for Lake Anna included continued monitoring via electrofishing and gill netting, continued stocking of Striped Bass, and continued evaluation of Striped Bass hybrids and Saugeye for several years.

Lake Anna successfully supports several fishing tournaments as indicated by the following URLs for different marinas located on the lake: Sturgeon Creek Marina[10], Anna Point Marina[11], and High Point Marina[12]. An overview of fishing in Lake Anna developed by Lake Anna Online is available at this URL: Lake Anna Online - Fishing[13].

Taken together, these references strongly support that the fishery of Lake Anna is successfully stocked and managed by DGIF to meet its goals of maintaining a robust recreational fishery and its forage base.

3.3 Review of the Federally Listed Species in Lake Anna

A desktop review to determine the federally listed species with the potential to occur in Lake Anna (Louisa, Orange, and Spotsylvania counties) was conducted on August 7, 2015 using the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPAC)

[10] http://sturgeoncreekmarina.com/tournaments.htm (accessed August 15, 2015)

[11] http://annapointmarina1.blogspot.com/p/fishing-tournaments.html (accessed August 15, 2015)

[12] http://www.highpointmarina.com/2015/05/tournament-info.html (accessed August 15, 2015)

[13] http://www.lakeannaonline.com/fishing.html (accessed August 15, 2015)

System (USFWS 2015). This review also considered a previous Endangered Species Act Section 7 consultation and review conducted for the Station and other documentation prepared for the site, as summarized below. The IPAC query indicated that the only aquatic federally listed species with the potential to occur in the Lake Anna area is the Dwarf Wedgemussel. However, the weight-of-evidence and prior evaluations by regulatory agencies including USFWS indicate that neither the Dwarf Wedgemussel nor any other federally listed aquatic species occurs in Lake Anna or the WHTF.

The Dwarf Wedgemussel has historically ranged in distribution in Atlantic slope drainages from New Brunswick, Canada through North Carolina. It has been documented in a variety of habitats, including small creeks and deep rivers in stable substrates that range from mixed sand, pebble and gravel, to clay and silty sand (USFWS 2007). Master (1986 as cited in Michaelson and Neves 1995) indicated that Dwarf Wedgemussels are absent from impoundments. Nedeau (2009) also noted the Dwarf Wedgemussel did not occur in lake habitats, though it has been observed in Vermont and New Hampshire in the upper end of run-of-river reservoirs where residual river velocities remain relatively strong.

USFWS (2007) indicates that the Dwarf Wedgemussel occurred in 70 sites at 15 major drainages. In Virginia, these drainages include the Middle Potomac River in Stafford County (Aquia Creek), the York River in Louisa (South Anna River) and Spotsylvania (Po River) counties, and Chowan River in Sussex, Nottoway, and Lunenburg counties (Nottoway River) (USFWS 2007). While part of the York River Watershed, the South Anna River and Po rivers are in different subwatersheds than Lake Anna. The South Anna River is a tributary of the Pamunkey River downstream of Lake Anna (i.e., the confluence of the North Anna and South Anna rivers form the Pamunkey River downstream of Lake Anna). The Po River is a tributary of the Mattaponi River, which enters the York River downstream of Lake Anna.

Extensive mussel surveys were conducted in 1972-1973, 1991, and 2004-2005 in the North Anna (downstream and upstream of Lake Anna), South Anna, and Pamunkey rivers (Lees 2005). Dwarf Wedgemussels were present at two of the South Anna sites in 1973, but was not encountered in the 1991[14] and 2004-2005 surveys; nor was it encountered during other, less extensive surveys that evaluated some of the same sites between 1991 and 2002 (Lees 2005). NRC (2010) also notes that Dwarf Wedgemussels were not observed in the North Anna River in pre-impoundment surveys.

Dominion conducted a site specific survey in 2008 at 22 sites on Lake Anna (located at upper, mid, lower, and Paumunkey Arm zones) and the Waste Heat Treatment Facility (WHTF) (in each of the three lagoons) (Dominion 2009). Three species of freshwater mussels were observed; Eastern Floater (*Pyganodon cataracta*), Eastern Elliptio (*Elliptio complanata*), and Pond Papershell (*Utterbackia imbecilis*) (Dominion 2009). No Dwarf Wedgemussels were found.

[14] Not all sites were surveyed in 1991. One of the two sites where Dwarf Wedgemussel was observed in 1973 was surveyed in 1991. Both sites where Dwarf Wedgemussel was initially observed in 1973 were surveyed in 2004-2005.

In 2005, NRC issued a *Biological Assessment of the North Anna Early Site Permit (ESP) Application,* which assessed the effect of site preparation and limited construction activities identified in the application for additional nuclear facilities at the North Anna Site. In the biological assessment, NRC (2005) concluded:

> "*The dwarf wedgemussel is known to occur in the South Anna River in Louisa County, VA (FWS 1993), but it has not been reported in the North Anna River or its tributaries. There are no rivers or streams on the proposed North Anna ESP site that are suitable habitat for the dwarf wedgemussel.*"
>
> "*There is no habitat for the dwarf wedgemussel on the North Anna ESP site, and the proposed site preparation activities would not have an effect on, or occur near, the North Anna River or any other potential habitat areas. Therefore, the staff concludes that the proposed action would have no effect on the dwarf wedgemussel.*"

In letter dated May 20, 2005, the USFWS provided its concurrence with NRC's 2005 biological assessment as follows:

> "*The dwarf wedgemussel is known to occur in the South Anna River in Louisa County and may occur in other streams and rivers in the county. However, because no appropriate habitat occurs on the power plant site, no impact to this species is expected to result from ESP activities.*"

In 2010, the NRC issued a supplemental environmental impact statement (SEIS) that considers and weighs the environmental impacts of constructing and operating a new nuclear unit (Unit 3) at the North Anna Power Station. In the SEIS, NRC (2010) concluded the following:

> "*No information was provided by Dominion on the presence or absence of Federally or State-listed aquatic species inhabiting streams potentially affected by construction of new transmission lines in the NAPS to Ladysmith transmission line right-of-way. The staff expects that future monitoring studies and subsequent management actions, such as the one proposed for mussels in Lake Anna by Dominion (2008b) will assist resource agencies in determining the potential of threatened and endangered species occurring in Lake Anna, the North Anna River, or their tributaries.*"

As stated above, the 2008 site-specific mussel surveys supported the conclusions provided in the 2005 NRC Biological Assessment (NRC 2005) and USFWS 2005 letter of concurrence. NRC (2013) issued "Draft Supplemental Information to the Biological Assessment North Anna Power Station Combined License Application" and concluded:

> "*Based on the results of the 2008 freshwater mussel survey and the lack of suitable habitat in the project area, the NRC staff concludes the proposed action would have no effect on the dwarf wedgemussel. This determination is consistent with the determination in the 2005 BA.*"

Based on the preceding, it is determined that no federally listed species or designated critical habitat occurs in Lake Anna.

4 Precedent for Designation of WOUS as CCRS

Dominion is aware of a number of cases where facilities similar to the North Anna Power Station and Lake Anna have successfully requested designation of a cooling water system as CCRS that utilizes a WOUS cooling impoundment. The most geographically relevant is SCANA's VC Summer Nuclear Station, located on Lake Monticello, South Carolina, which as been designated by the South Carolina Department of Health and Environmental Control as a CCRS. Some of the other cases have occurred in Texas where documentation evidenced that the reservoirs were designed, permitted, and constructed as part of the cooling system, and that the construction occurred prior to the effective date of the rule, allowing the Texas Commission on Environmental Quality (TCEQ) to designate the cooling water systems as a CCRS. Dominion is aware of another case in North Dakota in which the North Dakota Department of Health (NDDH) has reached a similar conclusion, although written confirmation is still pending.

5 Summary, Conclusions, and Request

The North Anna Power Station meets the definition of CCRS in the 316(b) Rule. Lake Anna and the WHTF were created in 1972 to dissipate waste heat from the Station. The permitting record is clear that the regulatory agencies understood that the lake would be created for this purpose. Therefore, Lake Anna and the WHTF meet the criteria for WOUS that is a CCRS. Dominion requests concurrence from DEQ regarding the application of the definition of CCRS in the 316(b) Rule to the Station.

A logical and reasonable outcome of the CCRS designation is that the cooling system at North Anna Station meets the BTA for impingement and can be evaluated for entrainment BTA under the rule. Additionally, the health of Lake Anna is strongly supported by the data available on the fishery of Lake Anna including its active management and stocking by DGIF. These conclusions were anticipated by the rule in the form of waivers from some or all of the requirements of the rule as described at 40 CFR 122.21(r).

Therefore, Dominion requests that DEQ waive the requirements of 40 CFR 122.21(r)(9) to (13) related to entrainment BTA for the North Anna Station. Dominion proposes to file the reports defined at 40 CFR 122.21(r)(2) to (8) as part of the next application for VPDES permit renewal.

6 References

Dominion Resources, Inc. (Dominion). 2009. A Survey for the Discovery of Freshwater Mussel Populations in Lake Anna, Louisa County and Hanover County, Virginia

Dominion. 2015. Environmental Study of Lake Anna, Waste Heat Treatment Facility, and the Lower North Anna River. Annual Report for 2014. Prepared by: Environmental Biology. Electric Environmental Services.

Lees, William Robert, "An investigation of the changes of species richness and distribution of the unionidae (Bivalvia: Molusca) within the Pamunkey Watershed" (2005). Master's Theses. Paper 662.

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.

Nedeau, E. 2009. Distribution, Threats, and Conservation of the Dwarf Wedgemussel (*Alasmidonta heterodon*) in the Middle and Northern Macrosites of the Upper Connecticut River. Report prepared for Vermont Fish and Wildlife Department and New Hampshire Fish and Game Department. Nuclear Regulatory Commission (NRC). 2005. Biological Assessment for the Early Site Permit (ESP) of the North Anna ESP Site and a Request for Informal Consultation.

Nuclear Regulatory Commission (NRC). 2005. Biological Assessment for the Early Site Permit (ESP) of the North Anna ESP Site and a Request for Informal Consultation.

NRC. 2010. Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3.

NRC. 2013. Draft Supplemental Information to the Biological Assessment North Anna Power Station Combined License Application. Docket No. 52-017.

Odenkirk, John. 2015. Email from John Odenkirk, Fisheries Biologist, DGIF to Bob Graham of Dominion Energy of August 17, 2015 providing a summary of the Lake Anna management recommendations and supporting observations.

U.S. Fish and Wildlife Service (USFWS). 2007. Dwarf Wedgemussel, *Alasmidonta heterodon*, 5-Year Review: Summary and Evaluation.

USFWS. 2015. IPAC Trust Resource Report [for Lake Anna Dam in Louisa, Orange, and Spotsylvania counties, Virginia]. Available online: https://ecos.fws.gov/ipac/. Accessed August 7, 2015.

Appendix A – Documents Related to Permitting of Lake Anna as Part of a Cooling Water System

A-1

Virginia Electric and Power Company. Application for License to Construct Dam. Case No. 18669

VIRGINIA:

BEFORE THE STATE CORPORATION COMMISSION

APPLICATION
VIRGINIA ELECTRIC AND POWER COMPANY CASE NO. 18669

APPLICATION FOR LICENSE TO CONSTRUCT DAM

1. Virginia Electric and Power Company (the Company) is a public service corporation organized and doing business under the laws of Virginia and is qualified to do business in West Virginia and North Carolina. Its principal business office is located at 700 East Franklin Street, Richmond, Virginia.

2. The Company hereby applies for a license to construct a dam across the North Anna River in Louisa and Spotsylvania Counties, Virginia, and associated dikes, approximately four miles north of the Town of Bumpass, Virginia, and approximately one-half mile upstream from the point at which Virginia Route 601 crosses the North Anna River. The locations of the dam and dikes are shown on Exhibit 1 attached hereto.

3. The Commission has jurisdiction to grant such a license under Chapter 7 of Title 62.1 of the Code of Virginia of 1950, as amended (Va. Code §62.1-80 through §62.1-103).

4. The dam will create a reservoir to provide cooling water for the North Anna Power Station to be constructed by the Company on the southern shore of the reservoir about 5.7 miles upstream from the dam, as shown on Exhibit 1. Anticipated load growth on the Company's system makes this additional generating capacity necessary. Present plans call for the first generating unit of the North Anna Power Station, capable of producing approximately 900,000 kw, to be placed in operation about March 1, 1974. The Company's load growth studies indicate that at that time the electric power produced by this station will be needed to satisfy the increased demands on the Company's system and its responsibilities under the CARVA Pool Agreement. Additional generating units will be added as required by system load growth.

5. Reservoir water will be used primarily as a coolant to condense turbine exhaust steam, but will also be used for other miscellaneous station water requirements. The water used as a coolant will be withdrawn from the reservoir, pumped through the power station and returned to the treatment lagoons, shown on Exhibit 1, which are created and separated from the main reservoir

by the dikes. While in the treatment lagoons, the water will lose most of the heat it absorbed while passing through the power station condensing equipment. The cooled water will be returned to the main reservoir through a submerged outlet in the easternmost dike. Upon its return to the main reservoir, this water will mix with the residual lake water with the result that, with the full development of at least 4,000,000 kilowatts, summer lake temperatures will be approximately four degrees fahrenheit above the normal ambient water temperature after mixing. On June 7, 1968, the Virginia Water Control Board approved this use of the reservoir water. A copy of the Board's approval is attached hereto as Exhibit 2.

6. The reservoir will be located in Louisa, Spotsylvania and Orange Counties. It will extend approximately 19 miles upstream from the dam site and will have a surface area of approximately 9600 acres.

A minimum reservoir elevation of 247 feet at the dam will be necessary to impound the 271,000 acre-feet of water (minimum operating pool) required to provide for heat transfer to the atmosphere when the project's ultimate generating capacity becomes operative. Reservoir operation studies indicate that, in addition, about 34,000 acre-feet of water will be needed for

power station operation and low flow augmentation of 40 cfs. This volume, added to the minimum operating pool, results in a normal operating pool elevation of 250 feet at the dam. An additional 68,000 acre-feet of storage capacity has been added to the reservoir design to allow for flood conditions. This capacity requires an additional 5 feet of reservoir elevation at the dam. The total volume of the reservoir is allocated as follows:

	Elevation Above Mean Sea Level At the Dam	Storage
Minimum Operating Pool (based on 40 cfs.)	247 Feet	271,000 acre-feet
Normal Operating Pool	247 Feet to 250 Feet	34,000 acre-feet
Flood Control Storage Capacity	250 Feet to 255 Feet	68,000 acre-feet
Total Storage Capacity	255 Feet	373,000 acre-feet

The above data regarding reservoir levels and storage is based upon the established minimum low flow augmentation release of 40 cfs., as approved by the State Water Control Board. Discussions have been held with the Virginia Department of Conservation and Economic Development relative to the

possibility of increasing this low flow augmentation to 60 cfs. The dam and associated works are designed to provide a minimum release of 60 cfs, but the elevation above mean sea level at the dam of the minimum operating pool would be decreased about 15 inches with a corresponding decrease in the acre-feet of storage for the minimum operating pool if a minimum of 60 cfs, rather than 40 cfs, were released.

7. As shown on Exhibit 3, the dam will consist of two compacted earth sections and a central concrete gravity spillway section and will have a total crest length of about 5,200 feet. The crest of the dam and spillway bridge will have an elevation of 265 feet, about 15 feet above normal pool and 10 feet above the maximum flood level. The dam will have a maximum height above stream bed of about 90 feet.

The two compacted earth sections of the dam will contain approximately 1,000,000 cubic yards of compacted earth materials. The typical cross section illustrated on Exhibit 3 will consist of a homogeneous type compacted fill provided with vertical chimney and horizontal downstream foundation drains constructed of select sand. Foundation seepage will be minimized by providing an impervious upstream blanket. Earthen slopes will be provided with riprap erosion protection when necessary and

other slopes will be seeded with grass. A service road will be constructed on the dam crest. The stability of the earthen dam will be assured through use of conservative design and construction procedures taking account all loads and forces to which the dam will be subjected. In all such calculations adequate safety factors will be maintained.

The concrete portion of the dam includes the spillway ogee, piers, apron and end walls to retain the earth fill at the spillway section. These structures will be designed to withstand all imposed loads with proper safety factors. The spillway ogee and piers will be designed as a unit to resist all loads as a gravity structure. A spillway apron will provide an area for energy dissipation of reservoir releases and will be designed to withstand the associated hydraulic forces. The concrete retaining walls will be gravity structures.

The spillway section will be about 200 feet long and will be founded on sound bedrock. It will contain about 50,000 cubic yards of concrete. Hydrologic studies have been made to establish the spillway capacity necessary to safely pass the flood created by a maximum probable storm centered in the water-shed. As a result of these studies, the spillway will be designed to pass about 100,000 cfs. when the reservoir water level

is 254 feet at the dam. To accomplish this three spillway bays, each 40 feet wide and having a crest at 219 feet, will be provided as shown on attached Exhibit 3. Individual hoists will be used for each main spillway gate. In addition to these gates, service outlets will be provided to pass normal reservoir releases. Provision will be made to assure that at least 40 cfs. is released at all times. Because the reservoir is to be operated to maintain an elevation of 250 feet whenever possible, it will be necessary to balance outflows with inflows and water uses. Therefore, normal reservoir releases will be greater than 40 cfs., and the mean annual release will be about 220 cfs. after installation of all contemplated generating units totaling at least 4,000,000 kilowatts.

In order to assure a full reservoir by the summer of 1973, which is necessary to supply water for preliminary operation of the first generating unit prior to its being placed in full service in the spring of 1974, construction of the dam must be completed by December of 1970.

8. The treatment lagoonswill have a surface area of approximately 3400 acres at an elevation of 251.5 ft. mean sea level. The water in the treatment lagoons will be separated from the main reservoir by three dikes, as shown on Exhibit 1 attached hereto.

Dike No. 3 will contain a submerged outlet through which the cooling water will be returned to the main reservoir. It will also include an emergency overflow section designed to accommodate the maximum probable flood from the drainage area of the lagoons.

The dikes separating the lagoons from the reservoir will be constructed of rockfill and/or compacted random fill with riprap erosion protection as shown on attached Exhibits 4A, 4B and 4C. Dike No. 3 will also be designed to carry a public road if the need for such a road is established. All dikes will be designed to withstand all imposed loads with proper safety factors.

9. The North Anna Power Station will be a nuclear generating station having an ultimate capacity of at least 4,000,000 KW. The station will be subject to the jurisdiction of the Atomic Energy Commission and will be designed and constructed to meet the requirements of that Commission. Application for a construction permit for the initial phase of the project will be filed with the A.E.C. in the near future. The nuclear reactors will be essentially identical to those now under construction by the Company at its Surry Power Station.

10. The drainage area of the North Anna River above the dam site is approximately 343 square miles. A review of the

available hydrologic information indicates that the mean annual inflow to the reservoir will be about 300 cubic feet per second (cfs.). Based on stream flow records at Doswell, Virginia, about 15 miles downstream, it is estimated that the maximum flood of record at the dam site, in April, 1937, was about 15,000 cfs. The minimum daily flow at the site was less than 1 cfs on several consecutive days in September and October, 1932.

11. The North Anna River flows southeastward from the dam site and forms the boundary between Hanover County and Caroline County. Approximately 50 miles downstream from the dam site the North Anna River joins the South Anna River to form the Pamunkey River. The Pamunkey is the boundary between Hanover County and Caroline and King William Counties and between King William County and New Kent County. The Pamunkey River becomes tidal approximately 38 miles downstream from the confluence of the North Anna and South Anna. After becoming tidal, the Pamunkey flows approximately 51 miles to West Point, Virginia, where it joins the Mattaponi River to form the York River. The area through which the North Anna and Pamunkey flow between the dam site and West Point is rural. West Point is the first center of population downstream from the dam site, and because the Pamunkey becomes tidal before reaching West Point the effect of the proposed dam

on the stream at West Point will be negligible.

12. Construction of the dam is expected to begin immediately upon the granting of a license and to be completed about December 1, 1970. The Company has already acquired part of the land to be occupied by the dam and reservoir. The remaining land necessary for the project will be obtained by purchase or by exercise of the right of eminent domain.

13. Approximately 8.1 miles of roads and several bridges will be covered when the reservoir is filled. The Company has submitted to the State Highway Department a plan proposing new locations for certain roads and bridges affected by the reservoir. The Company is consulting with the Highway Department and will consult with the Board of Supervisors of each county affected and will pay for such relocation work as is made necessary by the filling of the reservoir.

The dam and reservoir will not interfere with any railroad.

14. The Company is financially able to construct and operate the proposed project. The dam, reservoir, lagoons, dikes, and roads will cost approximately $28,200,000 and the initial generating facilities will cost approximately $191,800,000. Both will be financed in part by internally generated funds and

in part by funds obtained through the sale of securities. Attached as Exhibit 5 is the Company's Condensed Financial Statement dated November 1968.

15. The Company submits that the project described above will provide for the greatest practicable extent of utilization of the North Anna River, that the Company is financially able to construct the proposed dam and works, that the general public interest will be promoted thereby, and that the proposed project satisfies in all other respects the criteria set forth in Chapter 7 of Title 62.1 of the Code of Virginia of 1950, as amended.

WHEREFORE the Company asks that the Commission grant a license to construct the proposed dam and associated works.

VIRGINIA ELECTRIC AND POWER COMPANY

By John M. McGurn
John M. McGurn, President

(NOTE: All exhibits referred to in this application as being attached accompany the record of this case with the exhibits filed with the evidence)

Hunton, Williams, Gay,
Powell & Gibson
700 East Main Street
P. O. Box 1535
Richmond, Virginia 23212

A-2

Virginia SCC. 1969. Application of Virginia Electric and Power Company. Case No. 18669. June 12, 1969.

AT RICHMOND, JUNE 12, 1969

APPLICATION OF

VIRGINIA ELECTRIC AND POWER COMPANY CASE NO. 18669

For a license to construct a dam across the North Anna River in Louisa and Spotsylvania Counties and associated dikes under Chapter 7 of Title 62.1 of the Code of Virginia.

THE APPLICATION herein was heard on March 4 and 5, 1969 and taken under advisement, it appearing that the notice to the public required to be published by the Commission's order of January 30, 1969, had been given as required by that order, and that a copy of the application herein and the exhibits therewith and a copy of the Commission's order of January 30, 1969 had been filed with the Director of Conservation and Economic Development of the Commonwealth of Virginia within ten days after filing said application with the Commission. On April 2, 1969, the Commission entered an order setting an additional hearing in this proceeding for May 1, 1969. By order of April 15, 1969 the May 1, 1969 hearing date was changed to May 21, 1969. Further hearings were held on May 21, 22, and 23, 1969. At the hearings in March and May the applicant was represented by George D. Gibson, Evers B. Brasfield, Guy T. Tripp, III, and Turner T. Smith, Jr., its counsel; intervenors were represented by S. Page Higginbotham, counsel for certain landowners, C. Pembroke Pettit for the Louisa County Board of Supervisors, H. H. Whitlock for the Town of Mineral, Mineral Industrial Development Corporation, and Louisa County Industrial Development Corporation; the Commission was represented by its counsel. At the hearings in May additional intervenors were represented: C. Champion Bowles, Jr., counsel for the Town of Louisa, W. Randall Lipscomb, Jr. for New Kent County, Malcolm E. Ritsch, Jr. for Louisa County Water Authority, and D. Nelson Sutton, Jr. for The Chesapeake Corporation of Virginia.

NOW ON THIS DAY the Commission having considered the application filed herein and the evidence introduced in this proceeding and having weighed all of the [illegible]

disadvantages from the standpoint of the State as a whole and the people thereof and having made appropriate investigation as to the effect of the proposed construction upon cities, towns and counties and upon the prospective development of other natural resources and the property of others, a majority of the Commission is of the opinion and finds from all the evidence in this proceeding, in pursuance of the policy of the State of Virginia as expressed in Chapter 7 of Title 62.1 of the Code of Virginia (1950):

(1) That the plans of the applicant provide for the greatest practicable extent of utilization of the waters of the State for which this application is made;

(2) That the applicant is financially able to construct and operate the proposed dam and associated works;

(3) The general public interest will be promoted by the consummation of the proposed project; and

(4) That the applicant should be licensed pursuant to Chapter 7 of Title 62.1 of the Code of Virginia (1950) for the term therein specified to construct a dam across the North Anna River in Louisa and Spotsylvania Counties, Virginia and associated dikes substantially in accordance with the general and preliminary maps, plans and specifications set forth in the application and the exhibits and evidence in this proceeding, but subject to the limitations, restrictions, requirements and rights reserved to and on behalf of the Commonwealth of Virginia in Chapter 7 of Title 62.1 of the Code of Virginia (1950) and to all of the conditions, restrictions, limitations and requirements set forth in this order.

IT IS THEREFORE ORDERED that Virginia Electric and Power Company be licensed and authorized to construct, operate and maintain a dam across the North Anna River between Louisa and Spotsylvania Counties and associated dikes substantially in accordance with the general and preliminary maps, plans and spec-

evidence in this proceeding for the term and subject to the restrictions imposed by Chapter 7 of Title 62.1 of the Code of Virginia (1950).

IT IS FURTHER ORDERED that the license and authority herein granted be subject, in addition to those imposed by law, to the following conditions, limitations and restrictions:

(1) The licensee shall at all times discharge a flow of water through the dam for low flow augmentation in the amount of at least forty cubic feet per second (40 cfs).

(2) During the period when the reservoir is being filled, the licensee shall at all times release a flow of water through the dam of not less than one hundred and fifty cubic feet per second (150 cfs) during the months of February through June in 1971 and 1972 unless otherwise ordered by the Commission.

(3) That the maps, plans and specifications, submitted with and as a part of the application for the license, be approved and made a part of the license, and no substantial change shall hereafter be made in said maps, plans and specifications until such change shall have been approved by the Commission.

(4) That the proposed construction shall be commenced before the expiration of two years from the date of this order, unless such time be extended; and that the project be completed before the expiration of five years from the date of this order, unless such time be extended.

(5) That this proceeding be continued generally on the docket of the Commission for such other and further action as the Commission may take herein.

(6) That an attested copy hereof be sent to the applicant as and for the license herein granted, and an attested copy be sent to counsel for each of the parties appearing herein, and to the Chief Engineer-Electric Utilities of the Commission.

HOOKER, Commissioner, dissents for the reasons stated in the memorandum filed herewith.

STATE CORPORATION COMMISSION
RICHMOND

June 12, 1969

APPLICATION OF VIRGINIA ELECTRIC AND POWER COMPANY

CASE NO. 18669

HOOKER, Commissioner, Memorandum of Dissent:

As to the elevation of the reservoir and the lagoons, I am of the opinion that a reservoir elevation of 240 feet above mean sea level (10 feet lower than proposed) and a lagoon of approximately 245 feet (6½ feet lower than that proposed) will meet every requirement of the applicant.

Counsel for the applicant, in his closing argument, stated that while not forsaking his original position, as an alternative, that 241 feet for the dam and 251 feet for the lagoon would be acceptable. This would result in an increase in the maximum drawdown of slightly in excess of one foot and will not have any adverse effect on recreation.

It is obvious that a 10 foot reduction in the height of the dam (which is a mile wide) would reduce the cost of construction substantially. The Commission is obligated to require utilities to operate as economically as possible.

The Commission certainly should not approve a higher dam than is needed to meet the reasonable requirements of the applicant. The ultimate effect of this decision is to give to the applicant the right to exercise the power of eminent domain. The law of eminent domain is a drastic law and should never be permitted to be exercised unless it is an absolute necessity required to adequately meet the demands of the public.

NORTH ANNA ENVIRONMENTAL PERMIT

(A) License, Permit, Etc. Name: To Construct Railroad Grade Crossings over Virginia Routes 618, 700 and 652, Louisa Count and to trim trees on Route 700 in connection therewith.

(B) Government Agency from which it must be obtained:

State Highway Department and County of Louisa

(C) Statutory or Regulatory Authority:

Code of Virginia §§ 56-23, 56-24, 56-27

(D) Environmental effects(s) to which directed:

Land Use

(E) Issuance and duration:

(1) If issued, date and term of effectiveness:

a. Permit Number 7-32578 issued 11-17-69, extended to 10-17-70 and 3-27-71
b. County approval obtained 8-20-69

(2) If not yet obtained, status of efforts to obtain, expected date of issuance:

(F) Whether or not obtained, set forth date or projections showing compliance or how compliance will be accomplished.

Work completed in accordance with State Highway Department and Louisa County Board of Supervisors terms.

A-3

Virginia SCC. 1970. Application of Virginia Electric and Power Company. Case No. 18669. January 5, 1970.

AT RICHMOND, JANUARY 5, 1970

CASE NO. 11055

Application of

VIRGINIA ELECTRIC AND POWER COMPANY

For Amended Certificates under Utility Facilities Act

INSTITUTING SUPPLEMENTAL PROCEEDING
AND GRANTING AMENDED CERTIFICATES

CAME the applicant on December 24, 1969, and presented its supplemental application No. 19, executed and verified on December 24, 1969, by T. Justin Moore, Jr., Executive Vice President, setting forth in Schedule A certain additional electric transmission lines and other facilities, including a proposed nuclear generating station, the locations of which are shown on the revised maps filed with said supplemental application No. 19, and requested appropriate amended certificates therefor;

ON CONSIDERATION WHEREOF, the Commission being of the opinion that appropriate amended certificates should be issued to the applicant covering the proposed additional transmission lines and other facilities, including a proposed nuclear generating station in Louisa County and associated dam in Louisa and Spotsylvania Counties as set forth in said supplemental application No. 19; accordingly,

IT IS ORDERED:

(a) That the aforesaid supplemental application No. 19, and maps therewith, be filed, and a supplemental proceeding under the Utility Facilities Act be instituted, docketed and set for immediate informal consideration;

(b) That amended certificates of public convenience and necessity be issued to Virginia Electric and Power Company, as follows:

(1) Certificate No. ET-82c, for Gloucester County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, as shown on map attached thereto; which said Certificate No. ET-82c is to cancel and replace Certificate No. ET-82b, issued on June 30, 1959;

(2) Certificate No. ET-117c, for Louisa County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, including a proposed nuclear generating station and associated dam, as shown on map attached thereto; which said Certificate No. ET-117c is to cancel and replace Certificate No. ET-117b, issued on March 31, 1964;

(3) Certificate No. ET-93e, for Mecklenburg County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, as shown on map attached thereto; which said Certificate No. ET-93e is to cancel and replace Certificate No. ET-93d, issued on July 16, 1968;

(4) Certificate No. ET-94c, for Middlesex County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, as shown on map attached thereto; which said Certificate No. ET-94c is to cancel and replace Certificate No. ET-94b, issued on March 31, 1964;

(5) Certificate No. ET-99c, for Orange County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, as shown on map attached thereto; which said Certificate No. ET-99c is to cancel and replace Certificate No. ET-99b, issued on March 31, 1964;

(6) Certificate No. ET-108h, for Rockingham County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, as shown on map attached thereto; which said Certificate No. ET-108h is to cancel and replace Certificate No. ET-108g, issued on March 27, 1967; and

(7) Certificate No. ET-111b, for Spotsylvania County - to operate present transmission lines and facilities, and to construct and operate proposed transmission lines and facilities, including a portion of the proposed dam associated with the nuclear generating station to be constructed in Louisa County, as shown on map attached thereto; which said Certificate No. ET-111b is to cancel and replace Certificate No. ET-111a, issued on June 26, 1963.

(c) That an attested copy of this order, together with the amended certificates, with maps attached, be sent to the applicant in care of T. Justin Moore, Jr., Executive Vice President; and that an attested copy of this order be sent to George D. Gibson, of Counsel, for files of Counsel.

A True Copy

Teste: William B. Young

Clerk of State Corporation Commission

A-4

VA SWCB. Virginia Electric and Power Company. Application for a Certificate for the Proposed North Anna Power Station. June 3, 1968.

STATE WATER CONTROL BOARD

P. O. BOX 11143 Richmond, Va., 23230

IV-6 MEMORANDUM FOR AGENDA OF June 4, 1968 BOARD MEETING

SUBJECT: Virginia Electric and Power Company - Application for a Certificate for the Proposed North Anna Power Station

TO: Board Members

FROM: C. F. Cooley and E. P. Sutherland

DATE: June 5, 1968

By letter of April 8, 1968, Mr. J. D. Rishroch, Manager - Power Production of the Virginia Electric and Power Company, submitted an application to discharge such wastes as may be incurred by the installation operation and maintenance of five units at a site located in Louisa County, Virginia.

Discussion of Proposal

1. The Company has proposed that a Nuclear Power Generating Station be located near the head waters of the North Anna River in Louisa and Spotsylvania Counties. The primary water quality issue concerning the proposal centers around the threat of potential thermal pollution as resulting from the discharge of approximately 1600 cfs of condenser cooling water from each power producing unit which will be passed through the plant at maximum load.

2. Treatment facilities to prevent thermal pollution of the North Anna River include the construction of an 11,000 acre impoundment on the North Anna River with three separate interconnected, heat dissipation impoundments being created by diking of three southeastern arms of the reservoir containing 3500 acres. Water will be withdrawn from the main reservoir, passed through the condenser tubes, discharged into the western most cooling reservoir, passed through the other two cooling reservoirs and ultimately discharged into the main reservoir again. The maximum temperature under the most adverse conditions is expected to be no more than 90°F at the point of discharge and it is expected that this 90°F water will be rapidly mixed and dissipated in the main body of the reservoir itself. Maximum temperature for the reservoir outside the immediate area of the outfall is not expected to exceed 87°F in July, which is the most critical month. Other waste sources including radiological ones are insignificant or will be adequately monitored and treated. Potential radiological wastes will be eliminated or monitored in accordance with AEC standards.

3. In addition to providing protection to the River from thermal pollution effects, the impoundment on the North Anna River should exert a positive influence on water quality throughout the Pamunkey River Basin.

4. It is proposed that the reservoir be operated so that the minimum flow released from the impoundment will be 40 cfs, a substantial increase over the minimum flows to be expected in the North Anna and Pamunkey River at the present time. Figure 1 shows the expected effects of flow augmentation on the North Anna River. It can be seen that the 40 cfs will result in a 50 to 300 per cent increase in the minimum mean, 7-day consecutive drought flow with a ten year recurrence at various downstream gaging stations. The impact of this increased dilution flow on increasing the assimilation capacity of the North Anna - Pamunkey River system cannot be over-emphasized and should result in significantly reduced waste treatment requirements in Hanover County and King William County.

Results of Technical Conference

On May 24, 1968, the staff held a conference with the owner and his consultant to discuss in detail the design bases for computation of the efficiency of the cooling or heat dissipation reservoir system proposed for the plant.

The consultant reviewed in detail the equations and basic assumptions used in his analysis for computing the efficiencies of the heat dissipation ponds. The methodology, which involves iterative analysis, is identical to that outlined in a publication entitled "Pond Cooling for Steam - Electric Generating Stations", December 1961, Stone and Webster Corporation. The calculation of the isotherms of the effluent jet in the main reservoir was based on the publication "Surface Discharge of Horizontal Warm Water Jet" by Jen, Wiegel, and Masenau, Journal of the Power Division (JPOD), ASCE, April 1965.

Climatological and meteorological assumptions were based on data outlined from the U. S. Weather Bureau Station at Richmond and from official U. S. Weather Bureau Publications. The assumption that the entire volume of the ponds could be effectively utilized in the dissipation of heat energy is based on VEPCO's operating experience at the Mount Storm Power Generating Station. The use of monthly averages for climatological data was justified on the basis of the relatively long term detention time in the storage reservoir system.

COMMENTARY

The staff is of the opinion that the assumption made and the calculations used in evaluating the heat dissipation capacity and thermal-profile of the North Anna Nuclear Power Station Reservoir System are soundly based and conservative in their estimates.

This application was advertised in the Richmond Times-Dispatch and Newsleader and the Central Virginian newspapers. This advertising elicited two inquiries or general requests for information and neither expressed a, the staff.

STAFF RECOMMENDATIONS

On the basis of the Company's application and a detailed review of the technical information with the Company's consultant, the staff recommends that the application submitted by Virginia Electric and Power Company, be approved and that the staff be directed to prepare a certificate for the Chairman's signature.

GECKER:ms/ms

A-5

Virginia Electric and Power Company. North Anna Nuclear Generating Facility. Application to the VA SWCB for Certification of Project. March 5, 1969.

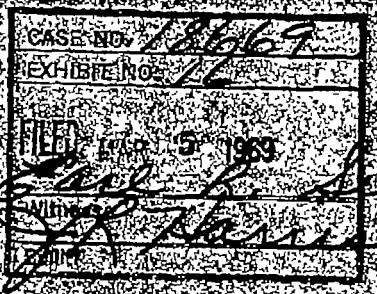
NORTH ANNA NUCLEAR GENERATING FACILITY

APPLICATION TO THE

VIRGINIA STATE WATER CONTROL BOARD

FOR

CERTIFICATION OF PROJECT



SITE

The station site is tentatively located in Louisa County, with the reservoir extending into Louisa, Spotsylvania and Orange Counties and will contain approximately 11,000 acres. Exhibits 1, 2 and 3 show the approximate location of the project.

PROPOSED RESERVOIR

The proposed dam would be constructed of compacted earth with concrete spillway to about elevation 250 MSL or about 95 feet above the stream bed. The dam will have a length of about 3,000 feet with a concrete spillway of approximately 250 feet and a service outlet to pass minimum flow requirements. The reservoir as contemplated will have a surface area of approximately 11,000 acres with a depth of about 80 feet at the dam. An area capacity curve of the proposed reservoir is shown in Exhibit 4.

HYDROLOGY OF NORTH ANNA RIVER

The North Anna River at the dam site drains approximately 343 square miles. The nearest gage, about 15 miles below the site at Doswell, has very good records back to 1928 and represents a drainage area of 439 square miles. The record discloses that the minimum flow of record is 1 cfs and occurred in September and October of 1932. The seven day low flow with a return frequency of once in ten years is 9 cfs. The maximum flow of record is 18,300 cfs, which occurred in April of 1937.

DOWNSTREAM FLOWS

Preliminary calculations disclose that it will be possible to re-regulate the North Anna River at the dam by passing at all times a minimum flow of 40 cfs. This re-regulation will be of inestimable value to downstream property owners, for it will greatly improve minimum flow conditions.

Approximately 70 per cent of the time, reservoir releases will exceed the proposed 40 cfs minimum, yet even in adverse water years similar to the drought years in the 1930's, the maximum pool drawdown with 40 cfs regulated discharge would only be about 3 feet, which would not greatly affect the recreational possibilities of the reservoir. The proposed generating facility would be designed to operate under these conditions.

WASTE HEAT TREATMENT FACILITIES

Exhibit 2 attached shows the reservoir and tentative location of the dam and power station. It also shows a series of treatment lagoons which are not a part of the reservoir, but are waste treatment facilities designed to allow cooling of the heated discharges from the facility. The area of these lagoons approximates 3,500 acres.

Preliminary studies indicate that the use of these treating facilities will enable the discharge of cooling waters back into the reservoir at approximately 10° F above ambient water temperatures under the most severe conditions of summer temperatures with maximum generation of over 4,000,000 kilowatts by the station at 100% of capability. These slightly warmer waters will spread over the surface of the receiving reservoir and will rapidly dissipate the excess temperature to the atmosphere and/or mix with the receiving waters. Under conditions of more favorable climatic conditions and lesser generation, the discharged waters will have lower temperatures than stated.

RECREATION

A reservoir of 11,000 acres with a shoreline of about 105 miles, situated near the center of a triangle formed by Richmond, Charlottesville and Fredericksburg, would be a boon to fishing and water sports of all kinds. Water level fluctuation in the reservoir would approximate only three feet under the most adverse prolonged drought conditions.

Under present design concepts, the facility will pass approximately 4% of the available reservoir volume through the condensers each day, after full development of the project to 4,000,000 kilowatts. In addition, intake design velocities will be approximately 1 foot per second, which should minimize the possibility of any fish being drawn into the cooling system. These proposed design criteria should eliminate or, at worst, minimize any possible damage to aquatic life.

APPLICATION FOR CERTIFICATION OF WASTE DISPOSAL FACILITIES NORTH ANNA UNITS ONE THROUGH FIVE

In accordance with the Water Control Law of the Commonwealth of Virginia, we are hereby submitting formal application to discharge such wastes as may be incurred by the installation, operation and maintenance of five units at a site located in Louisa County, Virginia. Exhibits 1, 2 and 3 are attached showing the location of this site.

Description of Facility

The proposed installation will have a capability of at least 4,000,000 kilowatts. Present plans call for commercial operation of Unit Number One in 1974. Succeeding units will be added as system growth dictates.

Unit Number One will consist of a pressurized water nuclear reactor and 815,000 kilowatt capability turbine-generator. Following are details of water requirements for the initial unit in the five unit station.

1. Water Consumption

It is anticipated that at full load, the unit will require approximately 1,600 cfs of reservoir water for condenser and miscellaneous cooling. In addition, approximately 2000 gpd of well water will be required for sanitary purposes.

2. Water Supply

It is planned to impound the North Anna River as shown on the attached Exhibit 2 to form a reservoir of approximately 11,000 surface acres.

A minimum flow of 40 cfs will be released from the impoundment, regardless of reservoir level, for downstream benefits.

3. Body of Water Into Which Wastes Will Discharge

Liquid wastes will be discharged back to the reservoir through the circulating water outfall.

4. Liquid Industrial Waste

The condenser cooling water will be discharged into a series of treatment lagoons as shown on Exhibit 2. The surface area of the lagoons approximates 3,500 acres. At the point where the treated effluent enters the reservoir, a submerged weir will be placed to insure that the warmer waters will be spread over the surface to allow for maximum heat transfer to the atmosphere.

The following are estimated station inlet and treatment lagoon effluent conditions:

	Station Inlet	Treatment Lagoon Discharge
Source	Reservoir	Reservoir
Treatment	None	None
Frequency of Discharge	Continuous	Continuous
Rate of Flow, Cfs	1600	1600
Temperature, ^{o}F at Max. Load	46-89*	50-99*

* For 4,000,000 kw station capability

It is estimated that the following variation of temperatures in the storage reservoir throughout a normal year will occur with the station at 4,000,000 kilowatt operation.

May	June	July	Aug.	Sept.	Oct.
78	85	89	86	81	68

Under most severe conditions, approximated in a summer following a 32 month drought and 4,000,000 kw load, the temperatures in the reservoir should not exceed 93^{o} F in July, except in a localized mixing zone area adjacent to the out-fall of the waste heat treatment facilities. Exhibit 5 is a plat showing estimated iso-therms.

B. Yard Drains

The drainage of the station area, consisting of natural precipitation, will drain into the circulating water outfall. The drainage from the remainder of the site will continue to drain to the reservoir by natural routes.

C. Flash Evaporator Blowdown

The make-up water flash evaporator blowdown will be approximately 50 gpm and will represent three to five concentrations of reservoir water in chemical composition.

D. Demineralizer Wastes

A mixed bed polishing demineralizer will follow the flash evaporator. It is estimated that this demineralizer will require regeneration once each 30 days.

The regeneration chemicals, composed of 155 gallons of 5% sulfuric acid and 225 gallons of 4% sodium hydroxide combined with approximately 3000 gallons of demineralized rinse water, will be blended and slowly discharged into the circulating water outfall.

E. Secondary Loop Blowdown

The anticipated volume and character of this blowdown is:

Flow	Continuous
Gallons Per Minute	15
PH	9.3 - 9.7
Total solids, ppm	5 - 15
Phosphates, as PO_4, ppm	3 - 5

This blowdown will be discharged to the circulating water discharge canal. In the unlikely event that this blowdown becomes radioactive, it will be diverted to the liquid waste disposal system.

F. Liquid Waste Disposal System (Possible Radioactive)

The liquid waste disposal system of radioactive wastes will be so designed that little or no radioactive wastes will be discharged to the reservoir. In any case, such discharge will be well below Federal regulation 10 CFR-20.

Exhibit 6 is a flow diagram of a typical liquid waste disposal system for two units. Exhibit 7 is a schematic flow sheet of the source of liquid wastes.

Disposable station liquids, either radioactive or potentially radioactive, are classified according to activity and enter the liquid waste disposal system high level header or low level header. Waste liquids which have significant activity are collected by the high level header.

High level header liquids are collected in a tank, and are from time to time processed by an evaporator system. The evaporator system liquid product is decontaminated clean water. The radioactive components are concentrated and disposed of as solid waste.

Low level header drains are essentially non-radioactive and include such things as the high level evaporator discharge, laundry, shower and laboratory drains. They will be collected in tanks on a batch basis until their activity is established.

In the event they are radioactive, they will be forwarded to the high level system for processing or if non-radioactive, they will be blended with the discharge flow from the service water system.

The combined high level and low level non-radioactive treated wastes will vary from 0 to 59 gpm and will be significantly diluted by the service water and circulating water system flow prior to discharge at the outfall.

A pre-operational environmental radioactivity monitoring program will be conducted in order to determine the magnitude of the radioactivity in the environment surrounding the nuclear reactor site and to study fluctuations in the radioactivity levels prior to the operation of the nuclear power station. The information obtained will serve as a guide and baseline in evaluating any changes in environmental radioactivity levels that may possibly be attributed to Station operations.

Sampling stations and sites will be selected on the basis of population density, meteorological, hydrological, and topographical conditions.

A comprehensive sampling program will be initiated at least two years prior to station startup and include such items as: type of samples, number, frequency of collection and method(s) of analysis. The collected samples will consist of water (rain, river, well and reservoir), silt, soil, vegetation, air particulate, animal, fish and plankton. Sample radioactivity analyses, based on the type of sample and information desired, will include one or more of the following: Gross Alpha, Gross Beta, Gross Beta-Gamma, Potassium-40, Iodine-131, Strontium-90 and others as appropriate. The program will be reviewed periodically to assure maximum effectiveness.

The post-operational environmental program will be similar to the pre-operational program with the sampling and analyses schedule remaining essentially the same. Results will be evaluated to insure the effectiveness of station radiation control and compliance with all regulatory agencies. This program will also be periodically reviewed and revised as required.

In developing this program, we are fortunate in having on our staff several of those persons who originated and conducted a similar program at the CVTR Station at Parr, South Carolina and are conducting a similar survey in connection with our Surry Station. In addition, we will also engage the services of the International Chemical and Nuclear Corporation, Pittsburgh, Pennsylvania, or other consulting firms of equal capabilities who are recognized specialists in this area of technology. We also plan to consult with the Virginia State Department of Health.

G. Drinking and Sanitary Water

Drinking and sanitary water will be derived from wells on the property.

H. Sanitary Sewage

The sanitary sewage will be discharged to a septic tank and in turn discharged to a tile field or sand filter. Proper certification of this

installation will be obtained from the State Health Department

I trust this information is sufficient; if further information is required, feel assured of our full cooperation.

Very truly yours,

J. D. Ristroph
Manager - Power Production

Attachments

A-6

VA SWCB. Water Quality Certifications Issued to Virginia Electric Power Company on November 23, 1970, February 11, 1972, and August 29, 1973. North Anna Nuclear Power Station.

WLC

COMMONWEAL OF VIRGINIA **STATE WATER CONTROL BOARD**

EXECUTIVE SECRETARY
A. H. PAESSLER

P. O. BOX 11143 - RICHMOND, VIRGINIA 23230 - (703) 770-2241

BOARD MEMBERS
Norman M. Cole, Jr
Chairman
Ray Edwards
Henry S. Holland III
Mrs. Beverly Holmberg
Andrew M. McThenia, Jr.
W. H. Singleton
Robert W. Spossard

CERTIFICATE

ISSUED TO

Virginia Electric and Power Company
P. O. Box 1194
Richmond, Virginia 23209

November 23, 1970 Units 1, 2 or 3 & 4 too

The State Water Control Board hereby certifies that the proposed North Anna Nuclear Power Station Project located on the North Anna River in Louisa County, Spotsylvania County and Orange County, Virginia, as specified in the application to the Board on September 28, 1970, provides reasonable assurance that applicable water quality standards will not be violated.

This certificate is issued with the following provisions applicable to downstream flow release schedule from the impoundment:

1. Average annual instantaneous low flow release will be not less than 60 cfs during any calendar year.

2. Minimum instantaneous release for the period June through September of any calendar year will be not less than 100 cfs and the minimum instantaneous release for the remaining period of any calendar year will be not less than 40 cfs.

3. Although the low flow release schedule may from time to time be amended in no event should the amended schedule require minimum instantaneous low flow releases to exceed 150 cfs, nor should such amended schedule require minimum instantaneous low flow releases to be less than 40 cfs and the amended release schedule should be so arranged that the average annual minimum instantaneous low flow release should not exceed 60 cfs.

In addition this certificate is issued with the understanding that, in accordance with the plans for the project, the Virginia Electric and Power Company and its project contractors will not violate the water quality standards as a result of a direct or indirect discharge of the spoil and construction materials to State waters. It is further understood that any direct or indirect discharge of spoil material or contruction material to State waters will be subject to abatement and control under the State Water Control Law.

By: A. H. Paessler
A. H. Paessler, Executive Secretary

CLEAN STREAMS PROVIDE HEALTH WEALTH AND RECREATION

Acceptance of the above provisions and responsibilities is acknowledged by the undersigned:

By: O. E. Strotph Date: 11/25/70
O. E. Strotph

Commonwealth of Virginia
STATE WATER CONTROL BOARD
P. O. Box 11143, 4010 W. Broad St., Richmond, Virginia 23230 - (703) 770-2241
A. H. Pressler, Executive Secretary

WLR

BOARD MEMBERS
Norman M. Cole, Jr.
Chairman
Ray W. Edwards
Henry S. Holland III
Mrs. Wayne Jackson
Andrew W. McThenia, J
W. H. Singleton
Robert W. Spessard

CERTIFICATE

ISSUED TO

Virginia Electric and Power Company
P.O. Box 1194
Richmond, Virginia 23209

AMENDED ON

February 11, 1972

The State Water Control Board hereby certifies that the proposed North Anna Nuclear Power Station Project located on the North Anna River in Louisa County, Spotsylvania County and Orange County, Virginia, as specified in the application to the Board on September 28, 1970, provides reasonable assurance that applicable water quality standards will not be violated subject to the following provisions:

1. That the Virginia Electric and Power Company shall at all times provide a minimum instantaneous release from the impoundment of at least 40 cfs.

2. During the period when the reservoir is being filled, the Virginia Electric and Power Company shall at all times provide a minimum instantaneous release from the impoundment of not less than 150 cfs during the months of February through June. This provision is subject to additional action, if required, by the State Corporation Commission or this Board.

3. That the staff, in conjunction with the Virginia Institute of Marine Science and the Virginia Electric and Power Company, monitor the downstream water quality and effect of salinity on downstream environment to determine the effect of the 40 cfs minimum release schedule.

4. If at any time firm data from such monitoring indicates that further action on the part of the Board is necessary in order to protect water quality standards within the authority granted it under Title 62.1, Chapter 3.1, Articles 1-7, Code of Virginia, the staff is to immediately report the need for such action to the Board.

CLEAN STREAMS PROVIDE HEALTH WEALTH AND RECREATION

addition, this Certificate is issued with the understanding that, in accordance with the plans for the project, the Virginia Electric and Power Company and its project contractors will not violate the water quality standards as a result of a direct or indirect discharge of the spoil and construction materials to State waters. It is further understood that any direct or indirect discharge of spoil material or construction material to State waters will be subject to abatement and control under the State Water Control Law.

The Board reserves the right to amend this Certificate for good cause and after proper hearing.

By: A H Paessler
A. H. Paessler, Executive Secretary

Acceptance of the above stipulations and provisions is acknowledged by the undersigned:

By: J D Ristroph
J. D. Ristroph, Executive Director
Environmental Control

Date: 2-14-72

Commonwealth of Virginia
STATE WATER CONTROL BOARD
P. O. Box 11143, 4010 W. Broad St., Richmond, Virginia 23230 (703) 770 2241

V-5-5 J-20-33-1

BOARD MEMBERS
Norman M Cole, Jr
Chairman
Dennis J Brion
Ray W. Edwards
Henry S Holland III
Mrs Wayne Jackson
Andrew W. McThenia
Robert W Speckard

ok: 1 & 2
study re: 3, 4

401 CERTIFICATE

ISSUED TO

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA NUCLEAR POWER STATION
LOUISA COUNTY, VIRGINIA
ON AUGUST 29, 1973

The State Water Control Board hereby certifies that the Applicant's proposed cooling water discharges from the North Anna Power Station, Units 1 and 2, proposed to be located on the North Anna River in Louisa County, Virginia, as specified in the application to the Board dated March 30, 1973, and supplemented by the letter from the Applicant dated May 25, 1973, and by the record of a hearing held on June 19, 1973, will comply with (i) the Virginia Water Quality Standards which became effective on July 20, 1970, and which are as amended, in full force and effect under Section 303 of Public Law 92-500, and (ii) a limitation on waste heat discharged to the treatment facility from the two units of 13.54 x 10^9 BTU/hr., which is an applicable limitation under Section 301 (b) (1) (C) of Public Law 92-500, and which is the basis of design of the facility. There is no other applicable effluent limitation or other limitation under Sections 301 (b) and 302 and there is not an applicable standard under Sections 306 and 307 of Public Law 92-500 presently in effect.

The Board directs that the Applicant take the following step to assure that the Virginia Water Quality Standards are complied with:

The Applicant, in cooperation with the staff, will by August 18, 1973, submit to the Board for its approval a comprehensive water quality monitoring program for Lake Anna, the waste heat treatment facility and the North Anna River downstream of the Lake Anna Dam, that will provide an adequate basis for determining, on the basis of results collected through the end of the first full year of operation of the second North Anna Unit to go into operation, whether the operation of the third and/or fourth units at the North Anna site will result in violation of (i) any applicable legal requirement, including water quality standards, and (ii) any effluent limitation on waste heat which must be imposed upon Units 3 and 4 by the Board in the above-mentioned Section 401 certification.

Pursuant to Sections 401 (d) and 510 of Public Law 92-500, this certificate is issued with the understanding that discharges from the above facilities must comply with applicable State Water Quality Standards, other limitations, standards, regulations, and requirements established in accordance with the State Water Control Law.

Further, the conditions of the certificate of assurance issued to the Applicant on February 11, 1972, pursuant to Section 21 (b) of Public Law 91-224, are incorporated herein by reference as limitations and shall continue in full force

and effect until amended as a result of modification of water quality standards and/or promulgation of applicable, more stringent effluent limitations pursuant to Public Law 92-500. This certificate is subject to revocation or amendment for good cause and after proper hearing.

By: Eugene F. Jensen
Eugene F. Jensen, Executive Secretary

From:	Thomas, Bryant (DEQ)
To:	Kenneth Roller (Services - 6)
Cc:	Mackert, Susan (DEQ); Linderman, Curtis (DEQ); Oula K Shehab-Dandan (Services - 6)
Subject:	[External] Dominion - North Anna Power Station 316(b)
Date:	Wednesday, April 05, 2017 9:02:17 AM

Ken,

This email is a follow-up to, and a summary of our conversation from last Friday, March 31, 2017, with respect to the Phase II 316(b) regulations as they pertain to the North Anna Power Station

As we discussed, Dominion previously requested concurrence from DEQ regarding the application of the 40 CFR §125.92(c)(2) definition of "closed-cycle recirculating system" to the North Anna Power Station After consultation with EPA Region 3, DEQ staff agrees that the Station meets the administrative criteria of a "closed-cycle recirculating system" consistent with the definition in 40 CFR §125.92(c)(2)

Additionally, Dominion requested waivers from the information requirements of 40 CFR §122 21(r)(9) through (r)(13) As we discussed, DEQ is not prepared to grant waivers to all the application requirements as contained in (r)(9) through (r)(13). While the Station meets the definition of the 316(b) rule for a closed-cycle recirculating system, it operates similar to a once-through system We would like to schedule a meeting to discuss the 316(b) application requirements with you and have the opportunity to review the biological data that has been collected to date.

It is our understanding that Dominion collected biological data to characterize entrainment between late April 2016 and mid-September 2016 Additionally, you re-initiated biological sampling in March of 2017 to capture the early stages of the peak abundance period missed during 2016. During our conversation we advised that the sampling re-initiated in 2017 continue at least until we have a chance to review and discuss the data collected to date as it may be appropriate to collect data over a continuous, uninterrupted period.

You had indicated that it may be June before the evaluation and analysis of the biological data are ready for review We would like to request a meeting as soon as practicable to review the available information and the path forward with respect to 316(b) application requirements for the reissuance of the VPDES permit for the North Anna Power Station. Please contact either Susan Mackert, or me, at your earliest convenience to coordinate on scheduling a meeting.

Respectfully,

Bryant Thomas
Regional Water Permits & Planning Manager
Virginia Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, Virginia 22193
Phone: (703) 583-3843
Email. Bryant.Thomas@deq.virginia.gov
Website: www.deq.virginia.gov

Appendix B

North Anna Power Station §122.21(r)(2) – (9) Submittal Requirement Checklist

Title	Citation 40 CFR 122.21(r)	Requirement	Provided in Report?
(2) Source Water Physical Data	(2)(i)	Narrative description and scaled drawings of source waterbody	Yes
	(2)(ii)	Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies	Yes, note that no physical studies were conducted to determine the area of influence
	(2)(iii)	Locational maps	Yes
(3) Cooling Water Intake Structure Data	(3)(i)	Narrative description of the configuration of each Cooling Water Intake Structure (CWIS) and where it is located in the waterbody and in the water column	Yes
	(3)(ii)	Latitude and Longitude of CWIS	Yes
	(3)(iii)	Narrative description of the operation of each CWIS	Yes
	(3)(iv)	Flow distribution and water balance diagram	Yes
	(3)(v)	Engineering drawing of CWIS	Yes
(4) Source Water Baseline Biological Characterization Data	(4)(i)	A list of the data in paragraphs (r)(4)(ii) through (vi) of this section that are not available and efforts made to identify sources of the data	Yes, but not applicable because all data are available
	(4)(ii)	A list of species (or relevant taxa) for all life stages and their relative abundance in the vicinity of CWIS	Yes
	(4)(iii)	Identification of the species and life stages that would be most susceptible to impingement and entrainment	Yes
	(4)(iv)	Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance for relevant taxa	Yes
	(4)(v)	Data representative of the seasonal and daily activities of biological organisms in the vicinity of CWIS	Yes
	(4)(vi)	Identification of all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at your cooling water intake structures	Yes
	(4)(vii)	Documentation of any public participation or consultation with Federal or State agencies undertaken in development of the plan	Yes
	(4)(viii)	Methods and QA procedures for any field efforts	Yes
	(4)(ix)	In the case of the owner or operator of an existing facility or new unit at an existing facility, the Source Water Baseline Biological Characterization Data is the information in (i) through (xii)	Yes, noted in report that (i) through (xii) provided
	(4)(x)	Identification of protective measures and stabilization activities that have been implemented, and a description of how these measures and activities affected the baseline water condition in the vicinity of CWIS	Yes
	(4)(xi)	List of fragile species as defined at 40 CFR 125.92(m) at the facility	Yes
	(4)(xii)	Information submitted to obtain incidental take exemption or authorization for its cooling water intake structure(s) from the U S. Fish and Wildlife Service or the National Marine Fisheries Service	Yes

Title	Citation 40 CFR 122.21(r)	Requirement	Provided in Report?
(5) Cooling Water System Data	(5)(i)	Narrative description of the operation of the cooling water system and its relationship to the CWIS	Yes
	(5)(i)	Proportion of the design intake flow that is used in the system	Yes
	(5)(i)	Number of days of the year the cooling water system is in operation and seasonal changes in the operation of the system	Yes
	(5)(i)	Proportion of design intake flow for contact cooling, non-contact cooling, and process uses	Yes
	(5)(i)	Distribution of water reuse to include cooling water reused as process water, process water reused for cooling, and the use of gray water for cooling	Yes, but not applicable
	(5)(i)	Description of reductions in total water withdrawals including cooling water intake flow reductions already achieved through minimized process water withdrawals	Yes
	(5)(i)	Description of any cooling water that is used in a manufacturing process either before or after it is used for cooling, including other recycled process water flows	Yes, but not applicable
	(5)(i)	Proportion of the source waterbody withdrawn (on a monthly basis)	Yes
	(5)(ii)	Design and engineering calculations prepared by a qualified professional and supporting data to support the description required by paragraph (r)(5)(i) of this section	Yes
	(5)(iii)	Description of existing impingement and entrainment technologies or operational measures and a summary of their performance	Yes
(6) Chosen Method(s) of Compliance with Impingement Mortality Standard	Identification of the chosen compliance method for the entire CWIS or each CWIS at its facility.		Yes
(7) Entrainment Performance Studies	(7)(i)	Site-specific studies addressing technology efficacy, through plant entrainment survival, and other impingement and entrainment mortality studies	Yes; note that no site-specific studies were conducted at this facility
	(7)(ii)	Studies conducted at other locations including an explanation of how they relevant and representative	Yes; note that studies at other locations were not determined to be relevant
	(7)(iii)	Studies older than 10 years must include an explanation of why the data are still relevant and representative	Not applicable
(8) Operational Status	(8)(i)	Description of individual unit age, utilization for previous 5 year, major upgrades in last 15 years	Yes
	(8)(ii)	Descriptions of completed, approved, or scheduled upgrades and Nuclear Regulatory Commission relicensing status of each unit at nuclear facilities	Yes
	(8)(iii)	Other cooling water uses and plans or schedules for decommissioning or replacing units	Yes
	(8)(iv)	For all manufacturing facilities, descriptions of current and future production schedules	Yes; but not applicable

Title	Citation 40 CFR 122.21(r)	Requirement	Provided in Report?
	(8)(v)	Descriptions of plans or schedules for any new units planned within the next 5 years	Yes, but not applicable
(9) Entrainment Characterization Study	(9)(i)	Entrainment Data Collection Method	Yes
	(9)(ii)	Biological Entrainment Characterization	Yes
	(9)(iii)	Analysis and Supporting Documentation	Yes

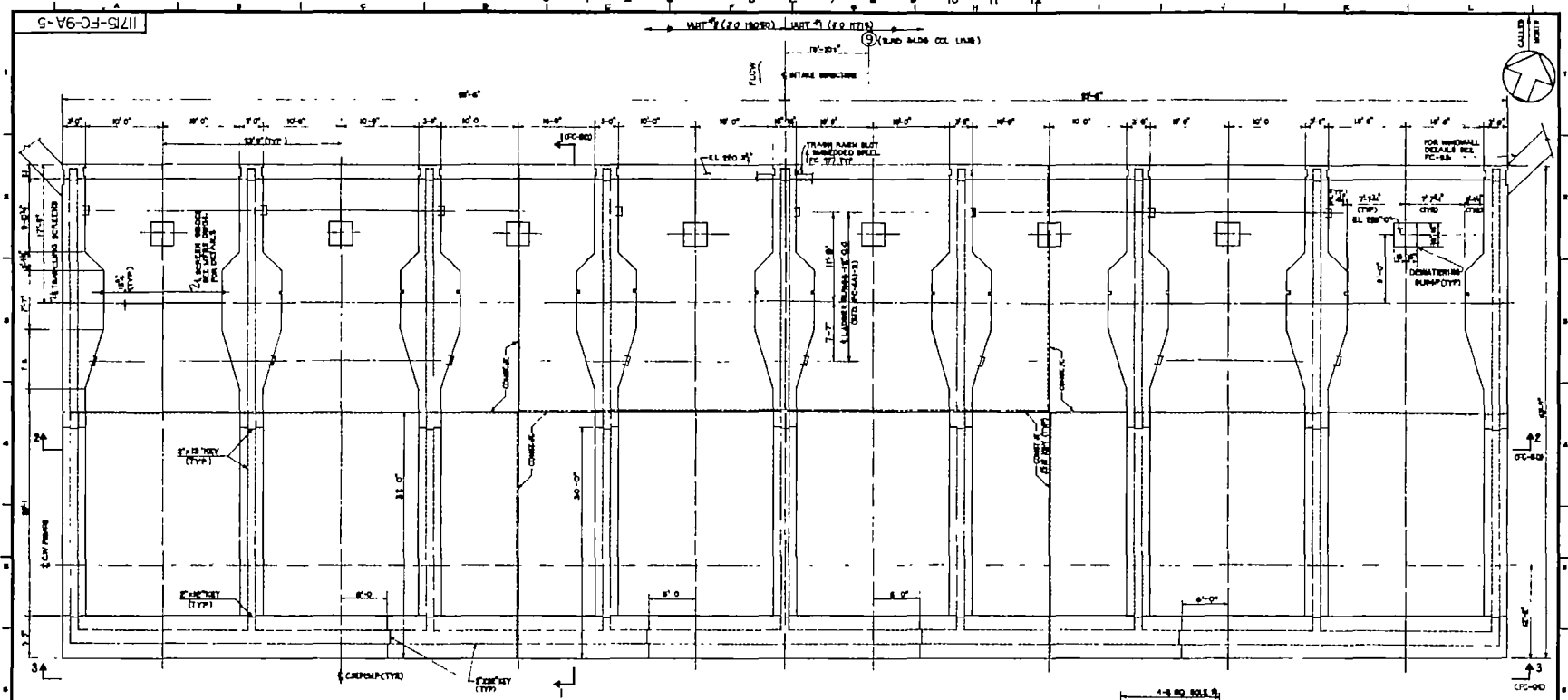
Appendix C

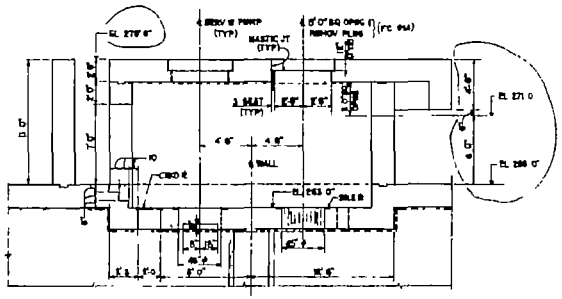
11- x 17-inch Engineering Drawings of Cooling Water Intake Structures

The following drawings are in the order of increasing details from Sheet 1 to Sheet 5:

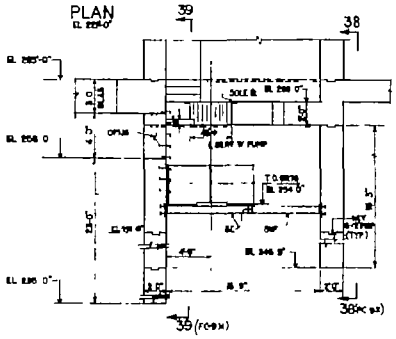
- Drawing No. 11715-FC-9A-5: North Anna Power Station Intake Structure Outline Sheet 1
- Drawing No. 11715-FC-9B-5: North Anna Power Station Intake Structure Outline Sheet 2
- Drawing No. 11715-FC-9C-15: North Anna Power Station Intake Structure Outline Sheet 3
- Drawing No. 11715-FC-9D-7: North Anna Power Station Intake Structure Outline Sheet 4
- Drawing No. 11715-FC-9E-7: North Anna Power Station Intake Structure Outline Sheet 5

11715-FC-9A-5

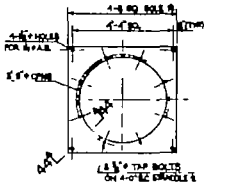




SECT 36-36 (FC 9C)
SCALE 1/4"=1'-0"



37-37 (FC 9C)
SCALE 1/4"=1'-0"



44-44
SCALE 1/4"=1'-0"

PLAN - (FC-9C)
SCALE 1/4"=1'-0"

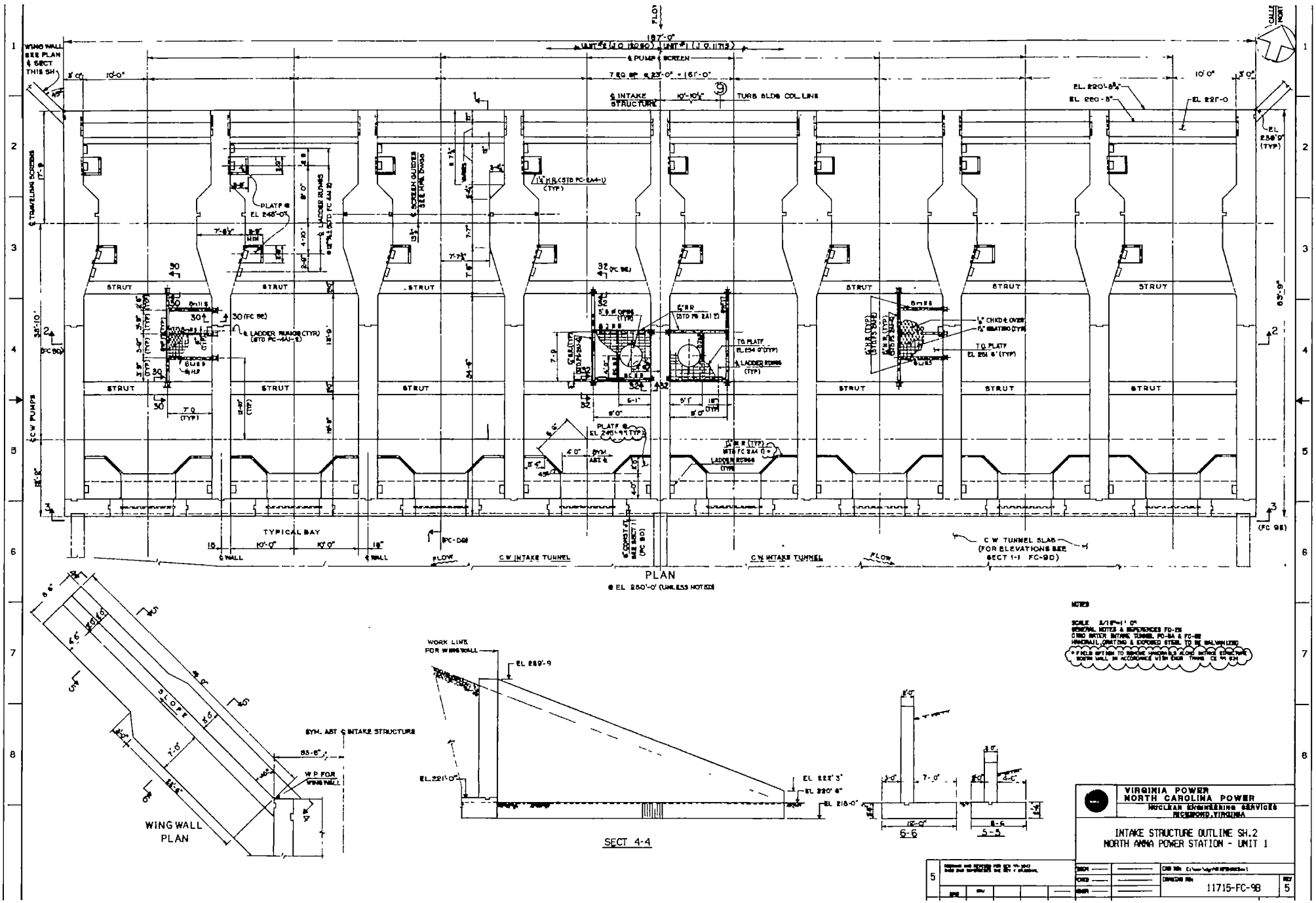
NOTES

INTAKE STRUCTURE OUTLINE - SH. 1

NORTH ANNA POWER STATION
VIRGINIA ELECTRIC AND POWER COMPANY
STONE & WEBSTER ENGINEERING CORPORATION

LI

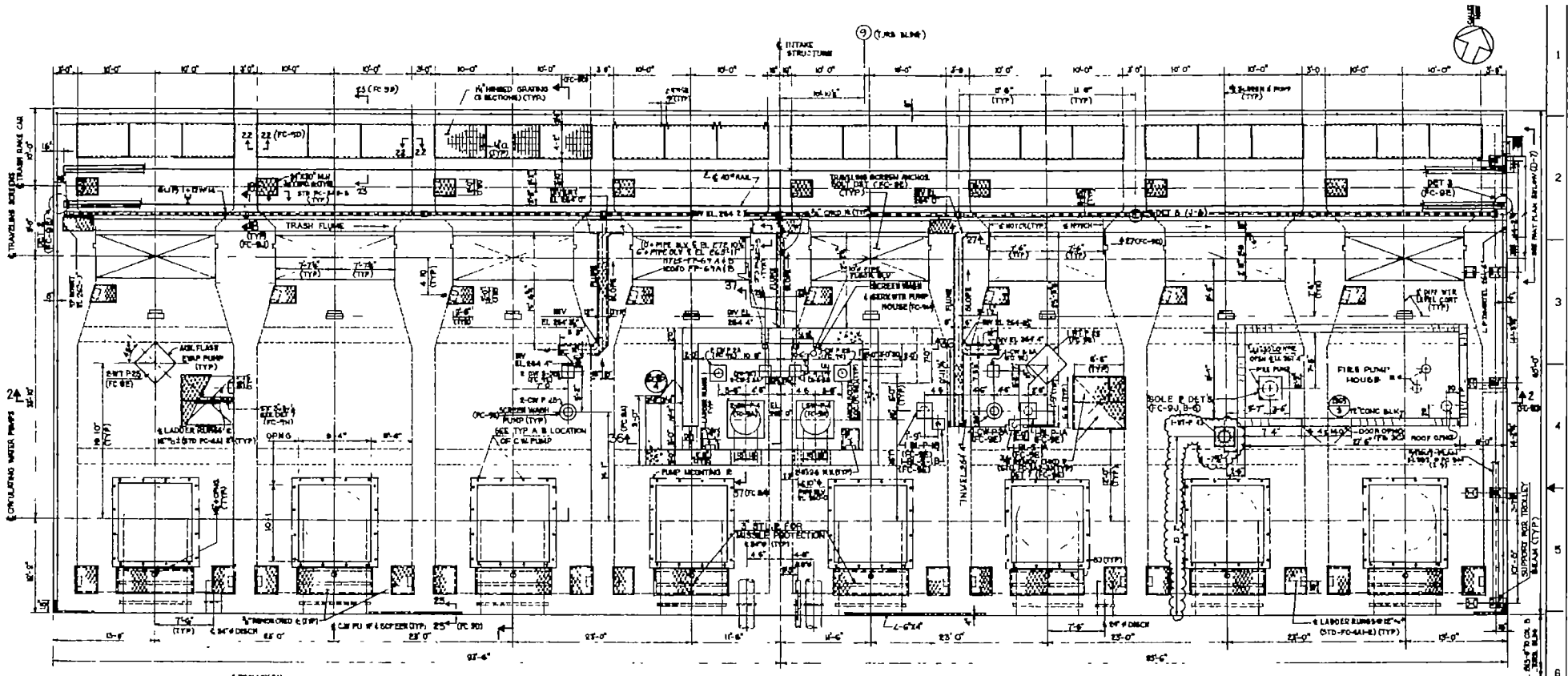
11715-FC-9A-5

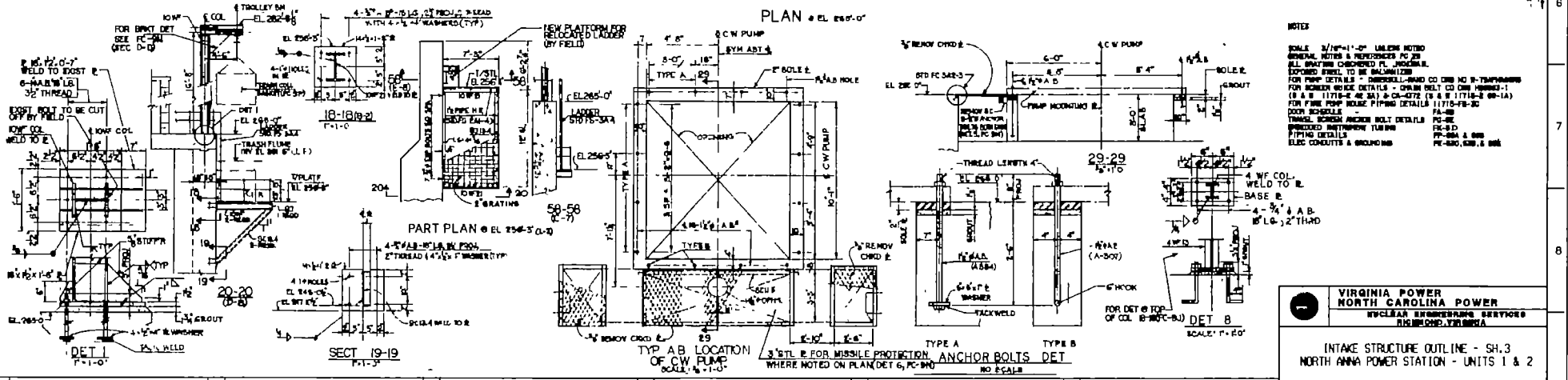


VIRGINIA POWER
NORTH CAROLINA POWER
NUCLEAR ENGINEERING SERVICES
RICHMOND, VIRGINIA

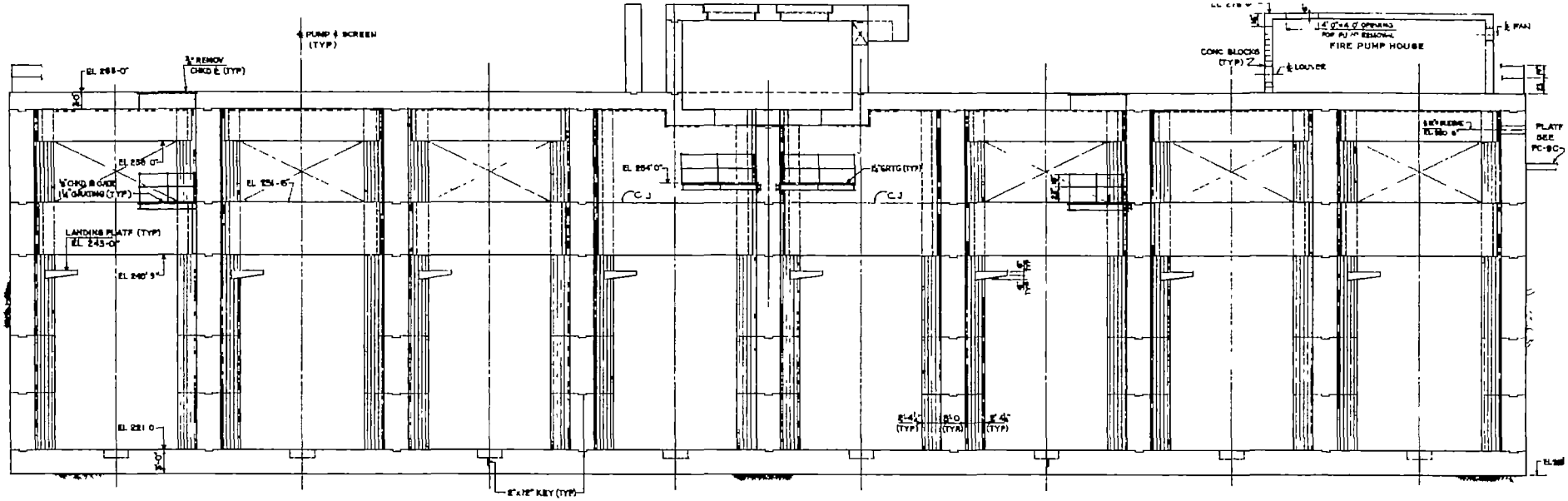
INTAKE STRUCTURE OUTLINE SH.2
NORTH ANNA POWER STATION - UNIT 1

11715-FC-98 REV 5

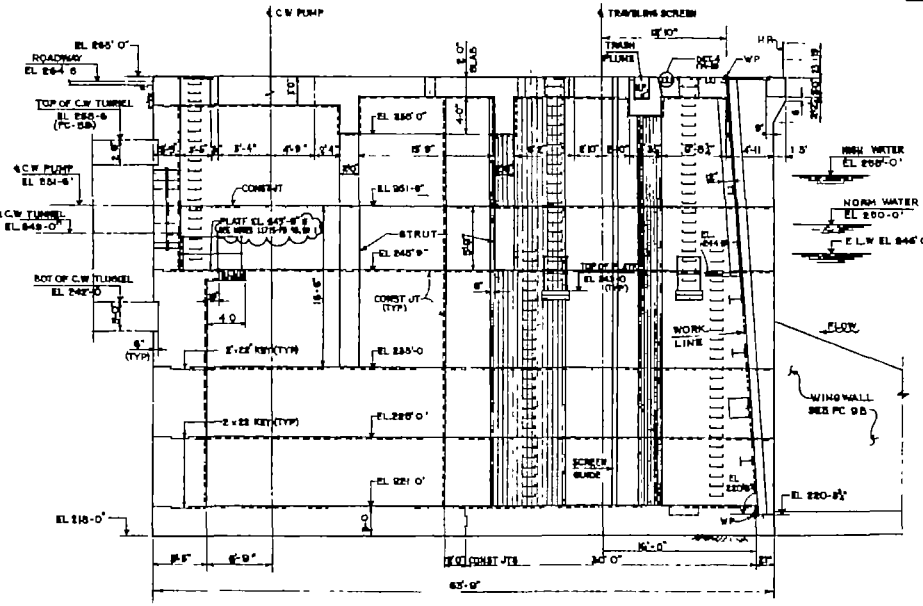




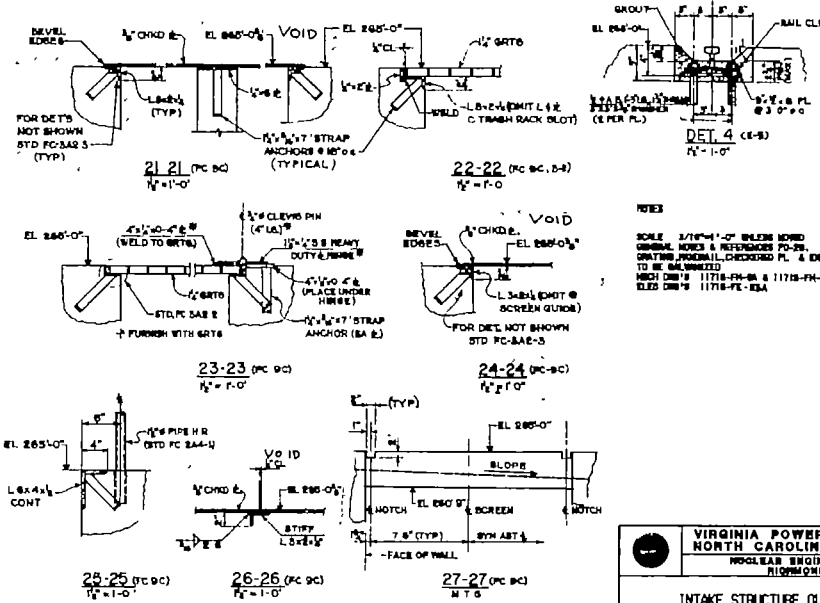
VIRGINIA POWER NORTH CAROLINA POWER NUCLEAR ENGINEERING SERVICES RICHMOND, VIRGINIA	
INTAKE STRUCTURE OUTLINE - SH. 3 NORTH ANNA POWER STATION - UNITS 1 & 2	
11715-FC-9C	REV. 15



2 - 2 (FC-9A)



SECT 1-1 (FC-9A)

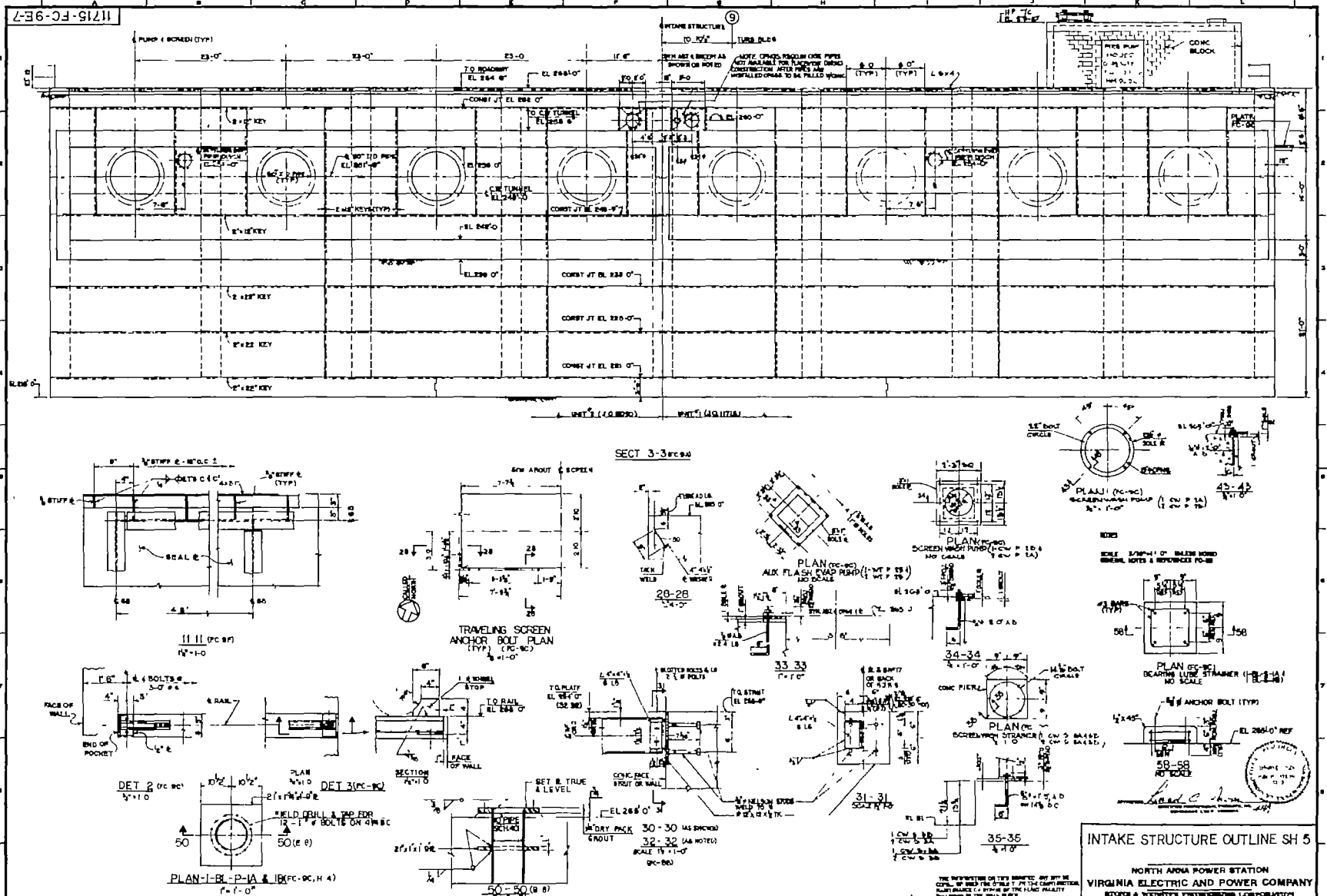


VIRGINIA POWER
NORTH CAROLINA POWER
NUCLEAR ENGINEERING SERVICES
RICHMOND, VIRGINIA

INTAKE STRUCTURE OUTLINE SH.4
NORTH ANNA POWER STATION - UNIT 1

11715-FC-9D
REV 7

11715-FC-9E-7


INTAKE STRUCTURE OUTLINE SH 5
NORTH ANNA POWER STATION
VIRGINIA ELECTRIC AND POWER COMPANY
11715-FC-9E-7
SECT 3-3
TRAVELING SCREEN ANCHOR BOLT PLAN (TYP)
PLAN-I-BL-P-IA & IB
DET 2
DET 3
PLAN
SECTION
33-33
34-34
35-35
30-30
31-31
32-32
28-28
58-58
50-50

Appendix D

Information, Planning, and Consultation and State-Threatened or Endangered Species Query Results

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

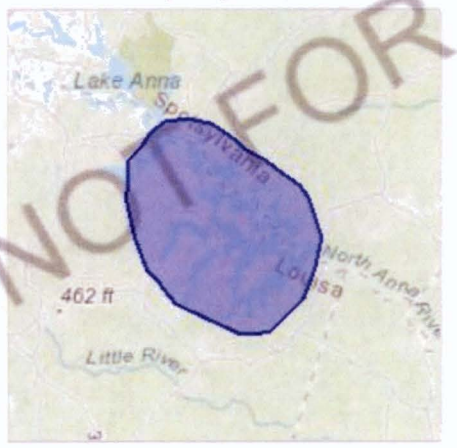
Project information

NAME

North Anna

LOCATION

Louisa and Spotsylvania counties, Virginia



Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

http://www.fws.gov/northeast/virginiafield/

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species

[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Clams

NAME	STATUS
Dwarf Wedgemussel Alasmidonta heterodon No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/784	Endangered

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31
Eastern Whip-poor-will Antrostomus vociferus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Red-headed Woodpecker Melanerpes erythrocephalus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10

Wood Thrush Hylocichla mustelina Breeds May 10 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME
This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Site Location

38,02,02.5 -77,46,38.8
is **the Search Point**

Show Position Rings
◉ Yes ○ No
1 mile and 1/4 mile at the **Search Point**

Show Search Area
◉ Yes ○ No
4 Search distance miles radius

Search Point is at map center

Base Map Choices
Topography

Map Overlay Choices
Current List: Position, Search

Map Overlay Legend

Position Rings at the Search Point

4 mile radius Search Area

back | Refresh Browser Page

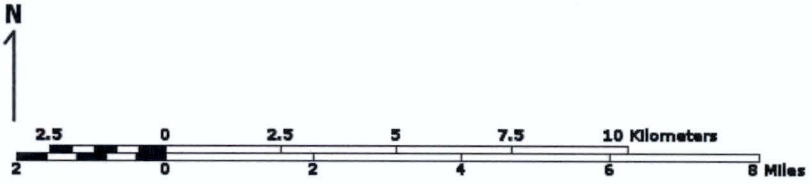
Map Click: Pan | Id | M

Map Scale: In | Zoom | Out

Screen Size: Small | Size | Big

Help





Point of Search 38,02,02.5 -77,46,38.8
Map Location 38,02,02.5 -77,46,38.8

Select **Coordinate System:**
◉ Degrees,Minutes,Seconds Latitude - Longitude
○ Decimal Degrees Latitude - Longitude
○ Meters UTM NAD83 East North Zone
○ Meters UTM NAD27 East North Zone

Base Map source: USGS 1:250,000 topographic maps (see Microsoft terraserver-usa.com for details)

Map projection is UTM Zone 18 NAD 1983 with left 246639 and top 4222832. Pixel size is 32 meters . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents 19200 meters east to west by 19200 meters north to south for a total of 368.6 square kilometers. The map display represents 63002 feet east to west by 63002 feet north to south for a total of 142.3 square miles.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic
http //www.national geographic com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries

map assembled 2018-04-12 18:35:19 (qa/qc March 21, 2016 12.20 - tn=898744.0 dist=6436 I
)
$poi=38.0340278 -77.7774444

| DGIF | Credits | Disclaimer | Contact shirl dressler@dgif virginia gov |Please view our privacy policy |
© 1998- 2018 Commonwealth of Virginia Department of Game and Inland Fisheries

VaFWIS Search Report Compiled on 4/12/2018, 6:34:19 PM

Help

Known or likely to occur within a **4 mile radius around point 38,02,02.5 -77,46,38.8** in **109 Louisa County, 177 Spotsylvania County, VA**

View Map of Site Location

498 Known or Likely Species ordered by Status Concern for Conservation (displaying first 22) (22 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database (s)
060003	FESE	Ia	Wedgemussel, dwarf	Alasmidonta heterodon		BOVA
050022	FTST	Ia	Bat, northern long-eared	Myotis septentrionalis		BOVA
050020	SE	Ia	Bat, little brown	Myotis lucifugus		BOVA
050034	SE	Ia	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		HU6
050027	SE	Ia	Bat, tri-colored	Perimyotis subflavus		BOVA
040293	ST	Ia	Shrike, loggerhead	Lanius ludovicianus		BOVA
060081	ST	IIa	Floater, green	Lasmigona subviridis		BOVA
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
060029	FP	IIa	Lance, yellow	Elliptio lanceolata		BOVA
030063	CC	IIIa	Turtle, spotted	Clemmys guttata		BOVA,HU6
030012	CC	IVa	Rattlesnake, timber	Crotalus horridus		BOVA
010077		Ia	Shiner, bridle	Notropis bifrenatus		BOVA
100248		Ia	Fritillary, regal	Speyeria idalia idalia		BOVA,HU6
040213		Ic	Owl, northern saw-whet	Aegolius acadicus		BOVA
040052		IIa	Duck, American black	Anas rubripes		BOVA,HU6
040036		IIa	Night-heron, yellow-crowned	Nyctanassa violacea violacea		BOVA
040181		IIa	Tern, common	Sterna hirundo		BOVA,HU6
040320		IIa	Warbler, cerulean	Setophaga cerulea		BOVA,HU6
040140		IIa	Woodcock, American	Scolopax minor		BOVA,HU6
040203		IIb	Cuckoo, black-billed	Coccyzus erythropthalmus		BOVA
040105		IIb	Rail, king	Rallus elegans		BOVA
060175		IIb	Slabshell, Roanoke	Elliptio roanokensis		BOVA

To view **All 498 species** View 498

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection 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
Virginia Widlife Action Plan Conservation Opportunity Ranking:
a - On the ground management strategies/actions exist and can be feasibly implemented.; b - On the ground actions or research needs have been identified but cannot feasibly be implemented at this time.; c - No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

View Map of All Query Results from All Observation Tables

Bat Colonies or Hibernacula: **Not Known**

Anadromous Fish Use Streams

N/A

Impediments to Fish Passage (2 records)

View Map of All Fish Impediments

ID	Name	River	View Map
671	LAKE ANNA DAM & RESERVOIR	NORTH ANNA RIVER	Yes
672	NORTH ANNA CAT I SERVICE WATER DIKE	NORTH ANNA-OS	Yes

Colonial Water Bird Survey

N/A

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (2 records)

View Map of All Query Results
Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
LO0602	6	Mar 19 2010	UNKNOWN	Yes
LO0901	2	Apr 11 2010	UNKNOWN	Yes

Displayed 2 Bald Eagle Nests

Species Observations (854 records - displaying first 20)

View Map of All Query Results
Species Observations

obsID	class	Date Observed	Observer	N Species Different Species	Highest TE*	Highest Tier**	View Map
620179	SppObs	May 16 2013	Paul; Vidonic	8		III	Yes
340391	SppObs	Sep 12 2002	Odenkirk, Owens, Herrmann	10		III	Yes
337141	SppObs	Jan 1 1981	VEPCO-B-VA. ELEC. & POWER	10		III	Yes
337145	SppObs	Jan 1 1981	VEPCO-B-VA. ELEC. & POWER	18		III	Yes
337154	SppObs	Jan 1 1981	VEPCO-B-VA. ELEC. & POWER	18		III	Yes
334650	SppObs	Jan 1 1973	JRR-R-REED	17		III	Yes
333728	SppObs	Jan 1 1970	JRR-R-REED	18		III	Yes
624546	SppObs	Nov 20 2014	BENJAMIN; EBERLINE	8		IV	Yes
624542	SppObs	Nov 17 2014	BENJAMIN; EBERLINE	9		IV	Yes
624704	SppObs	Mar 10 2014	PAUL; VIDONIC	8		IV	Yes
620025	SppObs	Aug 7 2013	Paul; Vidonic	10		IV	Yes
616633	SppObs	Feb 23 2012	PMV	8		IV	Yes
613412	SppObs	May 17 2011	PMV	9		IV	Yes
613396	SppObs	Feb 23 2011	PMV	7		IV	Yes

613394	SppObs	Feb 23 2011	PMV	8		IV	Yes
600726	SppObs	Aug 13 2008	P. M. Vidonic	8		IV	Yes
604121	SppObs	May 21 2008	P. M. Vidonic	7		IV	Yes
607576	SppObs	Feb 28 2008	P. M. Vidonic	7		IV	Yes
604031	SppObs	Feb 25 2008	P. M. Vidonic	8		IV	Yes
312835	SppObs	Dec 21 2005	Robert Ballantine	2		IV	Yes

Displayed 20 Species Observations

Selected 854 Observations View 500 (system constraint) Species Observations

Habitat Predicted for Aquatic WAP Tier I & II Species

N/A

Habitat Predicted for Terrestrial WAP Tier I & II Species

N/A

Virginia Breeding Bird Atlas Blocks (3 records)

View Map of All Query Results
Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species			View Map
		Different Species	Highest TE*	Highest Tier**	
49131	Lake Anna East, NW	21		III	Yes
49135	Lake Anna East, SW	1			Yes
48136	Lake Anna West, SE	59		III	Yes

Public Holdings:

N/A

Summary of BOVA Species Associated with Cities and Counties of the Commonwealth of Virginia:

FIPS Code	City and County Name	Different Species	Highest TE	Highest Tier
109	Louisa	368	FESE	I
177	Spotsylvania	379	FTSE	I

USGS 7.5' Quadrangles:
Buckner
Lake Anna West
Beaverdam
Lake Anna East

USGS NRCS Watersheds in Virginia:

N/A

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier
YO19	Contrary Creek-Lake Anna	48	SS	II
YO20	North Anna River/Lake Anna-Pigeon Run	50	SS	I
YO21	North Anna River/Lake Anna-Elk Creek	50	SS	I
YO22	Northeast Creek	39		I
YO23	North Anna River-Hawkins Creek	59	SE	I
YO24	Upper Little River	58	SE	I

Compiled on 4/12/2018, 6 34 20 PM 1898744 0 report=all searchType= R dist= 6436 por= 38,02,02 5 -77,46,38 8

PixelSize=64, Anadromous=0 023872, BBA=0 078753, BECAR=0 022313, Bats=0 019127, Buffer=0 389085, County=0 09173, HU6=0 111842, Impediments=0 034437, Int=0 465194, PublicLands=0 034264, Quad=0 065893, SppObs=0 488362, TEWaters=0 025791, TierReaches=0 031164, TierTerrestrial=0 069322, Total=1 853106, Tracking_BOVA=0 186372, Trout=0 026449, huva=0 055385

Appendix E

Engineering Calculations of Through-Screen Velocity

Originator	**Spencer Nush, EIT**	4/26/2018
Reviewer	**Wade Cope, PE**	4/27/2018
Approver	**Jamie You**	4/27/2018

Revision No	Revised by	Approved by	Description
0	-	-	-

Calculation Summary:

	Units	Unit 1	Unit 2
The estimated effective design through-screen velocity	fps	2 92	2 92
The estimated effective through-screen velocity at normal water elevation	fps	2 51	2 51
The estimated effective through-screen velocity at high water elevation	fps	2 14	2 14

System Description:

North Anna Power Station is a two-unit nuclear- fueled power station located on the Lake Anna in Louisa County, VA Lake Anna acts as a cooling water source for the nuclear power plant

Calculation Purpose:

Calculate the design through-screen velocity at Dominion's North Anna Power Station cooling water intake structure

Calculation Objectives:

1. Identify the screen physical parameters, and design intake flow rate
2. Calculate the fraction of the screen open for water flow
3. Calculate the design through-screen velocity under typical low water elevation/flow conditions, as well as normal and high water elevations/flow conditions

Calculation Methodology:

Formula 1

$$V = Q / (WD * OA * TW * K)$$

Units fps

where

Q = flow rate in gallons per minute (gpm)
V = through-screen velocity in feet per second (fps)
WD = wetted screen depth in feet (ft)
OA = proportion of screen open area to total screen area
TW = nominal screen basket width (ft)
K = 396 for through-flow screen or 740 for dual-flow screen

Formula 2

$$OA = (W * L) / ((W + D) * (L + d))$$

Units unitless

where

d = horizontal (shute) wire diameter in inches (in)
D = vertical (warp) wire diameter (in)
W = width of mesh opening (in)
L = vertical length of mesh opening (in)

Formula 3

$$EOA = PC * OA$$

Units unitless

where

EOA = proportion of effective open area
PC = screen percent clean (%)

Formula 4

$$V_{eff} = Q / (WD * EOA * TW * K)$$

Units fps

where

V_{eff} = effective through-screen velocity

Design Inputs:

	Unit 1	Unit 2		
Number of screens	4	4		[1]
Plant datum	MSL	MSL		
Elevation at bottom of intake	221 0	221 0	feet	[2]
Design low water surface elevation	246 0	246 0	feet	[2]
Normal water surface elevation	250 0	250 0	feet	[2]
Design high water elevation	255 0	255 0	feet	[2]
Screen basket width	14	14	feet	
Mesh size (L)	0 125	0 125	inch	
Mesh size (W)	0 500	0 500	inch	
Wire gauge type	W&M	W&M		
Vertical wire gauge number	16	16	gauge	
Vertical wire diameter	0 06	0 06	inch	[3]
Horizontal wire gauge number	16	16	gauge	
Horizontal wire diameter	0 06	0 06	inch	[3]
Screen percent clogged	0%	0%	%	
Number of circulating water pumps	4	4		[4]
Circulating water pumps Name Plate Rating	238,200	238,200	gpm	[4]
Number of screen wash pumps	2	2		[4]
Screen wash pumps Name Plate Rating	910	910	gpm	[4]

Assumptions:

1 Water elevation inside screenhouse is same as in the source waterbody immediately outside the trash racks
2 Intakes have not been modified since dates of references used
3 All screens function similarly
4 Flow rates are pump design maximum and are most conservative
5 The constant in Formulae 1 and 4 include units conversion (gpm to cfs) and other screen factors
6 Gauge type is Washburn and Moen or Steel Wire
7 Screens are completely free of clogging, unless specified otherwise
8 Dominion provided information regarding screen basket width, mesh size, and wire gauge

References

[1] Virginia Electric and Power Company 1971 Intake Structure Outline - SH 1 North Anna Power Station Drawing No 11715-FC-9A-5 - Rev 5 17 Nov 1971

[2] Virginia Power North Carolina Power Nuclear Engineering Services 2000 Intake Structure Outline SH 4 North Anna Power Station Drawing No 11715-FC-9D - Rev 7 2000

[3] Lide, D R , CRC Handbook of Chemistry and Physics (Ed 72), Chemical Rubber Publishing Co , USA, 1991-1992

[4] Dominion 2016 North Anna Power Station Updated Final Safety Analysis Report Revision 52-09/26/2016

Calculations:

1. Screen Physical Parameters and Design Intake Flow Rate

Given:

	Unit 1	Unit 2	
Q_{total} =	954,620	954,620	gpm
Q=	238,655	238,655	gpm per screen
D=	0 06	0 06	in
d=	0 06	0 06	in
L=	0 125	0 125	in
W=	0 500	0 500	in
WD=	25 0	25 0	ft
K=	396	396	
TW=	14 0	14 0	ft
PC=	100%	100%	

2. Proportion of Effective Open Screen Area to Total Screen Area

Formulae Used:
Formulae 3 and 4

Given:
Screen parameters as above

Calculate:

Screen	Unit 1	Unit 2
OA = (W * L) / ((W + D) * (L + d)) =	0 59	0 59
EOA = PC * OA =	59%	59%

Calculations: cont.

3. Design Through-screen Velocity

Formulae Used:
Formula 4

Given:
Screen parameters as above and calculated screen open area proportion

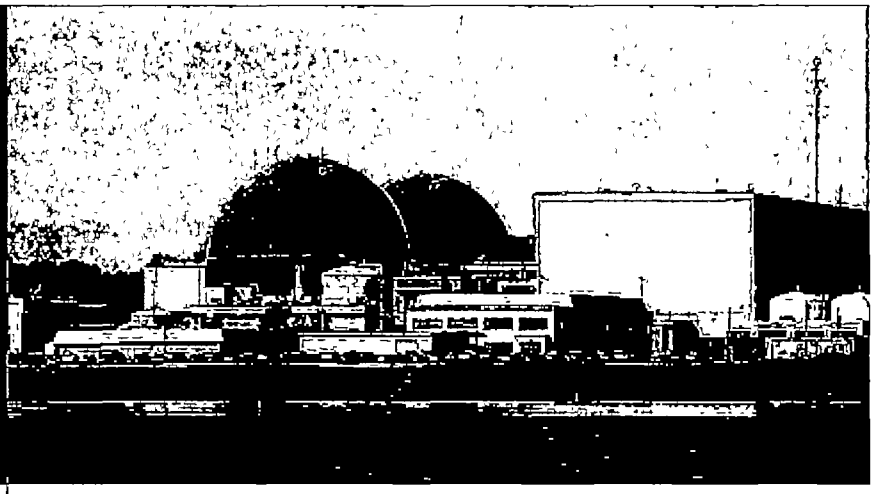
Calculate:

V_{act} = Q / (WD * EOA * TW * K) =

	Unit 1	Unit 2	
Low Water Elevation	**2.92**	**2.92**	fps
Normal Water Elevation	**2.61**	**2.61**	fps
High Water Elevation	**2.14**	**2.14**	fps

Appendix F

North Anna Power Station 2016-2017 Entrainment Characterization Study Report



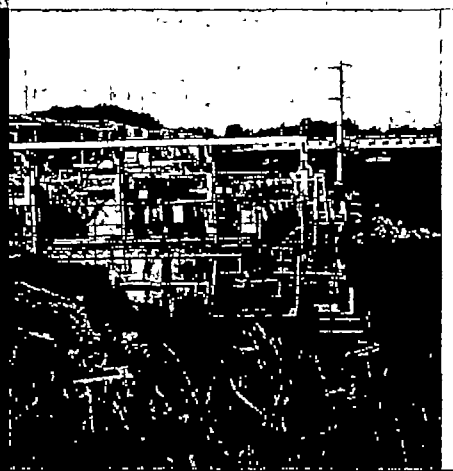


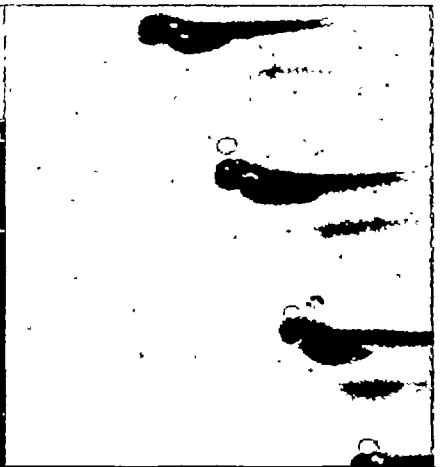
2016-2017 Entrainment Characterization Study

Prepared for:
Dominion Energy, Inc.

Prepared by:
HDR Engineering, Inc.

June 30, 2018





North Anna Power Station

VPDES Permit VA0052451
Louisa County, VA

Table of Contents

Executive Summary 1
1 Introduction 4
1.1 Regulatory Background 4
1.2 Prior Studies 5
1.2.1 Ambient Ichthyoplankton Study, 1984-1985 5
1.2.2 Entrainment Study, 1978–1983 11
1.3 Study Objectives and Document Organization 19
2 Generating Station Description 20
2.1 Site and Environmental Description 20
2.2 Station Description 21
3 Methods 25
3.1 Entrainment Sample Collection 25
3.2 Entrainment Monitoring 29
3.2.1 Sampling Gear and Protocol 29
3.2.2 Collection Processing 30
3.2.3 Morphometrics 30
3.2.4 Water Quality Collection 30
3.3 Data Analysis 30
3.4 Quality Assurance Procedures 31
4 Results 32
4.1 Taxonomic Inventory of Identified Fish and Shellfish Collected in Entrainment Sampling 32
4.2 Species Composition 34
4.3 Morphometrics 38
4.3.1 Morphometric Frequency 38
4.4 Sample Density 48
4.5 Diel Density 49
4.6 Monthly Density 52
4.7 Monthly and Annual Entrainment Estimates 53
4.7.1 Cooling Water Intake Flows 53
4.7.2 Numbers Entrained 54
Numbers Entrained in 2016 (Year 1) Based on Actual Flows 54
Numbers Entrained in 2017 (Year 2) Based on Actual Flows 55
Numbers Entrained in 2016 (Year 1) Based on Design Flows 56
Numbers Entrained in 2017 (Year 2) Based on Design Flows 57
4.8 Water Quality 58

5 Summary of Findings 61
5.1 Herrings and Shad (Clupeidae) 63
5.1.1 Gizzard Shad (*Dorosoma cepedianum*) 63
5.1.2 Threadfin Shad (*Dorosoma petenense*) 64
5.1.3 Blueback Herring (*Alosa aestivalis*) 64
5.2 Common Sunfishes (*Lepomis* spp.) 65
6 References 66

List of Appendices

Appendix A: Data Analysis Calculations
Appendix B: Entrainment Collection Data
Appendix C: Morphometric Data and Length-Frequency Distributions Plots
Appendix D: Water Quality Data

List of Tables

Table 1-1. Densities (#/1,000 m^3) of Ichthyoplankton Collected by Date (Month/Day) and Station during 1984 in Lake Anna 7

Table 1-2. Densities (#/1,000 m^3) of Ichthyoplankton Collected by Date (Month/Day) and Station during 1985 in Lake Anna 9

Table 1-3. North Anna Power Station March 1978 – July 1983 Entrainment Sampling Details 11

Table 1-4. Annual Total Catch and Percent of Fish Larvae Entrained at North Anna Power Station from 1978-1983 13

Table 1-5. Monthly Total Catch of Fish Larvae Entrained at North Anna Power Station from 1978-1983 . 14

Table 1-6. Total Larvae Collected by Sample Time at North Anna Power Station from 1978-1983 15

Table 1-7. Total Larvae Collected by Sample Depth at North Anna Power Station from 1978-1983 17

Table 2-1. North Anna Power Station Cooling Water Intake Pump Characteristics 22

Table 3-1. North Anna Power Station Entrainment Sampling Details, 2016-2017 25

Table 3-2. Sampling Depths at North Anna Power Station 26

Table 4-1. Monthly Sampling Success during Entrainment Sampling at North Anna Power Station, 2016-2017 32

Table 4-2. Master Species List of All Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017 33

Table 4-3. Number of Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017 34

Table 4-4. Total Number of Fish by Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling 35

Table 4-5. Total Number of Fish by Species and Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling 37

Table 4-6. Morphometric Measurements of Fish Collected at North Anna Power Station during 2016-2017 Entrainment Sampling 41

Table 4-7. Estimated Percent Exclusion of Finfish at North Anna Power Station (Years 1 and 2 Combined) 47

Table 4-8. Baseline Depth-Averaged Sample Density by Life Stage for Finfish at North Anna Power Station, 2016-2017 48

Table 4-9. Monthly Average Baseline Density (#/100 m^3 or 0.0264 million gallons) of Finfish by Depth Stratum at North Anna Power Station, 2016-2017.. 52

Table 4-10. Estimated Annual Entrainment Based on Actual Intake Flows in Year 1 (April 2016 – September 2016) 54

Table 4-11. Estimated Annual Entrainment Based on Actual Intake Flows in Year 2 (March 2017 – September 2017) 55

Table 4-12. Estimated Annual Entrainment Based on Design Flows in Year 1 (April 2016 – September 2016) 56

Table 4-13. Estimated Annual Entrainment Based on Design Flows in Year 2 (March 2017 – September 2017) 57

List of Figures

Figure 1-1. Ambient Ichthyoplankton Sampling Locations near NAPS during 1984-1985 6

Figure 1-2. Percent Distribution of Larvae Collected By Sample Time in All Collection Years from 1978-1983 16

Figure 1-3. Percent Distribution of Larvae Collected By Sample Depth in All Collection Years from 1978-1983 18

Figure 2-1. North Anna Power Station Regional Location Map 21

Figure 2-2. North Anna Power Station Cooling Water Intake Structure Location (38°03'43" N, 77°47'26" W) 23

Figure 2-3. Details of North Anna Power Station Traveling Water Screens at the Cooling Water Intake Structure 24

Figure 3-1. Primary Entrainment Sampling Location for North Anna Power Station 27

Figure 3-2. Secondary Entrainment Sampling Location for North Anna Power Station 28

Figure 3-3. Entrainment Pump Sampling System Configuration 29

Figure 4-1. Percentage Composition by Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling 36

Figure 4-2. Summary of the Step-Wise Process Used to Estimate Entrainment based on the EPA Rule and Actual Screens Installed at North Anna Power Station 40

Figure 4-3. Baseline Depth-Averaged Sample Density (#/100 m^3 or 0.0264 million gallons) by Life Stage at North Anna Power Station, 2016-2017 48

Figure 4-4. Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) by Depth Stratum at North Anna Power Station, 2016-2017 49

Figure 4-5. Average Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) During Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017 50

Figure 4-6. Average Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) during Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017 51

Figure 4-7. Monthly Average Actual Intake Flows by Unit at North Anna Power Station, 2016-2017 53

Figure 4-8. Monthly Average Water Quality Parameters with Monthly Minimum and Maximum at Near-Surface, Mid-, and Near-Bottom During 2016 59

Figure 4-9. Monthly Average Water Quality Parameters with Monthly Minimum and Maximum at Near-Surface, Mid-, and Near-Bottom During 2017 60

Executive Summary

North Anna Power Station (NAPS) is a two-unit nuclear generating facility located on a peninsula on the southwestern shore of Lake Anna in Louisa County, Virginia. Lake Anna was formed in 1972 to provide cooling water and other process water for NAPS. As a man-made reservoir, Lake Anna is managed by Virginia Department of Game and Inland Fisheries (VDGIF) for sport fishing. To that end, Lake Anna was stocked with forage and sport fish after it was filled, and stocked with sport fish annually since. The fish population has been surveyed annually by VDGIF to monitor fishing activities and inform management decisions.

Cooling water is drawn from Lake Anna through one intake structure located north of the station. A trash rack is installed across the intake structure to prevent the passage of large debris. There are eight traveling water screens, each 14 feet wide, that are designed to rotate once every 24 hours or when the differential pressure increases to a predetermined level. Each screen is constructed with 16-gage wire providing a vertically aligned, 1/8-inch by 1/2-inch screen mesh. Fish and debris collected on the traveling screens are conveyed to a debris collection structure and disposed of off-site. A two-year entrainment study was conducted at NAPS to support entrainment-related determinations required by the Clean Water Act §316(b) Rule (the Rule) for existing facilities. Entrainment samples were collected twice a month for 5.5 consecutive months from April 2016 through September 2016, and 6.5 consecutive months from March 2017 to September 2017.

Entrainment Characterization before Accounting for Screen Exclusion

During the first year of entrainment sampling, and excluding non-viable eggs (NVE), a total of 522 organisms distributed among 12 distinct taxa were collected at NAPS. During the second year of entrainment sampling, a total of 760 organisms (excluding NVE) distributed among 10 distinct taxa were collected. Finfish comprised 100 percent of the total entrainment sample collection for both years of the study. The species lists were consistent during the two years of sampling with slight differences. Post yolk sac larvae dominated the entrainment sample collections, accounting for 83.3 percent of the Year 1 total and 95.8 percent of the Year 2 total. The yolk sac larvae life stage comprised only 5.9 percent of the sample collection for Year 1 and 1.6 percent of the sample collection for Year 2.

Overall, Herrings and Shad (Clupeidae, which includes Blueback Herring, Threadfin Shad and Gizzard Shad), Shad (including Threadfin/Gizzard Shad, Gizzard Shad, and Threadfin Shad), and Common Sunfishes (*Lepomis* spp.) dominated the entrainment sample collection accounting for 43 percent, 7 percent, and 34 percent of the total number of organisms during Year 1 and 69 percent, 16 percent, and 9 percent during Year 2, respectively. White Perch accounted for 5 percent and 2 percent of the total sample collection in Year 1 and Year 2, respectively. All remaining taxa contributed no more than 1 percent of the finfish collection. No endangered or threatened species were collected.

The highest monthly depth-averaged densities occurred in May, June, and July of both years. These peak densities were attributed primarily to post yolk sac larval Herrings and Shad (May to July), Common Sunfishes (June and July, extending into August of the first year of sampling), and

Threadfin/Gizzard Shad (May to July of second year of sampling). The lowest depth-averaged monthly densities generally occurred during early spring (March and April) and September. White Perch contributed to the early spring densities (April) primarily during the first year of sampling.

Entrainment Characterization after Accounting for Screen Exclusion

The U.S. Environmental Protection Agency (EPA) defines impingeable organisms as those that would be collected or retained in a sieve with a maximum opening dimension[1] of 0.56 inches (14.2 millimeters [mm]). Only organisms that would pass through the maximum opening of 0.56 inches, and thus be entrained, are used to estimate entrainment losses (which is called "baseline entrainment" hereafter). The traveling water screens at NAPS have a unique mesh size that is finer than the mesh size defined in the Rule; there is no fish return system at NAPS and the "converts" (i.e., organisms that would be entrainable by the Rule definition of entrainment, but retained by the NAPS screens as impinged organisms) are not returned to the source waterbody. Therefore, baseline entrainment density and annual loss estimates are more relevant than the actual entrainment based on the screen mesh installed at the NAPS. Annual baseline entrainment at NAPS during 2016 (April through September) was estimated at 53,593,333 finfish and 67,924,622 finfish under actual intake flows and design flows, respectively, based on the first year of sampling. Annual baseline entrainment for 2017 (March through September) was estimated at 83,421,119 finfish and 99,782,529 finfish under actual intake flows and design flows, respectively, based on the second year of sampling.

Comparison to Historical Data

Overall, the entrainment composition collected in 2016-2017 compares well with the entrainment study data conducted from March 1978 through July 1983 (VEPCO 1985), with the dominant taxa for both studies consisting of Gizzard Shad, White Perch, and Sunfishes. The current study contained a higher taxonomic grouping of Herrings and Shad. Blueback Herring and Threadfin Shad were introduced to Lake Anna in the 1980's and therefore would not have been available for collection in the earlier entrainment study. The previous study noted that changes in total numbers entrained from year to year were generally reflected in the numbers of Gizzard Shad, Sunfishes, and White Perch collected, and this is consistent with the current study. The previous study also noted that entrainment densities overall were highest in the midnight samples (VEPCO 1985) based primarily on the abundance of Gizzard Shad and White Perch. However, Sunfish were collected at higher densities during the day. Overall in the current study, entrainment densities were higher at night during the first year of sampling while equally abundant in the late afternoon and evening during the second year of sampling. Entrainment densities by depth were highly variable by taxon and study year for both studies. The combined data of the previous study indicate overall densities were similar for each depth strata with 33 percent of organisms collected in surface samples, 35 percent in mid-depth samples, and 32 percent in near-bottom samples

[1] EPA recognizes that 1/2 by 1/4 inch mesh are used in some instances and perform comparably to the 3/8 inch square mesh. Therefore, the Rule allows for facilities to apply a 1/2 by 1/4 inch sieve (diagonal opening of 0.56 inches) or a 3/8 inch sieve (diagonal opening of 0.53 inches) when discerning between impinged and entrained organisms - Federal Register / Vol. 79, No. 158. Page 48321.

(VEPCO 1985). Results of the current study indicate densities were highest at mid-depth but percentages varied by year. During the first year of sampling, 48 percent of organisms were collected at the mid-depth and 46 percent were collected in near-bottom samples. During the second year of sampling, 56 percent of organisms were collected at the mid-depth compared to 36 percent in near-bottom samples. Densities were lowest in near-surface samples, accounting for 6 percent and 11 percent during the first and second year of sampling, respectively.

1 Introduction

1.1 Regulatory Background

Clean Water Act §316(b) was enacted under the U.S. Environmental Protection Agency (USEPA) 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. CWIS interact with the environment by drawing early life-stage fish and shellfish into and through cooling water systems (entrainment), or trapping juvenile or adult fish against the traveling water screens (TWS) at the opening of an intake structure (impingement).

On August 15, 2014, the final §316(b) Rule (the Rule) for existing facilities was published in the Federal Register.[2] The Rule became effective on October 14, 2014 and 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. Facilities subject to the 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. 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.

Dominion Energy, Inc.'s (Dominion Energy) North Anna Power Station (NAPS) is subject to the Rule and based on its current configuration and operation, it is 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, unless otherwise waived by the Director. In anticipation of these requirements, Dominion Energy commissioned a two-year entrainment study at the facility. This document provides methods and results from both years of the study with consideration of specific requirements related to entrainment data and evaluations (i.e., 122.21(r)(4), (7), (9) and (11)).

Dominion Energy requested concurrence from Virginia Department of Environmental Quality (DEQ) regarding the application of the 40 CFR §125.92(c)(2) definition of "closed-cycle recirculating system (CCRS)" to the NAPS. After DEQ's consultation with the EPA Region 3, DEQ agreed that Lake Anna including the Waste Heat Treatment Facility (WHTF) (see Figure 1-1) created as makeup water supply and heat dissipation treatment for the NAPS met the administrative criteria of a "CCRS" consistent with the definition in 40 CFR §125.92(c)(2)[3]; therefore, the use of CCRS meets the impingement mortality reduction standard through Compliance Alternative 1 (§125.94(c)(1)).

[2] https://www.gpo.gov/fdsys/pkg/FR-2014-08-15/pdf/2014-12164.pdf

[3] E-mail correspondence from Bryant Thomas (Regional Water Permits & Planning Manager) of Virginia Department of Environmental Quality, Northern Regional Office on April 5, 2017.

1.2 Prior Studies

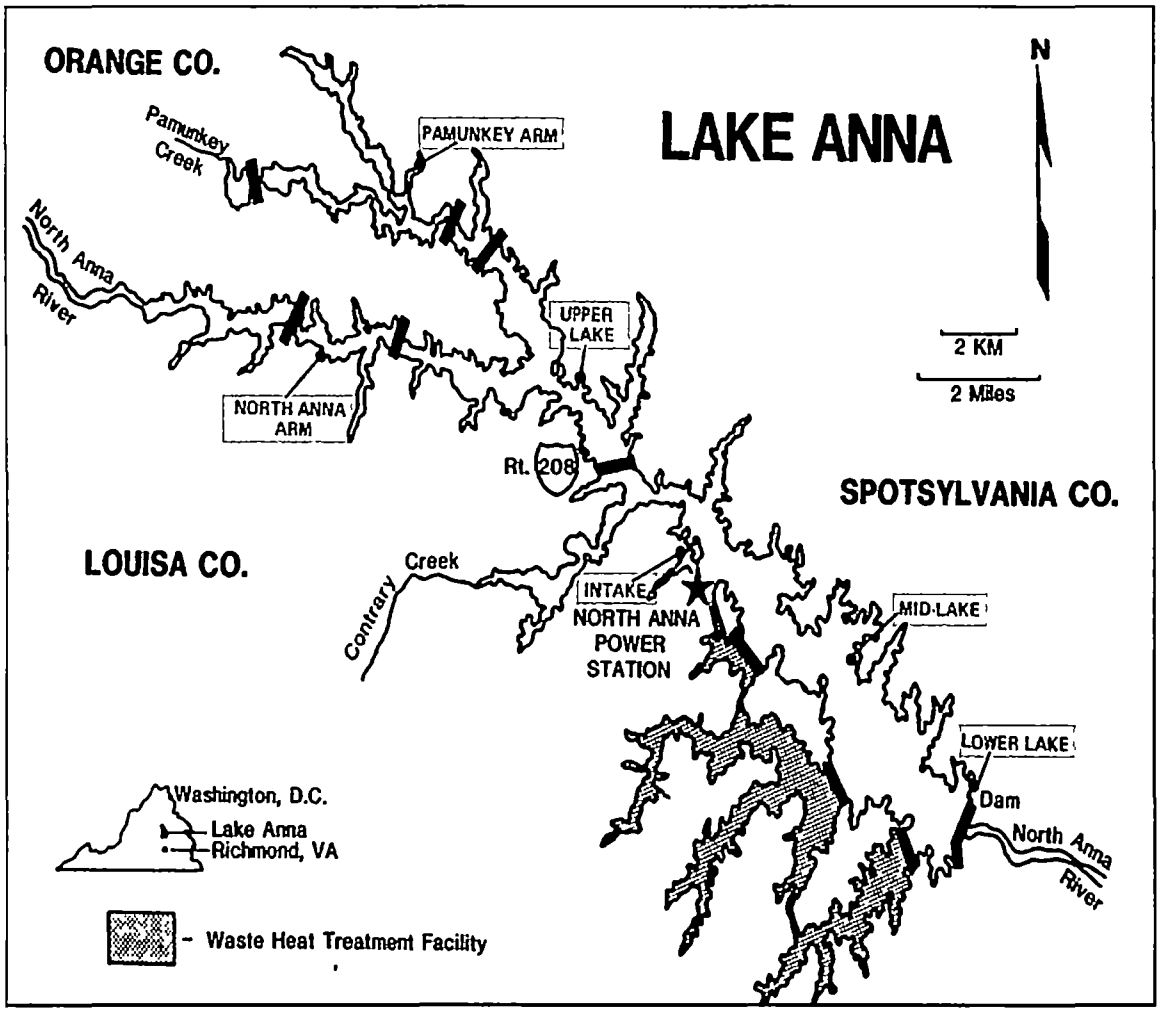
A detailed synopsis of prior entrainment studies is provided below to help place the current study into a historical context. No prior studies conducted at NAPS (entrainment or otherwise) reported an occurrence of threatened or endangered species. It is important to note that environmental conditions during prior studies are not assumed to be similar to the most recent studies conducted in 2016-2017. Therefore, any direct comparisons may be limited.

Also relevant to the fisheries studies summarized below is the stocking history for Lake Anna. The stocking of forage and predatory fish began in 1972 when Largemouth Bass (*Micropterus salmoides*), Bluegill (*Lepomis macrochirus*), Redear Sunfish (*Lepomis microlophus*), and Channel Catfish (*Ictalurus punctatus*) were introduced to Lake Anna (Odenkirk 2016). These introductions were subsequently followed by additions of Walleye (*Sander vitreus*) and Striped Bass (*Morone saxatilis*), then Threadfin Shad (*Dorosoma petenense*) and Blueback Herring (*Alosa aestivalis*) in the 1980's. Walleye stocking was terminated in 2007. A one-time experimental stocking of the hybrid Saugeye (male Sauger [*Sander canadensis*] and female Walleye) was made in 2013. An additional experimental stocking of the hybrid Striped Bass (male White Bass [*Morone chrysops*] and female Striped Bass) was made in 2014. The primary forage species in Lake Anna consist of Gizzard Shad (*Dorosoma cepedianum*), Threadfin Shad and Blueback Herring. No other herring species are known to occur in Lake Anna based on annual sampling by Virginia Department of Game and Inland Fisheries (VDGIF) (Odenkirk 2016).

1.2.1 Ambient Ichthyoplankton Study, 1984-1985

Bi-weekly ichthyoplankton sampling was conducted at NAPS from 1984 to 1985 (VEPCO 1986). Samples were collected at six locations in Lake Anna using a side towed plankton net (Figure 1-1; Tables 1-1 and 1-2).

Yellow Perch (*Perca flavescens*) eggs and larvae were generally first collected during this study in early April, when water temperatures approached 12 degrees Celsius (°C). White Perch (*Morone americana*) eggs and larvae appeared in April when the temperature approached 14°C and peaked in numbers by mid-May. Both White and Yellow Perch spawn typically in the spring. Gizzard Shad eggs and larvae generally were first collected in late April to early May at water temperatures between 14°C and 18°C and peaked in numbers in mid-May to early June. Gizzard shad typically spawn in early summer/late spring. Sunfish (Centrarchidae) eggs and larvae were the last group to occur in samples (May-June) and were first collected when water temperatures rose to 19°C. Both Gizzard Shad and Sunfish were collected in relatively fewer numbers in July. The most commonly caught sunfish, Bluegill, typically spawn during early summer. The egg and larval presence follows the spawning patterns of each individual species and is consistent between 1984 and 1985 (Jenkins and Burkhead 1994).



Source: VEPCO, 1986; Figure 4.4-3

Figure 1-1. Ambient Ichthyoplankton Sampling Locations near NAPS during 1984-1985

Table 1-1. Densities (#/1,000 m^3) of Ichthyoplankton Collected by Date (Month/Day) and Station during 1984 in Lake Anna

Gizzard Shad														
Station	**3/22**	**4/2**	**4/19**	**5/2**	**5/18**	**5/31**	**6/14**	**6/28**	**7/12**	**7/26**	**8/10**	**8/23**	**9/5**	**9/20**
Lower Lake	-	-	913.0	23,173.9	4,494.9	6,714.8	54.1	-	-	41.0	51.3	-	-	-
Mid-Lake	-	-	33.0	1,220.7	4,603 2	7,562.7	171.7	35.0	-	371.7	40.5	-	-	-
Intake	-	-	-	1,416.7	6,232.6	15,979.4	1,913.0	573.8	41.8	655.7	46.3	49.5	-	-
Upper Lake	-	-	-	7,817.3	909.1	9,539.2	945.9	5,523.5	723.4	40.7	-	-	-	-
North Anna Arm	-	-	-	46.7	47.2	32,746.8	8,284 5	6,386.9	86.6	375.0	-	93.0	95.7	-
Pamunkey Arm	-	-	-	47.2	3,925.2	18,325.1	86,050.4	8,165.1	4,609 4	5,381 5	615.4	140.8	49.8	-
Sunfish														
Station	**3/22**	**4/2**	**4/19**	**5/2**	**5/18**	**5/31**	**6/14**	**6/28**	**7/12**	**7/26**	**8/10**	**8/23**	**9/5**	**9/20**
Lower Lake	-	-	-	-	-	5,487.4	10,757.0	3,703.7	3,139.5	123.0	1,948.7	676.3	99.0	-
Mid-Lake	-	-	-	-	-	3,010.8	515.0	489.5	820.9	37.2	2,105.3	41.5	-	-
Intake	-	-	-	-	-	14,673.5	2,739.0	3,401.6	2,050.2	532.8	740.7	346.5	-	-
Upper Lake	-	-	-	-	-	184.3	19,775.0	2,418.8	255.3	122.0	289.9	189.6	-	-
North Anna Arm	-	-	-	-	-	429.2	2,762 0	1,094.9	2,207.8	41.7	368.7	930.2	239.2	-
Pamunkey Arm	-	-	-	-	-	98.5	188,067.0	10,137.6	1,093.0	1,325.3	1,346.2	1,056.3	149.3	-
Yellow Perch														
Station	**3/22**	**4/2**	**4/19**	**5/2**	**5/18**	**5/31**	**6/14**	**6/28**	**7/12**	**7/26**	**8/10**	**8/23**	**9/5**	**9/20**
Lower Lake	3,396.2	3,508 8	782.6	-	-	-	-	-	-	-	-	-	-	-
Mid-Lake	48.1	7,170.5	231.0	46.9	-	-	-	-	-	-	-	-	-	-

Intake	-	699.6	338.5	83.3	-	-	-	-	-	-	-	-	-	-
Upper Lake	89.3	3,855.4	955.6	101.5	-	-	-	-	-	-	-	-	-	-
North Anna Arm	-	-	37.0	-	-	-	-	-	-	-	-	-	-	-
Pamunkey Arm	-	125.0	33.1	-	-	-	-	-	-	-	-	-	-	-

White Perch

Station	3/22	4/2	4/19	5/2	5/18	5/31	6/14	6/28	7/12	7/26	8/10	8/23	9/5	9/20
Lower Lake	-	-	-	304.3	-	180.5	-	-	-	-	-	-	-	-
Mid-Lake	-	-	-	328.6	238.1	143.4	-	-	-	-	-	-	-	-
Intake	-	-	-	83.3	418.6	515.5	43.5	-	-	-	-	-	-	-
Upper Lake	-	-	-	101.5	505.1	506.9	-	-	-	-	-	-	-	-
North Anna Arm	-	-	-	-	-	42.9	-	-	-	-	-	-	-	-
Pamunkey Arm	-	-	33.1	-	887.9	640.4	-	-	-	-	-	-	-	-

Black Crappie

Station	3/22	4/2	4/19	5/2	5/18	5/31	6/14	6/28	7/12	7/26	8/10	8/23	9/5	9/20
Lower Lake	-	-	-	43.5	50.5	-	-	-	-	-	-	-	-	-
Mid-Lake	-	-	-	-	39 7	71.7	-	-	-	-	-	-	-	-
Intake	-	-	-	83.3	139.5	-	-	-	-	-	-	-	-	-
Upper Lake	-	-	-	-	909.1	-	-	-	-	-	-	-	-	-
North Anna Arm	-	-	-	-	47.2	-	-	-	-	-	-	-	-	-
Pamunkey Arm	-	-	-	-	-	98.5	-	-	-	-	-	-	-	-

Table 1-2. Densities (#/1,000 m^3) of Ichthyoplankton Collected by Date (Month/Day) and Station during 1985 in Lake Anna

Gizzard Shad													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Lower Lake	-	-	54.3	127.4	3,790.0	50 8	51.0	96.2	-	-	-	-	-
Mid-Lake	-	-	-	139.9	7,376.2	-	49.5	200 0	-	-	-	-	-
Intake	-	-	47 6	588.2	7,412.9	97 1	536.6	761.4	135.1	-	-	-	-
Upper Lake	-	-	-	476.2	3,130.8	5,707 1	2,830.2	157.9	-	-	-	-	-
North Anna Arm	-	-	-	3,707.3	1,753.6	1,492.5	14,444.4	5,055.6	137.0	105.8	-	52.1	-
Pamunkey Arm	-	-	-	887.9	7,718.4	8,446.6	14,046.5	3,265.3	1,342.0	-	-	248.8	-

Sunfish													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Lower Lake	-	-	-	-	2,237.4	1,015.2	6,071.4	4,711.5	172.4	55.9	410.3	158.7	-
Mid-Lake	-	-	-	-	-	1,952.4	1,881.2	150.0	296.6	-	114.9	-	-
Intake	-	-	-	-	12,636.8	2,718.4	10,536.6	12,284.3	6,441.4	108.7	366.5	-	-
Upper Lake	-	-	-	-	-	151.5	235.8	315.8	1,082.3	284.1	-	93.5	-
North Anna Arm	-	-	-	-	-	497.5	-	7,444.4	1,917.8	317.5	54.3	416.7	-
Pamunkey Arm	-	-	-	-	-	145.6	976.7	1,479.6	692.6	829.0	1,270.7	248.8	49.5

Yellow Perch													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Lower Lake	1,105.3	1,793.7	54.3	-	-	-	-	-	-	-	-	-	-
Mid-Lake	2,402.0	483.1	-	-	-	-	-	-	-	-	-	-	-

Intake	105.3	418.6	-	-	-	-	-	-	-	-	-	-	-
Upper Lake	-	1,278.5	-	-	-	-	-	-	-	-	-	-	-
North Anna Arm	130.4	-	-	-	-	-	-	-	-	-	-	-	-
Pamunkey Arm	-	138.9	-	-	-	-	-	-	-	-	-	-	-
White Perch													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Intake	-	-	47.6	84.0	-	-	-	-	-	-	-	-	-
Upper Lake	-	-	46.1	105.8	-	-	-	-	-	-	-	-	-
Black Crappie													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Intake	-	-	-	210.1	-	-	-	-	-	-	-	-	-
Upper Lake	-	-	-	211.6	-	-	-	-	-	-	-	-	-
Largemouth Bass													
Station	**3/25**	**4/3**	**4/19**	**5/2**	**5/16**	**5/30**	**6/13**	**6/27**	**7/11**	**7/25**	**8/9**	**8/22**	**9/5**
Intake	-	-	-	2,226.9	-	-	-	-	-	-	-	-	-

1.2.2 Entrainment Study, 1978–1983

Entrainment sampling at NAPS was conducted from March 1978 through July 1983 (VEPCO 1985). Details of the March 1978–July 1983 entrainment sampling program are presented in Table 1-3.

Table 1-3. North Anna Power Station March 1978 – July 1983 Entrainment Sampling Details

Entrainment	Details
Units Sampled	Units 1 and 2
Sampling Location	In front of a predetermined intake forebay
Surveys March – July, 1978 to 1983	Weekly surveys March – July, 1978 through 1983
Daily Collection Schedule	Every six hours in a 24-hour period (four collections / 24-hour period) centered around 0600, 1200, 1800 and 2400 hours
Depths Sampled	Surface, mid-depth, and bottom
Number of Samples Collected per Depth	Two samples per depth using paired conical nets (duplicate samples at each depth)
Sample Duration	Ten minutes
Sampling Gear	Conical measurements of 0.5-meter (m) x 1.5 m plankton nets constructed of 505-micron (μm) mesh netting, each affixed in a double-net bongo frame; General Oceanics Model 2030 MK II low-velocity-sensitive digital flowmeters suspended in the mouth of each
Water Quality Measurements	Water temperature and dissolved oxygen (DO) measured at each sample depth

A total of 7,908 fish larvae were collected in entrainment samples at NAPS from 1978-1983. The most abundant entrained larvae over all years were Gizzard Shad (65.7%) followed by White Perch (15.0%), Sunfishes, *Lepomis spp.* (13.4%), Yellow Perch (4.9%) and Black Crappie (*Pomoxis nigromaculatus*) (1.0%). Channel Catfish and Largemouth Bass were each represented by a single collected individual. Sunfishes were considered to represent several possible species. More Sunfish and Yellow Perch larvae were collected in the first year (1978) than in subsequent years. Gizzard Shad, however, were collected in relatively greater numbers in 1979 and 1981. White Perch numbers generally increased over the study period. Black Crappie numbers are considered too low for meaningful comparisons. With the exception of 1978, the changes in total numbers entrained from year to year are generally reflected in the numbers of Gizzard Shad, Sunfishes, and White Perch collected. The percentage of the total larvae collected represented by Gizzard Shad had remained high and stable for each year, whereas the percentage of White Perch increased each year. Table 1-4 presents the annual total catch and percent larvae entrained, and Table 1-5 shows the monthly total catch of fish larvae entrained at NAPS from 1978 to 1983.

Yellow Perch was first to appear in all collection years from 1978 to 1983, generally in late March to early April when water temperatures approached 12 °C. White Perch were collected in entrainment samples in mid-April when temperatures approached 14 °C and peaked in numbers by mid-May. Gizzard Shad generally were first collected in late April to early May at water temperatures between 14 °C and 18 °C, and peaked in numbers in mid-May to early June. Sunfishes were the last group to appear in samples (May-June) and were first collected when water temperatures rose to 19 °C. Both Gizzard Shad and Sunfish were collected in relatively fewer numbers in July (Table 1-5).

Samples collected during the six hour intervals within a day generally showed that total numbers and percent varied considerably from 0600 hours to 1800 hours and were highest during the 2400-hour sample. Over all years and samples, the percentage of fish larvae collected during the midnight sample was 43 percent. Gizzard Shad and White Perch collections were responsible for the highest numbers during the 2400-hour sample. Sunfishes were, on the contrary, generally collected more frequently during daylight hours and Yellow Perch numbers fluctuated during sample intervals (Table 1-6; Figure 1-2).

Factors such as turbidity, temperature, larval size, and gear type have been shown to influence distributional patterns (VEPCO 1985). Any combination of factors could cause site specificity in larval distribution. The percent of total larvae collected at each sample depth varied from year to year and for each species. Sunfishes, Yellow Perch, and Black Crappie were collected primarily from surface samples; Gizzard Shad were collected primarily from middle and bottom depths; and White Perch numbers were similar at all depths (Table 1-7). Over all species and all collection years, the percentage of larvae collected from the surface was 33 percent, from the mid-depth (13.1 feet) was 35 percent, and from the bottom (26.2 feet) was 32 percent (Figure 1-3).

No fish eggs were collected during the sample years 1978-1983. Most species of reproducing fish in Lake Anna produce demersal, adhesive eggs, which significantly reduced potential entrainment (VEPCO 1985).

Table 1-4. Annual Total Catch and Percent of Fish Larvae Entrained at North Anna Power Station from 1978-1983

Species	1978		1979		1980		1981		1982		1983		Total	Percent
	Catches	%	Catches	%	Catches	%	Catches	%	Catches	%	Catches	%		
Gizzard Shad	514	43.2	1,397	87.9	941	73.6	1,126	64.2	471	51.1	733	62.3	**5,182**	**65.5**
Channel Catfish	-	0.0	-		-	0.0	-	0.0	-	0.0	1	0.1	**1**	**0.0**
White Perch	3	0.3	56	3.5	91	7.1	391	22.3	293	31.8	361	30.7	**1,195**	**15.1**
Sunfish	531	44.6	112	7.0	161	12.6	117	6.7	114	12.4	28	2.4	**1,063**	**13.4**
Largemouth Bass	1	0 1	-	0.0	-	0.0	-	0.0	-	0.0	-	0.0	**1**	**0.0**
Black Crapple	12	1.0	6	0.4	13	1.0	16	0.9	6	0.7	29	2.5	**82**	**1.0**
Yellow Perch	130	10.9	18	1.1	72	5.6	103	5.9	37	4.0	24	2.0	**384**	**4.9**
Total	**1,191**	**100**	**1,589**	**100**	**1,278**	**100**	**1,753**	**100**	**921**	**100**	**1,176**	**100**	**7,908**	**100**

Table 1-5. Monthly Total Catch of Fish Larvae Entrained at North Anna Power Station from 1978-1983

Month	Species							Total
	Black Crappie	Channel Catfish	Gizzard Shad	Largemouth Bass	Sunfish	White Perch	Yellow Perch	
Year 1978								
March								
April							110	**110**
May	7		55			1	19	**82**
June	5		453	1	300	2	1	**762**
July			6		231			**237**
Total	**12**		**514**	**1**	**531**	**3**	**130**	**1,191**
Year 1979								
March								
April						2	17	**19**
May	5		801		2	54	1	**863**
June	1		556		72			**629**
July			40		38			**78**
Total	**6**		**1,397**		**112**	**56**	**18**	**1,589**
Year 1980								
March								
April						6	72	**78**
May	10		452		7	75		**544**
June	2		452		103	10		**567**
July	1		37		51			**89**
Total	**13**		**941**		**161**	**91**	**72**	**1,278**
Year 1981								
March								
April			11			95	103	**209**
May	6		856			285		**1147**
June	10		248		64	11		**333**
July			11		53			**64**
Total	**16**		**1,126**		**117**	**391**	**103**	**1,753**
Year 1982								
March							5	**5**
April			2			44	32	**78**
May	6		136		38	238		**418**
June			315		33	10		**358**
July			18		43	1		**62**
Total	**6**		**471**		**114**	**293**	**37**	**921**
Year 1983								
March							4	**4**
April						64	20	**84**
May	28		393		3	242		**666**
June	1	1	332		6	51		**391**
July			8		19	4		**31**
Total	**29**	**1**	**733**		**28**	**361**	**24**	**1,176**
Grand Total	**82**	**1**	**5,182**	**1**	**1,063**	**1,195**	**384**	**7,908**

Table 1-6. Total Larvae Collected by Sample Time at North Anna Power Station from 1978-1983

Species	Year	Hour 0600	%	Hour 1200	%	Hour 1800	%	Hour 2400	%	Total
Gizzard Shad	1978	90	17.5	63	12.3	95	18.5	266	51.8	**514**
	1979	153	11 0	167	12.0	337	24.1	740	53.0	**1,397**
	1980	215	22.8	106	11.3	158	16.8	462	49.1	**941**
	1981	173	15.4	143	12.7	277	24.6	533	47.3	**1,126**
	1982	88	18 7	66	14.0	28	5.9	289	61.4	**471**
	1983	140	19.1	215	29.3	137	18.7	241	32.9	**733**
	Total	**859**	**16.6**	**760**	**14.7**	**1,032**	**19.9**	**2,531**	**48.8**	**5,182**
Channel Catfish	1983							1	100.0	**1**
	Total							**1**	**100.0**	**1**
Sunfish	1978	80	15.1	199	37.5	144	27.1	108	20.3	**531**
	1979	16	14.3	26	23.2	37	33.0	33	29.5	**112**
	1980	18	11.2	55	34.2	64	39.8	24	14.9	**161**
	1981	43	36.8	38	32.5	26	22.2	10	8.5	**117**
	1982	31	27.2	52	45.6	10	8.8	21	18.4	**114**
	1983	3	10.7	13	46.4	8	28.6	4	14.3	**28**
	Total	**191**	**18.0**	**383**	**36.0**	**289**	**27.2**	**200**	**18.8**	**1,063**
Largemouth Bass	1978			1	100.0					**1**
	Total			**1**	**100.0**					**1**
White Perch	1978		0.0		0.0		0.0	3	100.0	**3**
	1979	3	5 4	13	23.2	11	19.6	29	51.8	**56**
	1980	13	14 3	8	8.8	16	17.6	54	59.3	**91**
	1981	53	13 6	57	14.6	114	29.2	167	42.7	**391**
	1982	29	9.9	58	19.8	43	14.7	163	55.6	**293**
	1983	62	17 2	133	36.8	57	15.8	109	30.2	**361**
	Total	**160**	**13.4**	**269**	**22.5**	**241**	**20.2**	**525**	**43.9**	**1,195**
Yellow Perch	1978	14	10.8	35	26.9	46	35.4	35	26.9	**130**
	1979	3	16.7	13	72.2		0.0	2	11.1	**18**
	1980	17	23.6	19	26.4	3	4.2	33	45.8	**72**
	1981	15	14.6	12	11 7	41	39.8	35	34.0	**103**
	1982	3	8 1	10	27.0	7	18.9	17	45.9	**37**
	1983	10	41.7	3	12 5	5	20.8	6	25.0	**24**
	Total	**62**	**16.1**	**92**	**24.0**	**102**	**26.6**	**128**	**33.3**	**384**

Species	Year	Hour 0600	%	Hour 1200	%	Hour 1800	%	Hour 2400	%	Total
Black Crappie	1978	4	33.3	6	50.0	1	8.3	1	8.3	**12**
	1979	1	16.7		0.0	3	50.0	2	33.3	**6**
	1980	4	30.8	2	15.4	6	46.2	1	7.7	**13**
	1981	2	12.5	5	31.3	5	31.3	4	25.0	**16**
	1982	2	33.3	2	33.3	1	16.7	1	16.7	**6**
	1983	1	3.4	18	62.1	3	10.3	7	24.1	**29**
	Total	**14**	**17.1**	**33**	**40.2**	**19**	**23.2**	**16**	**19.5**	**82**
Grand Total		**1,286**	**16.3**	**1,538**	**19.4**	**1,683**	**21.3**	**3,401**	**43.0**	**7,908**

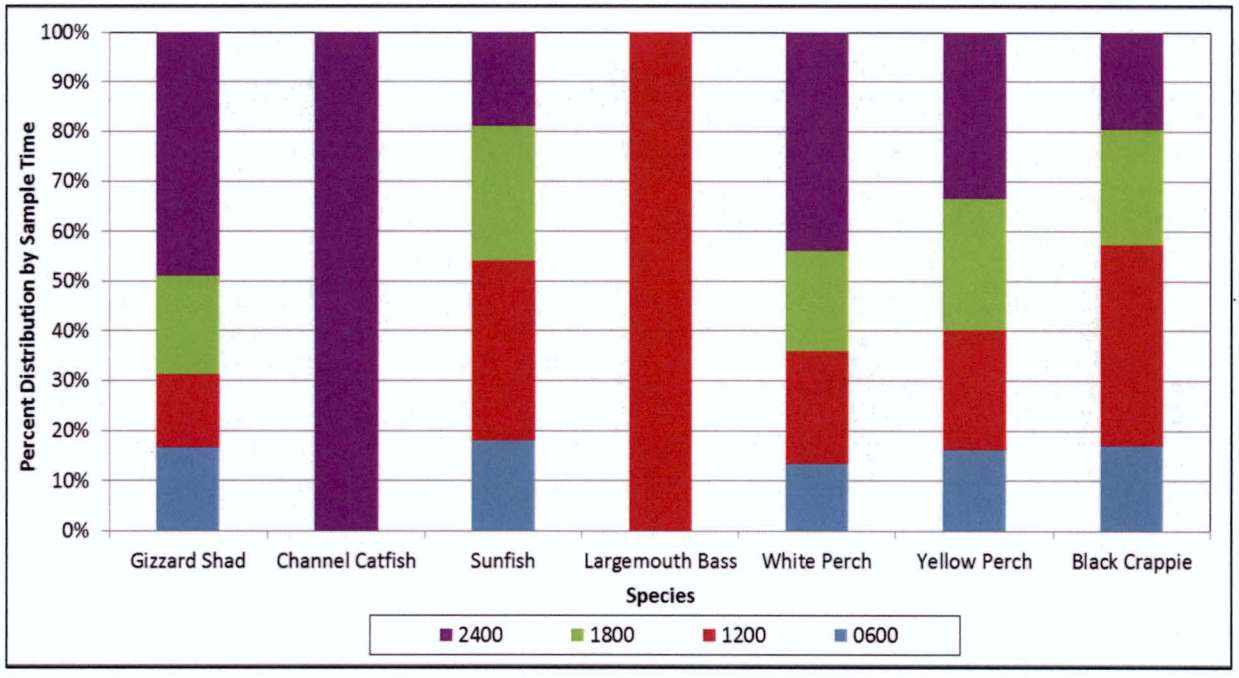


Figure 1-2. Percent Distribution of Larvae Collected By Sample Time in All Collection Years from 1978-1983

Table 1-7. Total Larvae Collected by Sample Depth at North Anna Power Station from 1978-1983

Species	Year	Surface	%	Middle	%	Bottom	%	Total
Gizzard Shad	1978	100	19.5	296	57.6	118	23.0	**514**
	1979	408	29.2	478	34.2	511	36.6	**1,397**
	1980	111	11.8	463	49.2	367	39.0	**941**
	1981	219	19.4	473	42.0	434	38.5	**1,126**
	1982	63	13.4	186	39.5	222	47.1	**471**
	1983	146	19.9	276	37.7	311	42.4	**733**
	Total	**1,047**	**20.2**	**2,172**	**41.9**	**1,963**	**37.9**	**5,182**
Channel Catfish	1983					1	100.0	**1**
	Total					**1**	**100.0**	**1**
Sunfish	1978	403	75.9	72	13.6	56	10.5	**531**
	1979	84	75.0	18	16.1	10	8.9	**112**
	1980	133	82.6	13	8.1	15	9.3	**161**
	1981	102	87.2	6	5.1	9	7.7	**117**
	1982	92	80.7	12	10.5	10	8.8	**114**
	1983	16	57.1	8	28.6	4	14.3	**28**
	Total	**830**	**78.1**	**129**	**12.1**	**104**	**9.8**	**1,063**
Largemouth Bass	1978	1	100.0					**1**
	Total	**1**	**100.0**					**1**
White Perch	1978	-	-	3	100.0	-	-	**3**
	1979	16	28.6	26	46.4	14	25.0	**56**
	1980	17	18.7	33	36.3	41	45.1	**91**
	1981	125	32.0	129	33.0	137	35.0	**391**
	1982	123	42.0	87	29.7	83	28.3	**293**
	1983	154	42.7	105	29.1	102	28.3	**361**
	Total	**435**	**36.4**	**383**	**32.1**	**377**	**31.5**	**1,195**
Yellow Perch	1978	86	66.2	20	15.4	24	18.5	**130**
	1979	15	83.3	2	11.1	1	5.6	**18**
	1980	40	55.6	9	12.5	23	31.9	**72**
	1981	74	71.8	18	17.5	11	10.7	**103**
	1982	17	45.9	8	21.6	12	32.4	**37**
	1983	14	58.3	3	12.5	7	29.2	**24**
	Total	**246**	**64.1**	**60**	**15.6**	**78**	**20.3**	**384**

Species	Year	Surface	%	Middle	%	Bottom	%	Total
Black Crappie	1978	7	58.3	1	8.3	4	33.3	**12**
	1979	5	83.3	1	16.7	-	-	**6**
	1980	10	76.9	2	15.4	1	7.7	**13**
	1981	14	87.5	1	6.3	1	6.3	**16**
	1982	5	83.3	1	16.7	-	-	**6**
	1983	19	65.5	10	34.5	-	-	**29**
	Total	**60**	**73.2**	**16**	**19.5**	**6**	**7.3**	**82**
Grand Total		**2,619**	**33.1**	**2,760**	**34.9**	**2,529**	**32.0**	**7,908**

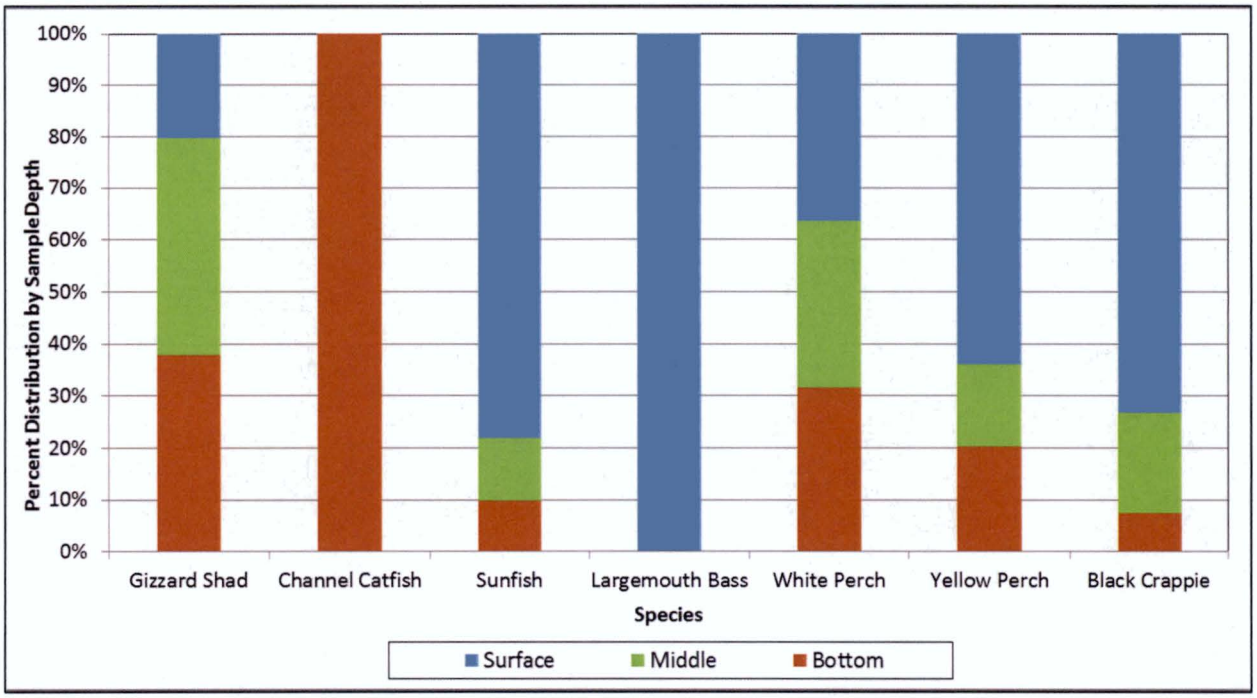


Figure 1-3. Percent Distribution of Larvae Collected By Sample Depth in All Collection Years from 1978-1983

1.3 Study Objectives and Document Organization

A two-year entrainment characterization study from April 2016 through September 2016 (Year 1), and from March 2017 to September 2017 (Year 2) is among Dominion Energy's ongoing efforts to support NAPS §316(b) compliance by documenting current, site-specific entrainment data that meet Rule requirements and achieve the following key objectives:

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[4];
2. Collect data to support development of §122.21(r)(7), which allows for summaries of relevant technology efficacy studies conducted at the facility;
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 Energy'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.

This report summarizes findings from the completed two-year entrainment study and is organized as follows: station's configuration and normal operations (Section 2); entrainment sampling and analysis methods (Section 3), results (Section 4), and a brief summary of findings (Section 5). Section 5 also includes a discussion of the most commonly entrained taxa.

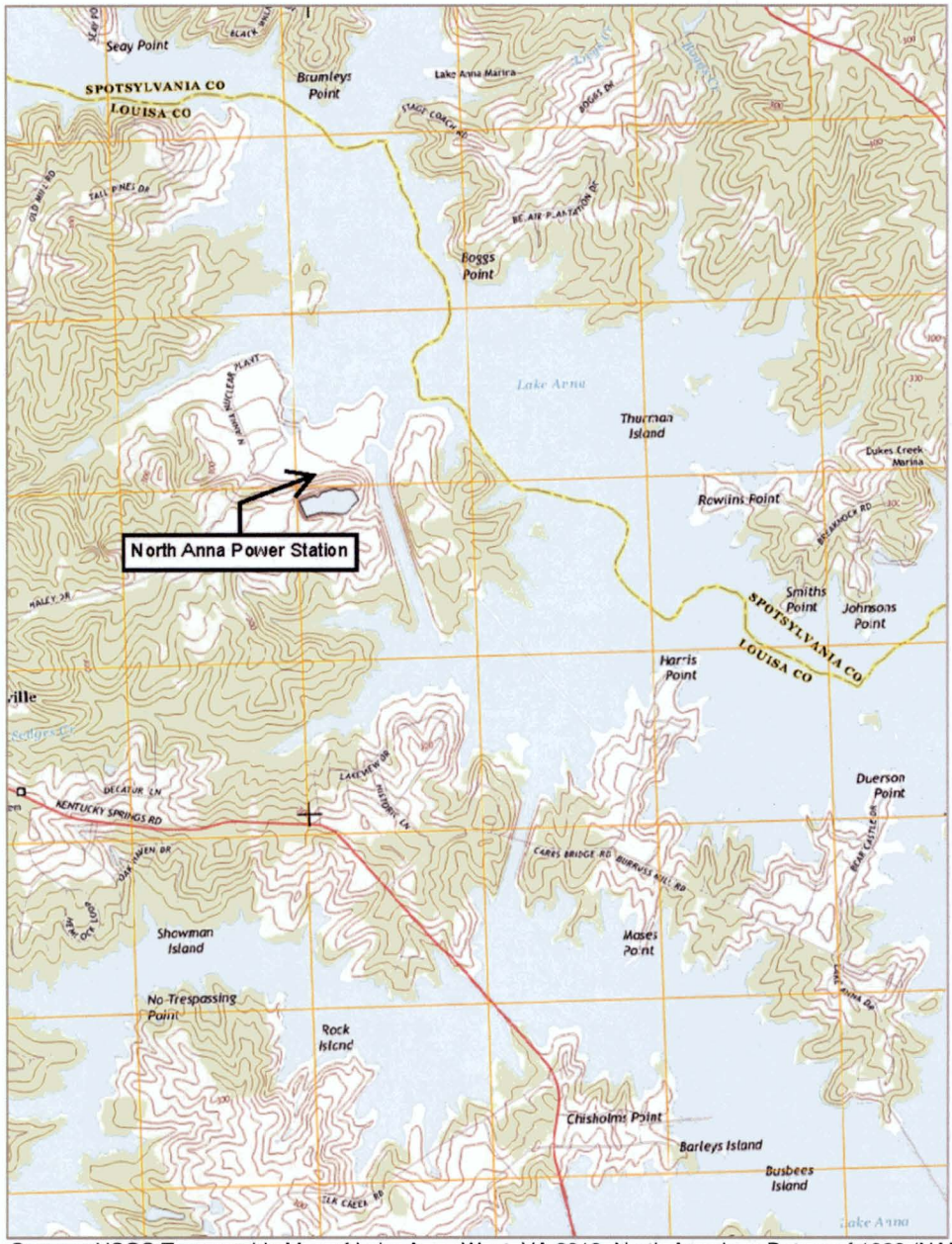
[4] 40 C.F.R. §122.21(r)(4) requires applicant to submit available Source Water Baseline Biological Characterization data.

2 Generating Station Description

2.1 Site and Environmental Description

NAPS is located on a peninsula on the southwestern shore of Lake Anna in Louisa County, Virginia (Figure 2-1). In 1971, Virginia Electric and Power Company (VEPCO) impounded the North Anna River, creating Lake Anna, a 9,600-acre freshwater lake and the 3,400 acre WHTF, specifically for the purpose of constructing a nuclear power plant, previously permitted by the Virginia State Water Control Board. Lake Anna began filling in January 1972 and reached full pool in December 1972. Lake Anna is 17 miles long and contains over 272 miles of shoreline. It is in the headwaters of the York River and drains about 343 square miles.

Dominion Energy is required to maintain a minimum discharge of 20 cubic feet per second under drought conditions, and a minimum discharge of 40 cubic feet per second during non-drought periods from the Lake Anna Dam. The annual discharge from the dam to the river averaged 273.9 cubic feet per second (USGS 2015) from 1979 to 2014 based on the annual average flow at U.S. Geological Survey (USGS) Gage 01670400 in the North Anna River near Partlow, VA, which is used as a surrogate flow gage for discharge from the dam. The water level in the lake ranges from elevation (El.) 255 feet (maximum) to El. 242 feet (minimum) above mean sea level (msl). The lake is managed to target a water level of El. 250 feet, at which stage it holds approximately 305,000 acre-feet of water. The lake has a maximum depth of approximately 90.0 feet and an average depth of 24.9 feet at full pool. In the vicinity of the dikes, the WHTF has an average depth of 18.0 feet and a maximum depth of approximately 49 feet (VEPCO 1986). Figure 2-1 shows the topographic elevation in the vicinity of NAPS.



Map Source: USGS Topographic Map of Lake Anna West, VA 2013; North American Datum of 1983 (NAD83)

Figure 2-1. North Anna Power Station Regional Location Map

2.2 Station Description

VEPCO, doing business as Dominion Energy, operates NAPS, consisting of two nuclear power-generating units (Unit 1 and 2). Unit 1 began commercial operation in June 1978 and Unit 2 began operating in December 1980. Eight circulating water pumps (four pumps per unit) supply cooling water drawn from Lake Anna. Each pump capacity is 238,200 gallons per minute (gpm) (i.e., 343.0 MGD) and the maximum design capacity for eight circulating water pumps is 2,744.1 MGD. The CWIS also contains service water pumps: two screenwash pumps, each rated at 910 gpm for each unit, and two auxiliary service water pumps (Table 2-1). Pump operation is seasonally

variable in response to generation demand and maintenance activities. Generating unit outages are generally scheduled for the winter, late fall, and early spring months.

Table 2-1. North Anna Power Station Cooling Water Intake Pump Characteristics

Unit	Purpose	# of Pumps	Pump Capacity	Design Flow per Unit
1	Circulating Water	4	343.0 MGD (238,200 gpm)	1,372.0 MGD (952,800 gpm)
	Service Water	2	1.3 MGD (910 gpm)	2.6 MGD (1,820 gpm)
2	Circulating Water	4	343.0 MGD (238,200 gpm)	1,372.0 MGD (952,800 gpm)
	Service Water	2	1.3 MGD (910 gpm)	2.6 MGD (1,820 gpm)
Maximum Design Intake Flow				**2,749.3 MGD (1,909,240 gpm)**

Cooling water for both units is through two screenwells (one per nuclear unit) in a single CWIS located at the end of a cove just north of the station on the southwestern shore of Lake Anna (Figure 2-2). Each screenwell consists of four 20-foot-wide intake bays and is equipped with four traveling water screens (TWS). Each intake bay is comprised of a steel trash rack (0.5-inch-wide by 3.5-inch-thick vertical bars placed 4 inches on center), a TWS, and a circulating water pump. The steel trash racks extend across the length of the CWIS to prevent large debris from damaging the TWSs.

Each TWS, located approximately 16 feet downstream from each trash rack, is 14 foot-wide and constructed with 16-gauge wire providing a vertically aligned, 1/8-inch by 1/2-inch screen mesh size (Figure 2-3). There are four screen wash pumps, one pump per two TWSs, located downstream of the TWSs, that supply 380 gpm per screen at 80 pounds per square inch (psi). Guides located on the support walls upstream of the screens accommodate installation of stop logs for screen maintenance. The stop logs allow dewatering for maintenance and isolate the bays when the screens are removed.

A single discharge canal is located 200 feet south of the CWIS; the 3,600-foot long canal discharges into the first of three waste heat treatment facilities in series, which disperse heat before the water is returned to Lake Anna. Debris cleaned from the screens is sluiced to a common debris trough and collected in a large steel basket located on the east side of the CWIS; debris is not returned to Lake Anna.

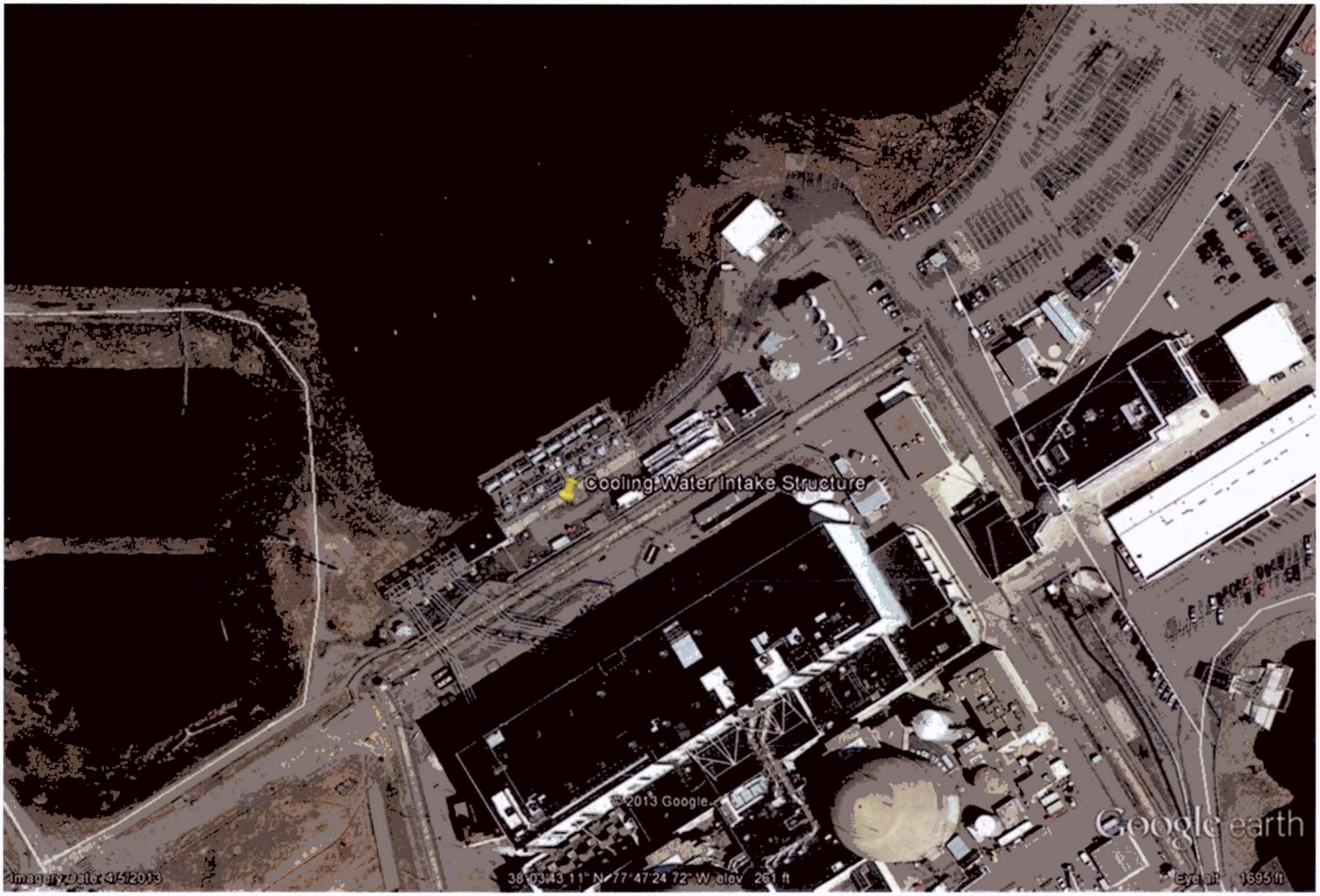
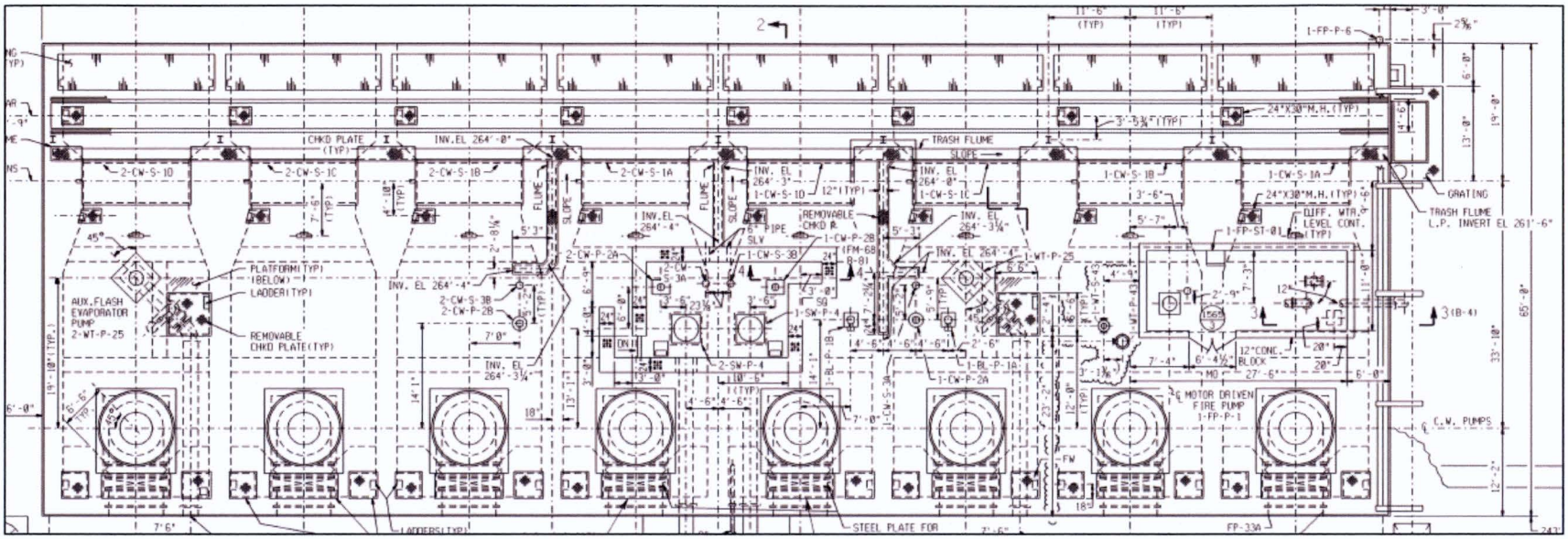


Figure 2-2. North Anna Power Station Cooling Water Intake Structure Location (38°03'43" N, 77°47'26" W)



Drawing Source: Provided by Dominion Energy

Figure 2-3. Details of North Anna Power Station Traveling Water Screens at the Cooling Water Intake Structure

3 Methods

3.1 Entrainment Sample Collection

Entrainment samples were collected twice a month (generally within the second and fourth week of each month) for 5.5 consecutive months from April 2016 through September 2016, and 6.5 consecutive months from March 2017 to September 2017 for a total of 24 sampling events. Each sampling event lasted 24 hours subdivided into four, six-hour subsampling periods. Sample duration was approximately 100 minutes per depth per six-hour sample (or the time required to get 100 m^3 per depth per six-hour sample). Specific details of the 2016-2017 entrainment sampling program are presented in Table 3-1. Entrainment samples were collected from intake piping installed along the front of the bar racks at Unit 2 from near-surface, mid-water, and near-bottom depths (Table 3-2). Samples were collected at Unit 2, in front of bar rack 2B or 2A (Figure 3-1); however, if a situation would arise where Unit 2 was not operational (this did not occur during 2016-2017 sampling), samples would have been collected at Unit 1, in front of bar rack 1C or 1D (Figure 3-2), as a secondary sampling location.

Table 3-1. North Anna Power Station Entrainment Sampling Details, 2016-2017

Entrainment	Details
Units to be Sampled	Unit 2 (Primary Location) and Unit 1 (Secondary Location)
Sampling Events during April – early September 2016 and March – early September 2017	Twice per month sampling events (within the second and fourth week of each month) for 5.5 months in 2016 and 6.5 months in 2017 (2/month x 12 months = 24 sampling events)
Daily Collection Schedule	Samples collected every 6 hours in a 24-hour period (4 collections / 24-hour 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 were 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)
Proposed Number of Samples per Sampling Event	4 collections/survey x 3 depths/collection x 1 sample/depth = 12 samples/survey
Proposed Total Number of Samples	12 samples/survey x 2 surveys/month x 12 months = 288 samples
Water Quality Measurements	Temperature, DO, pH, salinity, and conductivity approximately every six hours in the entrainment sampling buffering tanks for near-surface, mid-depth, and near-bottom depths

Table 3-2. Sampling Depths at North Anna Power Station

Sampling Location	Sampling Depth Relative to MSL	Sampling Depth from Intake Deck Level (+12 feet MSL)
Near-Surface (Mean Low Water – 4.5 feet MSL)	-4.5 feet	-19.5 feet
Mid-depth (Mid-point between MSL and bottom of intake)	-14.75 feet	-29.75 feet
Near-Bottom (Bottom of Intake + 3 feet MSL)	-26.0 feet	-41.0 feet

Note: MSL= Mean Sea Level

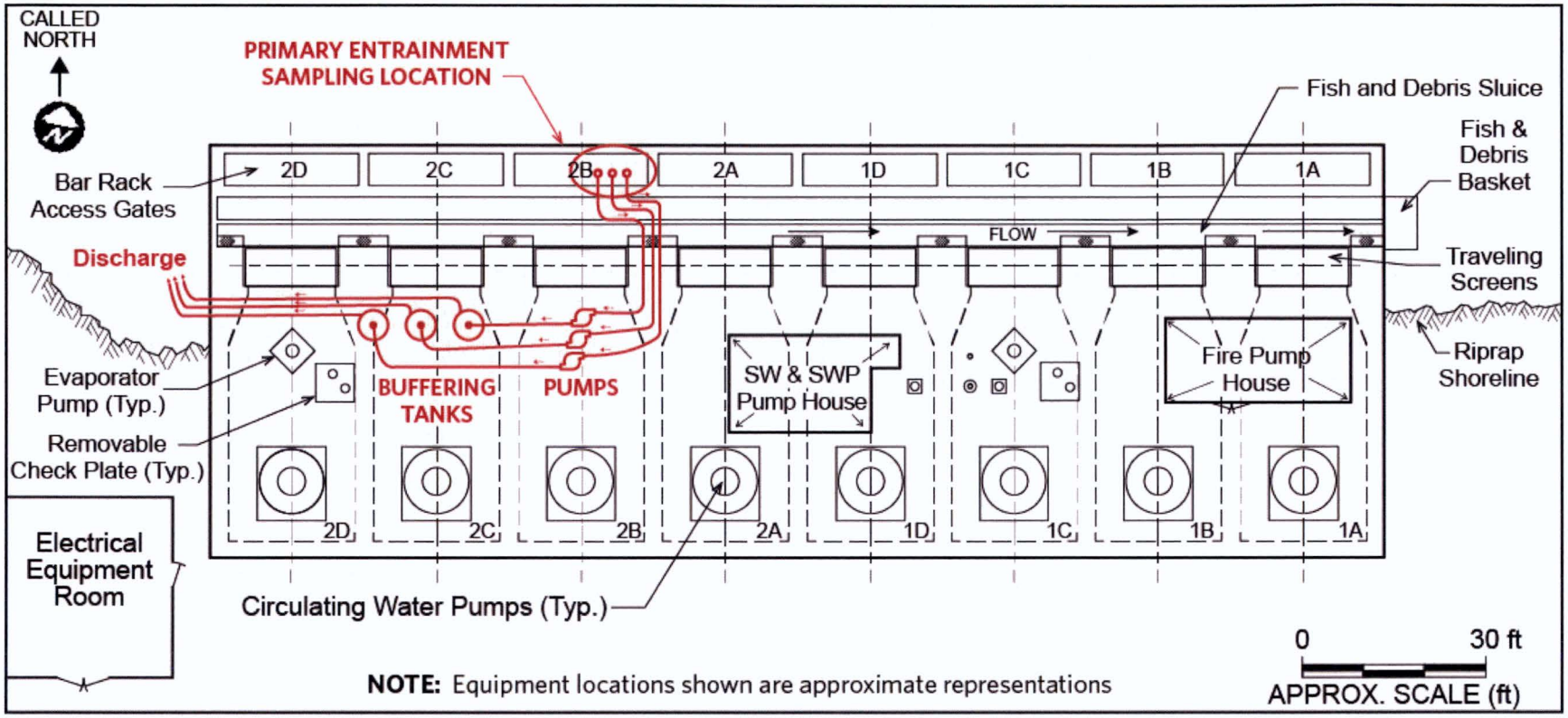


Figure 3-1. Primary Entrainment Sampling Location for North Anna Power Station

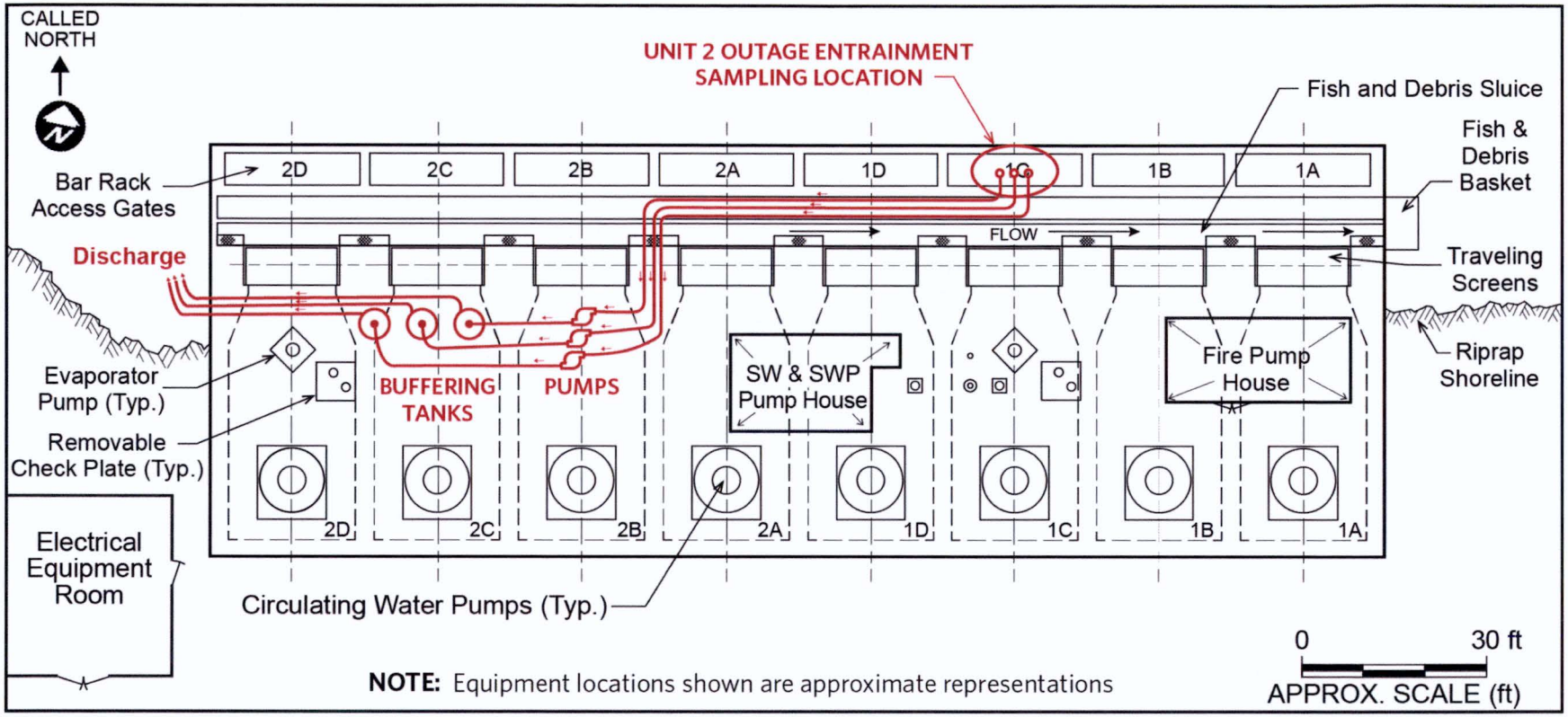


Figure 3-2. Secondary Entrainment Sampling Location for North Anna Power Station

3.2 Entrainment Monitoring

3.2.1 Sampling Gear and Protocol

Pumped entrainment samples were collected using 94 by 102-centimeter (cm), 335- μm mesh hoop plankton nets with a PVC cod-end bucket (Figure 3-3). Intake water from three depths (near-surface, mid-depth, and near-bottom) was pumped through the separate nets using gas-powered 4-inch diameter centrifugal trash pumps and 4-inch PVC pipelines. To minimize organism damage, the water was pumped into 200-gallon polyethylene water-filled sample buffering tanks (one for each depth) where the plankton net was suspended. The samples were collected concurrently using three pairs of pumps and buffering tanks. A pump flow rate check was conducted prior to commencing the first sampling period and again at the beginning of the second crew shift. Total flow sampled was monitored using an in-line totalizing flowmeter. Once a flow rate of approximately 250-275 gpm was achieved, sampling would begin and the time and start flowmeter numbers were recorded. The sample duration was approximately 100 minutes per depth or the time required to sample a minimum of 100 m^3 (26,400 gallons) of water.

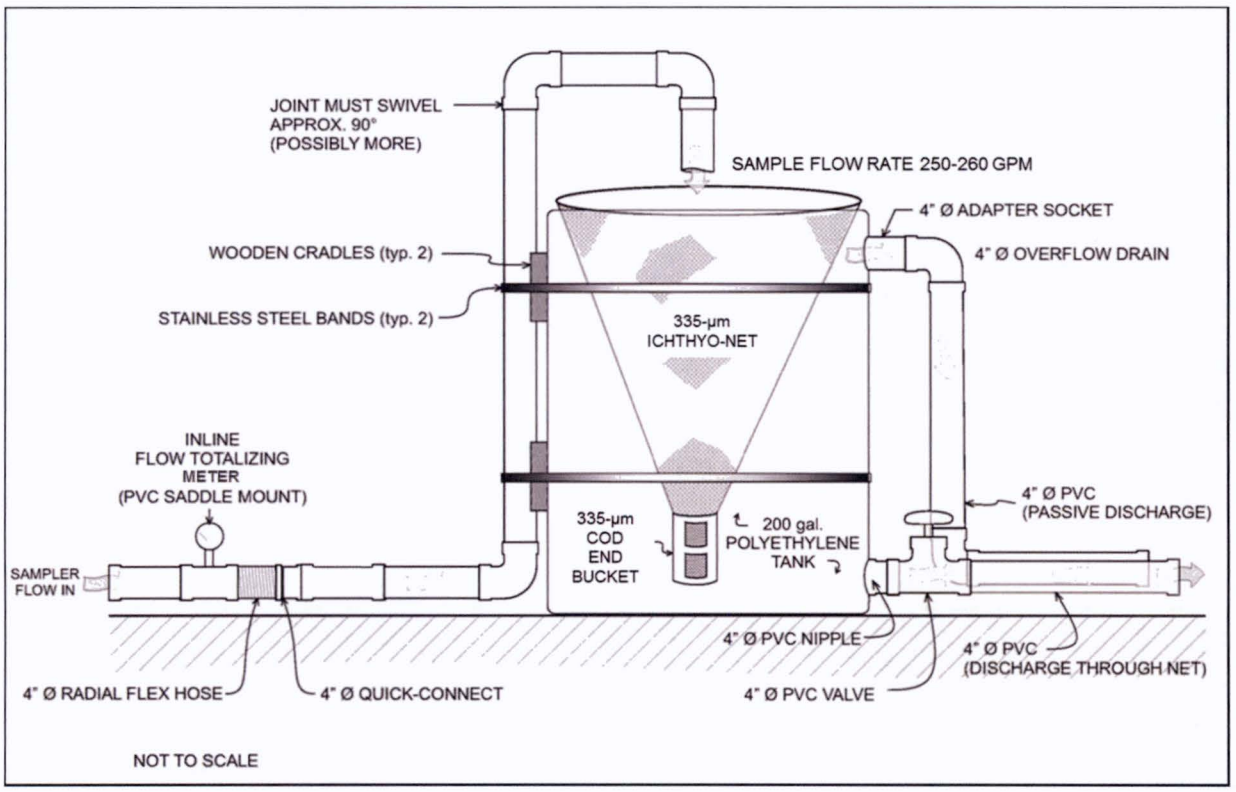


Figure 3-3. Entrainment Pump Sampling System Configuration

Each sample was collected by washing down the contents of the net from the outside into the cod-end bucket. The sample was then transferred to a labeled 1-liter wide-mouth polyethylene sample jar and preserved for laboratory analysis using a 5 percent formalin solution with Rose Bengal stain.

3.2.2 Collection Processing

After sample collection, each sample was washed through a 335-µm sieve in the laboratory to remove the excess formalin from the sample. Each sample was then sorted in a glass sorting tray, which was placed on a light box. The aquatic fauna were sorted into groups of fish eggs, fish larvae (including later life stages), and shellfish. Each group was preserved in 5 percent formalin, placed in separate, labeled glass vials, and stored. Samples that were estimated to contain more than 400 fish eggs or 400 larvae were sub-sampled.

After sorting, the fish eggs, fish larvae, and shellfish were identified to the lowest practical taxon and enumerated. All ichthyoplankton was assigned a life stage: viable egg, non-viable egg (NVE), 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) were counted.

3.2.3 Morphometrics

For each 24-hour sampling period, the following morphometric data was collected and recorded for each life stage of fish:

- Up to 5 eggs of each fish taxon was measured for minimum and maximum egg diameter;
- Up to 5 larvae from each fish taxon and life stage was measured for total length and notochord length, maximum body depth and width, and head capsule depth and width, all to the nearest 0.1 millimeter (mm).

Only whole organisms were subject to morphometric evaluations. Organisms subject to the morphometric evaluation were selected at random from within each taxonomic category (i.e., each taxon and life stage). Length measurements were performed with a microscope and ImageTool™ Software. Organisms too large to be viewed entirely under the microscope were measured with a ruler.

3.2.4 Water Quality Collection

During each 6-hour entrainment sample period, water quality data (water temperature, DO, pH, salinity, and conductivity) were collected at three depths (near-surface, mid-depth, and near-bottom) using a calibrated water quality meter immersed in the buffering tanks. Samples were collected twice each sample period at the start and end of the 6-hour collection. Other climatic data such as precipitation, cloud cover, wind speed and direction, etc. were also recorded. Quality control for water quality data collection was performed twice per sampling event (once per 12-hour shift) using a second calibrated water quality meter.

3.3 Data Analysis

Characterization of the collected entrainment samples required evaluation of sampling results in the context of entrainment density using the water volume circulated through the entrainment sampler while the samples were being collected. This flow-standardized abundance of each taxon was calculated as density (number/100 m^3) for each sample period and averaged over different

diel, daily, and monthly time periods. Then, the monthly and annual entrainment estimates were calculated using monthly average entrainment densities and actual and design intake flows. Appendix A of this report presents these calculation procedures in detail.

3.4 Quality Assurance Procedures

Consistent with the quality assurance program detailed in the Entrainment Characterization Study Plan (HDR 2017), a field audit was conducted to ensure field sampling was done in accordance with the approved Standard Operating Procedure (HDR 2017). The field audit was conducted on April 20, 2016 and followed the prescribed field audit report. No deviations from the written plans were observed.

4 Results

A total of 288 samples were collected during the 2016-2017 sampling program, including 132 samples during the first year of entrainment sampling (April 2016 – September 2016) and 156 samples during the second year of entrainment sampling (March 2017 – September 2017) (Table 4-1). All samples were collected in accordance with the Standard Operating Procedure (HDR 2017).

Table 4-1. Monthly Sampling Success during Entrainment Sampling at North Anna Power Station, 2016-2017

Year	Month	Executed Samples	Number of Proposed Samples
2016	Apr	24	24
	May	24	24
	Jun	24	24
	Jul	24	24
	Aug	24	24
	Sep	12	12
2017	Mar	24	24
	Apr	24	24
	May	24	24
	Jun	24	24
	Jul	24	24
	Aug	24	24
	Sep	12	12
Grand Total		**288**	**288**

4.1 Taxonomic Inventory of Identified Fish and Shellfish Collected in Entrainment Sampling

A total of 986 organisms were collected during the first year of entrainment sampling and included finfish distributed among 12 distinct taxa. Entrainment collection data are presented in Appendix B. Table 4-2 presents the complete list of species by common name and scientific name. A number of fish eggs (464) collected primarily in April, were considered non-viable (e.g., unfertilized or dead/decaying); therefore, they would not have contributed to future fish

populations. As such, these NVE were excluded from further entrainment analysis. Removing the total number of NVE reduced the total number of organisms considered for entrainment to 522 during Year 1 (2016) entrainment sampling.

During the second year of entrainment sampling (2017), a total of 795 organisms were collected and included finfish distributed among 10 distinct taxa. Removing the total number of NVE eggs (35), collected entirely in May, reduced the total number of organisms considered for entrainment during the second year to 760. Three distinct taxa collected in the first year of sampling were not collected during the second year and one distinct taxa collected in the second year of sampling was not collected during the first year.

Table 4-2. Master Species List of All Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017

Group	Common Name	Scientific Name	Year 1 (Apr 2016 – Sep 2016)	Year 2 (Mar 2017 – Sep 2017)
Finfish	Blueback Herring	*Alosa aestivalis*	X	X
	Bluegill	*Lepomis macrochirus*	X	X
	Channel Catfish	*Ictalurus punctatus*	X	X
	Common Sunfishes	*Lepomis* spp.	X	X
	Crappie	*Pomoxis* spp.	X	
	Darters	*Etheostoma* spp.	X	X
	Gizzard Shad	*Dorosoma cepedianum*	X	X
	Threadfin/Gizzard Shad	*Dorosoma* spp.	X	X
	Golden Shiner	*Notemigonus crysoleucas*	X	
	Herrings and Shad	Clupeidae	X	X
	Largemouth Bass	*Micropterus salmoides*	X	X
	Minnow	Cyprinidae	X	X
	Non-Viable Egg	NA	X	X
	Spottail Shiner	*Notropis hudsonius*		X
	Sunfish	Centrarchidae	X	
	Threadfin Shad	*Dorosoma petenense*	X	X
	Unidentified Finfish	Unidentified	X	X
	White Catfish	*Ameiurus catus*	X	
	White Perch	*Morone americana*	X	X
	Yellow Perch	*Perca flavescens*	X	X

Note:
NA = Not Applicable

Overall, taxonomic diversity was low in entrainment samples with the number of distinct taxa ranging from a monthly low of 1 in September of each year to a high of 7 in May 2016 (Table 4-3). The most taxonomically rich samples were collected in spring: April (5 of each year) and May (7 and 5 in 2016 and 2017, respectively).

Table 4-3. Number of Taxa Collected during Entrainment Sampling at North Anna Power Station, 2016-2017

Year	Number of Distinct Taxa Collected						
	Mar	Apr	May	Jun	Jul	Aug	Sep
2016	NA	5	7	4	5	3	1
2017	3	5	5	4	4	3	1

Note: NA = Not Applicable

When counting the number of distinct taxa collected, general taxonomic designations at the genus, family, and higher taxonomic levels were dropped if there was one, valid lower-level designation for that group. For example, because *Lepomis* spp. and *Lepomis macrochirus* were identified in the collections, *Lepomis* spp. was not counted in the total number of distinct taxa. While eggs were distinguishable from one another, taxonomic identification could not be made; therefore, these taxa were not considered distinct taxa. Similarly, taxonomic identification could not be made for unidentified finfish; therefore, these were not considered in distinct taxa counts.

4.2 Species Composition

Finfish species comprised 100 percent of the total entrainment sample collection for both years of the study. Post yolk sac larvae dominated the entrainment sample collections, accounting for 83 percent of Year 1 total and 96 percent of the Year 2 total. Yolk sac larvae comprised 6 percent of the sample collection for Year 1 and 2 percent of the sample collection for Year 2 (Table 4-4; Figure 4-1). Very few juveniles, eggs, or adult fish were collected, with each comprising five percent or less of the total collection for both years of entrainment sampling.

Table 4-5 presents the total number of organisms collected by species and life stage for the first and second year of entrainment sampling. Herrings and Shad (Clupeidae; 37%) and Common Sunfishes (*Lepomis spp.*; 33%) post yolk sac larvae were the most abundant fish taxa and life stage collected during the first year of entrainment sampling. White Perch post yolk sac larvae (4%), Herrings unidentified life stage larvae (4%), Threadfin/Gizzard Shad (*Dorosoma* spp.) post yolk sac larvae (3%), and Herrings and Shad yolk sac larvae (3%) were collected in relatively low abundance during the first year. The remaining fish taxa each accounted for two percent or less of the total collection.

During the second year of entrainment sampling, Herrings and Shad (68%), Threadfin/Gizzard Shad (13%), and Common Sunfishes (9%) post yolk sac larvae were the most abundant fish taxa collected (Table 4-5). Threadfin/Gizzard Shad post yolk sac larvae (13%) and Threadfin Shad post yolk sac larvae (2%) were collected in relatively higher abundance than the first year, while White Perch post yolk sac larvae (2%), Herrings and Shad unidentified life stage larvae (<1%), and Herrings and Shad yolk sac larvae (<1%) were collected in relatively low abundance during the second year when compared to Year 1. The remaining fish taxa each accounted for one percent or less of the total catch in Year 2.

Table 4-4. Total Number of Fish by Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling

Life Stage	Year 1 (Apr 2016 – Sep 2016)		Year 2 (Mar 2017 - Sep 2017)	
	Total Number of Organisms Collected	Percent Total (%)	Total Number of Organisms Collected	Percent Total (%)
Finfish				
Non-Viable Egg	464	See Note	35	See Note
Post Yolk Sac Larvae	435	83.3	728	95.8
Yolk Sac Larvae	31	5.9	12	1.6
Unidentified Life Stage Larvae	29	5.6	8	1.1
Juveniles	26	5.0	6	<1
Eggs	1	<1	5	<1
Adults	-	0	1	<1
Total	**522**	**100**	**760**	**100**

Note: Non-viable eggs (NVE) were removed from further analysis; therefore, percentages reported in this table do not include NVE.

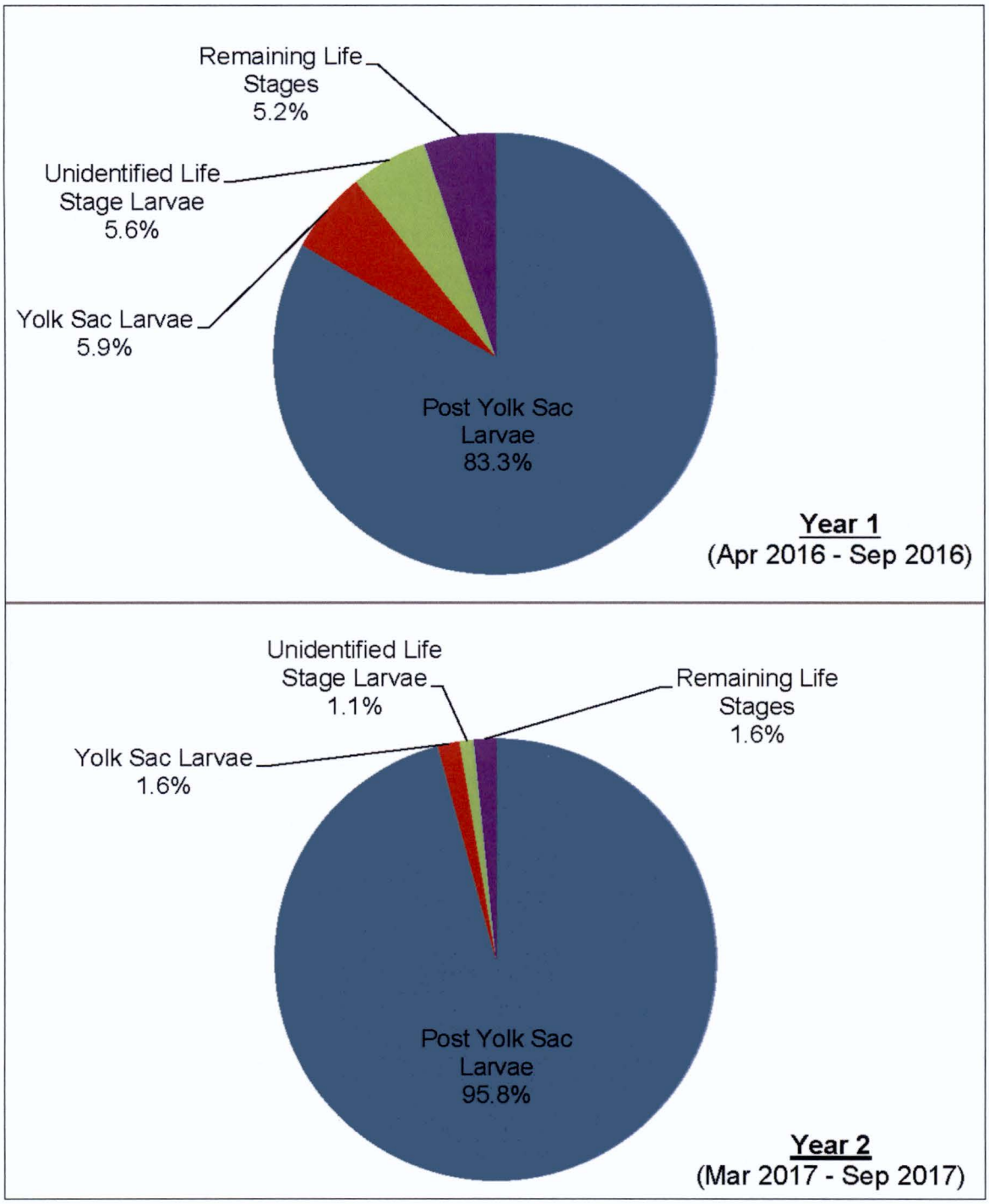


Figure 4-1. Percentage Composition by Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling

Table 4-5. Total Number of Fish by Species and Life Stage Collected at North Anna Power Station during 2016-2017 Entrainment Sampling

Taxa	Life Stage	Year 1 (Apr 2016 - Sep 2016)		Year 2 (Mar 2017 - Sep 2017)	
		Total Number of Organisms Collected	Percent Total (%)	Total Number of Organisms Collected	Percent Total (%)
Finfish					
Herrings and Shad	PYSL	191	37	519	68
Common Sunfishes	PYSL	172	33	65	9
White Perch	PYSL	23	4	14	2
Herrings and Shad	UIDL	19	4	3	<1
Threadfin/Gizzard Shad	PYSL	15	3	98	13
Herrings and Shad	YSL	14	3	1	<1
Largemouth Bass	Juv	11	2	3	<1
Unidentified Finfish	UIDL	10	2	5	1
Gizzard Shad	YSL	9	2	1	<1
Gizzard Shad	PYSL	7	1	1	<1
Threadfin Shad	PYSL	7	1	18	2
Channel Catfish	PYSL	6	1	4	1
Blueback Herring	Juv	5	1	-	
Bluegill	Juv	5	1	1	<1
Common Sunfishes	Juv	5	1	-	
Yellow Perch	YSL	5	1	4	1
Crappie	PYSL	4	1	-	
Sunfish	PYSL	4	1	-	
White Perch	YSL	3	1	4	1
Darters	PYSL	2	<1	-	
Golden Shiner	PYSL	1	<1	-	
Herrings and Shad	Egg	1	<1	5	1
Largemouth Bass	PYSL	1	<1	-	
Minnow	PYSL	1	<1	3	<1
White Catfish	PYSL	1	<1	-	
Blueback Herring	Adult	-		1	<1
Blueback Herring	PYSL	-		2	<1
Darters	YSL	-		2	<1
Gizzard Shad	Juv	-		1	<1
Spottail Shiner	PYSL	-		1	<1
Threadfin Shad	Juv	-		1	<1
Yellow Perch	PYSL	-		3	<1
Total		**522**	**100**	**760**	**100**

Note:
YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

4.3 Morphometrics

The median, minimum, and maximum of head capsule depth and width, body depth, notochord length, and total length of each taxon collected in the first and second year entrainment sampling, and the two years combined are presented in Table 4-6. Morphometric data and length-frequency distributions for each measurement are presented in Appendix C. A total of 294 finfish were measured during the two years of sampling. Common Sunfishes post yolk sac larvae was the most commonly measured taxon and life stage (71 organisms), followed by Herrings and Shad post yolk sac larvae (70), White Perch post yolk sac larvae (25), and Threadfin/Gizzard Shad post yolk sac larvae (17).

4.3.1 Morphometric Frequency

The U.S. Environmental Protection Agency (EPA) defines impingeable organisms as those that would be collected or retained on a sieve with maximum opening dimension of 0.56 inches (14.2 mm; a diagonal opening of ¼ x ½ inch mesh), which is called "baseline screen" in Figure 4-2. Only organisms that would pass through this mesh size, and thus be entrained, are used to estimate the regulatory definition of entrainment, which is called "baseline entrainment" hereafter. The TWS at NAPS have a finer sized 1/8 x ½ inch mesh screen; therefore, there is also potential for some organisms to be retained on the finer NAPS screen, i.e. organisms may be retained rather than entrained. Organisms that are retained by the NAPS screen but would have been entrained (pass through) based on the Rule's mesh size (¼ x ½ inch) are termed 'converts'. Organism limiting morphometrics sized at 3.2 mm correspond to exclusion on the 1/8-inch mesh of the NAPS screens. However, there is no fish return system at NAPS and the converts would not be returned to the source waterbody; therefore, baseline entrainment density and annual loss estimates are more relevant rather than the actual entrainment based on the screen mesh installed at the NAPS. To account for the exclusion of impingeable organisms based on the baseline screen and to provide an accurate estimate of entrainment, exclusion fractions were estimated based on morphometric data collected on the sampled organisms. This was done for consistency with the Rule (which defines an entrainable organism as one that would pass a 0.56-inch sieve opening), and to avoid underestimation of entrainment.

See Appendix A for a detailed summary of the calculations used. The following summarizes the step-wise process used to estimate baseline entrainment based on the Rule. The entrainment estimates based on the actual mesh size at NAPS were also calculated according to the procedures below and provided for information only. Refer to Figure 4-2.

- NVE that will never hatch and thus do not contribute to the future populations were removed from the entrainment assessment.
- Finfish with body depth greater than 14.2 mm (0.56 inch) are excluded from the raw entrainment data as these organisms would be impinged on the screens, and not entrained by the Rule-prescribed mesh size.
- Finfish with body depth less than 14.2 mm represent entrainable-sized organisms consistent with the Rule-prescribed mesh size (organisms that could pass a 14.2 mm [0.56 inch] opening).

- Finfish with body depth less than 14.2 mm, but with head capsule width greater than 3.2 mm (a.k.a., converts), are organisms that are retained by the NAPS screens but are considered entrainable by the Rule.
- Finfish with head capsule width less than 3.2 mm represent actual entrainment with the current NAPS mesh size.

The percentage of each species/life stage excluded is presented in Table 4-7. Appropriate morphometrics were selected with consideration of the Rule's mesh specifications for entrainable organisms (Baseline Screen), the NAPS rectangular mesh specifications (Actual Screen), and an examination of the collected finfish morphometric data where each morphometric dimension was determined to be limiting. For unidentified life stages of finfish species identified to the genus and higher taxonomic levels, the morphometric data for all identified early life stages (e.g., yolk sac larvae and post yolk sac larvae) for that particular species are combined. For unidentified finfish species with identified life stages (such as when the alimentary canal is missing and the presence of a yolk sac could not be determined), the morphometric data for all specimens of that life stage (e.g., yolk sac larvae, post yolk sac larvae or juveniles) are combined, and the fraction excluded by each screen (baseline and actual screens) was estimated.

During the two years of sampling, body depths ranged from a minimum 0.1-mm for Gizzard Shad yolk sac larvae to a maximum 30-mm Bluegill juvenile. Bluegill juvenile was the only taxon that measured greater than 14.2-mm maximum body depth (Table 4-6). Total lengths ranged from a minimum 3.2-mm White Perch yolk sac larvae to a maximum 91-mm Bluegill juvenile. Head capsule widths ranged from a minimum 0.2-mm for Gizzard Shad yolk sac larvae to a maximum 14.0-mm Bluegill juvenile.

Organisms with life stages that were impingeable on baseline screen mesh size consist of Blueback Herring adult (100%), Bluegill juvenile (100%) and unidentified finfish juvenile (16%) life stages. Blueback Herring adult (100%), Bluegill juvenile (100%), Channel Catfish post yolk sac (10%), Common Sunfishes (80%) and Largemouth Bass (44%) juvenile, and unidentified finfish post yolk sac (0.4%) and juvenile (48%), and unidentified life stages (0.4%) would be impingeable on NAPS actual screen mesh size (Table 4-7). All viable eggs were assumed to be entrainable due to small size and lack of hard structure.

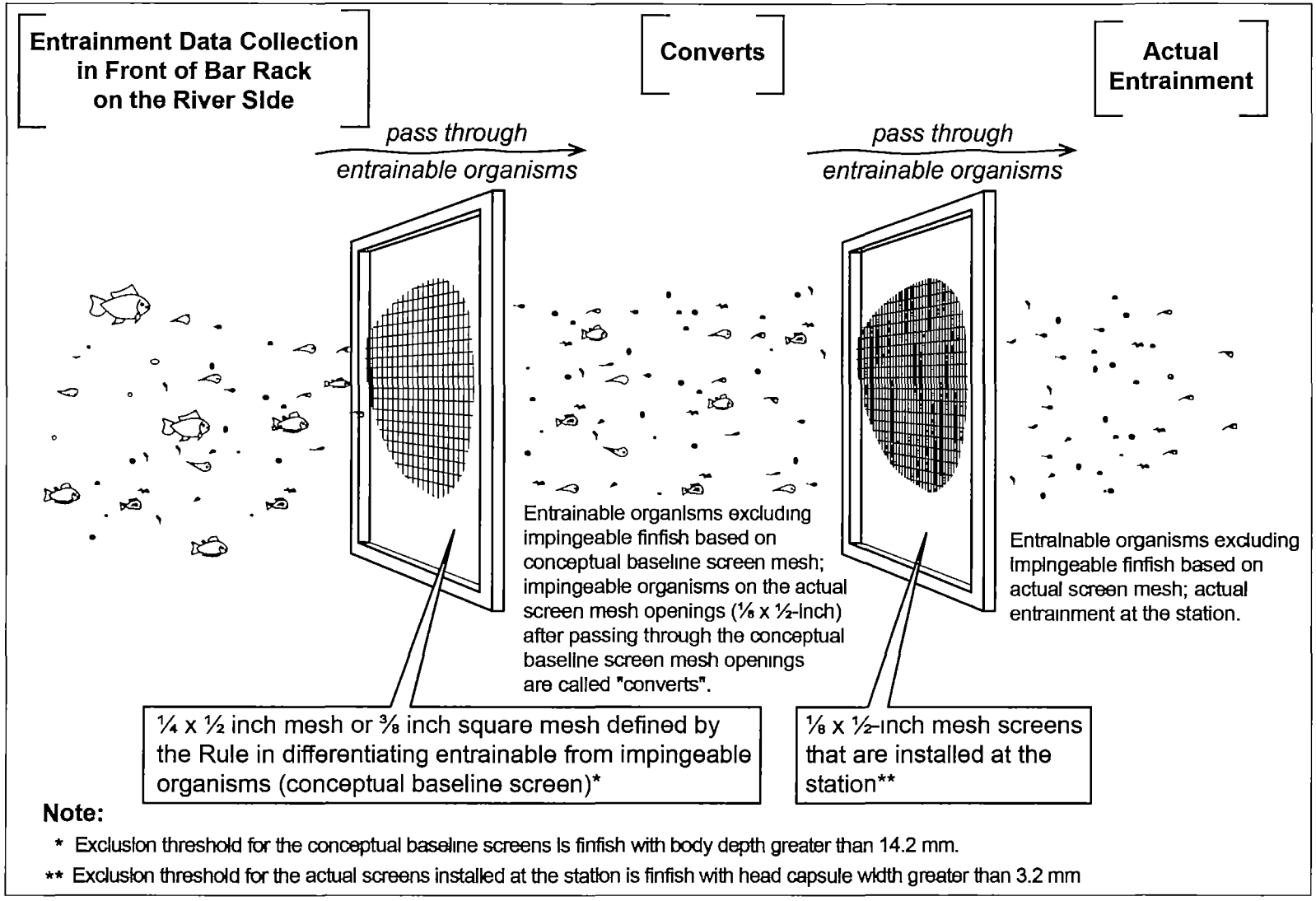


Figure 4-2. Summary of the Step-Wise Process Used to Estimate Entrainment based on the EPA Rule and Actual Screens Installed at North Anna Power Station

Table 4-6. Morphometric Measurements of Fish Collected at North Anna Power Station during 2016-2017 Entrainment Sampling

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
Blueback Herring	PYSL	Head Capsule Depth					0.6	0.6	0.7	2	0.6	0.6	0.7	2
		Head Capsule Width					0.5	0.6	0.6	2	0.5	0.6	0.6	2
		Max Body Depth					0.5	0.5	0.5	2	0.5	0.5	0.5	2
		Notochord Length					6.5	6.9	7.3	2	6.5	6.9	7.3	2
		Total Length					6.6	7.0	7.3	2	6.6	7.0	7.3	2
	Juv	Head Capsule Depth	1.5	2.0	3.0	5					1.5	2.0	3.0	5
		Head Capsule Width	1.5	2.0	3.0	5					1.5	2.0	3.0	5
		Max Body Depth	2.0	3.0	3.0	5					2.0	3.0	3.0	5
		Notochord Length	17.5	19.0	20.5	5					17.5	19.0	20.5	5
		Total Length	20.0	22.0	23.0	5					20.0	22.0	23.0	5
Bluegill	Juv	Head Capsule Depth	9.0	20.0	21.0	3	20.0	20.0	20.0	1	9.0	20.0	21.0	4
		Head Capsule Width	8.0	13.0	14.0	3	13.0	13.0	13.0	1	8.0	13 0	14.0	4
		Max Body Depth	17.0	29.0	30.0	3	29.0	29.0	29.0	1	17.0	29.0	30.0	4
		Notochord Length	46.0	74.0	78.0	3	60.0	60.0	60.0	1	46.0	67.0	78.0	4
		Total Length	55.0	91.0	91.0	3	75.0	75 0	75.0	1	55.0	83.0	91.0	4
Channel Catfish	PYSL	Head Capsule Depth	2.6	3.2	3.4	6	2.8	2.9	3.1	4	2.6	3.0	3.4	10
		Head Capsule Width	3.0	3.2	3.6	6	2.5	2.8	3.0	4	2.5	3.0	3.6	10
		Max Body Depth	2.7	2.9	3.3	6	2.5	2.7	2.9	4	2.5	2.8	3.3	10
		Notochord Length	13.6	13.9	14.4	6	13.6	13.8	14.7	4	13.6	13.8	14.7	10
		Total Length	16.2	16.7	16.9	6	15.3	16.1	17.0	4	15.3	16.5	17.0	10
Common Sunfishes	PYSL	Head Capsule Depth	0.5	1.3	3.6	37	0.6	1.7	3.4	34	0.5	1.5	3.6	71
		Head Capsule Width	0.4	1.2	3.0	37	0.4	1.2	2.4	34	0.4	1.2	3.0	71
		Max Body Depth	0.5	1 1	5.0	37	0.5	1.5	3.9	34	0.5	1.3	5.0	71

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
		Notochord Length	4.6	7.2	16.0	37	4.5	8.7	14.2	34	4.5	8.1	16.0	71
		Total Length	4.8	7.4	19.0	37	4.6	10.0	16.0	34	4.6	8.8	19.0	71
	Juv	Head Capsule Depth	3.0	6.0	9.0	5					3.0	6.0	9.0	5
		Head Capsule Width	3.0	4.0	5.0	5					3.0	4.0	5.0	5
		Max Body Depth	5.0	8.0	12.0	5					5.0	8.0	12.0	5
		Notochord Length	17.0	24.0	30.0	5					17.0	24.0	30.0	5
		Total Length	20.5	29.0	37.5	5					20.5	29.0	37.5	5
Crappie	PYSL	Head Capsule Depth	0.7	0.7	0.9	3					0.7	0.7	0.9	3
		Head Capsule Width	0.5	0.6	0.8	3					0.5	0.6	0.8	3
		Max Body Depth	0.4	0.5	0.5	3					0.4	0.5	0.5	3
		Notochord Length	4.0	4.1	4.5	3					4.0	4.1	4.5	3
		Total Length	4.2	4.3	4.7	3					4.2	4.3	4.7	3
Darters	YSL	Head Capsule Depth					0.9	0.9	0.9	1	0.9	0.9	0.9	1
		Head Capsule Width					1.0	1.0	1.0	1	1.0	1.0	1.0	1
		Max Body Depth					1.0	1.0	1.0	1	1.0	1.0	1.0	1
		Max Body Width					1.0	1.0	1.0	1	1.0	1.0	1.0	1
		Notochord Length					5.2	5.2	5.2	1	5.2	5.2	5.2	1
		Total Length					5.3	5.3	5.3	1	5.3	5.3	5.3	1
	PYSL	Head Capsule Depth	0.9	1.0	1.1	2					0.9	1.0	1.1	2
		Head Capsule Width	1.0	1.1	1.1	2					1.0	1.1	1.1	2
		Max Body Depth	0.6	0.7	0.8	2					0.6	0.7	0.8	2
		Notochord Length	5.4	5.8	6.2	2					5.4	5.8	6.2	2
		Total Length	5.6	6.0	6.4	2					5.6	6.0	6.4	2
Gizzard Shad	YSL	Head Capsule Depth	0.3	0.3	0.3	6					0.3	0.3	0.3	6
		Head Capsule Width	0.2	0.3	0.4	6					0.2	0.3	0.4	6

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
		Max Body Depth	0.4	0.4	0.5	6					0.4	0.4	0.5	6
		Max Body Width	0.1	0.2	0.3	6					0.1	0.2	0.3	6
		Notochord Length	3.9	4.1	4.3	6					3.9	4.1	4.3	6
		Total Length	4.0	4.3	4.4	6					4.0	4.3	4.4	6
	PYSL	Head Capsule Depth	1.2	2.5	3.0	7	3.5	3.5	3.5	1	1.2	2.5	3.5	8
		Head Capsule Width	1.3	2.0	2.5	7	2.6	2.6	2.6	1	1.3	2.0	2.6	8
		Max Body Depth	1.0	3.0	4.0	7	3.1	3.1	3.1	1	1.0	3.0	4.0	8
		Notochord Length	12.7	19.0	20.0	7	18.6	18.6	18.6	1	12.7	18.8	20.0	8
		Total Length	13.5	21.0	24.0	7	19.6	19.6	19.6	1	13.5	20.8	24.0	8
	Juv	Head Capsule Depth					4.0	4.0	4.0	1	4.0	4.0	4.0	1
		Head Capsule Width					3.0	3.0	3.0	1	3.0	3.0	3.0	1
		Max Body Depth					5.0	5.0	5.0	1	5.0	5.0	5.0	1
		Notochord Length					24.0	24.0	24.0	1	24.0	24.0	24.0	1
		Total Length					29.0	29.0	29.0	1	29.0	29.0	29.0	1
Threadfin/Gizzard Shad	PYSL	Head Capsule Depth	1.1	1.9	3.2	10	0.6	1.5	2.1	17	0.6	1.7	3.2	27
		Head Capsule Width	1.0	1.8	2.7	10	0.6	1.1	1.5	17	0.6	1.2	2.7	27
		Max Body Depth	0.9	1.7	3.4	10	0.6	1.4	2.4	17	0.6	1.4	3.4	27
		Notochord Length	12.1	14.8	18.6	10	7.1	14.0	17.1	17	7.1	14.2	18.6	27
		Total Length	12.9	16.3	22.0	10	7.3	14.9	18.7	17	7.3	15.3	22.0	27
Golden Shiner	PYSL	Head Capsule Depth	0.8	0.8	0.8	1					0.8	0.8	0.8	1
		Head Capsule Width	1.1	1.1	1.1	1					1.1	1.1	1.1	1
		Max Body Depth	0.5	0.5	0.5	1					0.5	0.5	0.5	1
		Notochord Length	5.8	5.8	5.8	1					5.8	5.8	5.8	1
		Total Length	6.1	6.1	6.1	1					6.1	6.1	6.1	1

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
Herrings and Shad	Egg	Minimum Diameter	1.3	1.3	1.3	1	1.1	1.2	1.3	5	1.1	1.3	1.3	6
		Maximum Diameter	1.4	1.4	1.4	1	1.2	1.3	1.3	5	1.2	1.3	1.4	6
	YSL	Head Capsule Depth					0.4	0.4	0.4	1	0.4	0.4	0.4	1
		Head Capsule Width					0.4	0.4	0.4	1	0.4	0.4	0.4	1
		Max Body Depth					0.7	0.7	0.7	1	0.7	0.7	0.7	1
		Max Body Width					0.4	0.4	0.4	1	0.4	0.4	0.4	1
		Notochord Length					3.2	3.2	3.2	1	3 2	3.2	3.2	1
		Total Length					3.3	3.3	3.3	1	3.3	3.3	3.3	1
	PYSL	Head Capsule Depth	0.3	0.7	2.3	34	0.4	0.7	2.5	36	0.3	0.7	2.5	70
		Head Capsule Width	0.4	0.7	1.9	34	0.3	0.6	2.1	36	0.3	0.6	2.1	70
		Max Body Depth	0.3	0.6	1.6	34	0.3	0.6	1.8	36	0.3	0.6	1.8	70
		Notochord Length	4.7	7.7	17.7	34	5.0	8.0	18.9	36	4.7	7.8	18.9	70
		Total Length	4.8	7.9	19.8	34	5.1	8.1	20.1	36	4.8	7.9	20.1	70
Largemouth Bass	PYSL	Head Capsule Depth	3.5	3.5	3.5	1					3.5	3.5	3.5	1
		Head Capsule Width	3.0	3.0	3.0	1					3.0	3.0	3.0	1
		Max Body Depth	3.4	3.4	3.4	1					3.4	3.4	3.4	1
		Notochord Length	13.2	13.2	13.2	1					13.2	13.2	13.2	1
		Total Length	15.5	15.5	15.5	1					15.5	15.5	15.5	1
	Juv	Head Capsule Depth	3.0	4.0	5.0	6	4.0	5.0	5.0	3	3.0	4.0	5.0	9
		Head Capsule Width	3.0	3.0	4.0	6	3.0	4.0	4.0	3	3.0	3.0	4.0	9
		Max Body Depth	3.5	4.0	6.0	6	5.0	6.0	7.0	3	3.5	5.0	7.0	9
		Notochord Length	18.5	20.5	23.0	6	22.0	24.0	27.5	3	18.5	22.0	27.5	9
		Total Length	22.0	23.8	26.0	6	26.0	29.0	31.0	3	22.0	25.0	31.0	9
Minnow	PYSL	Head Capsule Depth	0.8	0.8	0.8	1	1.1	1.2	1.3	3	0.8	1.1	1.3	4

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
		Head Capsule Width	0.7	0.7	0.7	1	0.8	1.0	1.1	3	0.7	0.9	1.1	4
		Max Body Depth	0.7	0.7	0.7	1	0.8	0.9	1.0	3	0.7	0.9	1.0	4
		Notochord Length	5.6	5.6	5.6	1	6.3	6.3	6.5	3	5.6	6.3	6.5	4
		Total Length	5.8	5.8	5.8	1	6.3	6.4	6.6	3	5.8	6.4	6.6	4
Spottail Shiner	PYSL	Head Capsule Depth					0.8	0.8	0.8	1	0.8	0.8	0.8	1
		Head Capsule Width					0.9	0.9	0.9	1	0.9	0.9	0.9	1
		Max Body Depth					0.7	0.7	0.7	1	0.7	0.7	0.7	1
		Notochord Length					5.6	5.6	5.6	1	5.6	5.6	5.6	1
		Total Length					5.9	5.9	5.9	1	5.9	5.9	5.9	1
Threadfin Shad	PYSL	Head Capsule Depth	1.0	2.2	3.0	7	1.7	2.6	3.0	10	1.0	2.5	3.0	17
		Head Capsule Width	0.9	1.9	2.0	7	1.5	1.6	2.4	10	0.9	1.8	2.4	17
		Max Body Depth	0.7	2.1	4.0	7	1.4	2.5	3.2	10	0.7	2.5	4.0	17
		Notochord Length	9.5	15.9	18.0	7	14.6	16.7	18.3	10	9.5	16.4	18.3	17
		Total Length	9.7	18.4	22.0	7	15.3	17.8	19.4	10	9.7	18.2	22.0	17
	Juv	Head Capsule Depth					4.0	4.0	4.0	1	4.0	4.0	4.0	1
		Head Capsule Width					3.0	3.0	3.0	1	3.0	3.0	3.0	1
		Max Body Depth					5.0	5.0	5.0	1	5.0	5.0	5.0	1
		Notochord Length					23.0	23.0	23.0	1	23.0	23.0	23.0	1
		Total Length					26.0	26.0	26.0	1	26.0	26.0	26.0	1
White Catfish	PYSL	Head Capsule Depth	3.4	3.4	3.4	1					3.4	3.4	3.4	1
		Head Capsule Width	3.2	3.2	3.2	1					3.2	3.2	3.2	1
		Max Body Depth	3.1	3.1	3.1	1					3.1	3.1	3.1	1
		Notochord Length	13.7	13.7	13.7	1					13.7	13.7	13.7	1
		Total Length	16.1	16.1	16.1	1					16.1	16.1	16.1	1

Taxa	Life Stage	Morphometric (mm)	Year 1				Year 2				Combined			
			Min	Med	Max	N	Min	Med	Max	N	Min	Med	Max	N
White Perch	YSL	Head Capsule Depth					0.5	0.5	0.7	3	0.5	0.5	0.7	3
		Head Capsule Width					0.4	0.6	0.7	3	0.4	0.6	0.7	3
		Max Body Depth					0.5	0.5	0.6	3	0.5	0.5	0.6	3
		Max Body Width					0.3	0.6	0.7	3	0.3	0.6	0.7	3
		Notochord Length					3.1	3.5	4.0	3	3.1	3.5	4.0	3
		Total Length					3.2	3.7	4.1	3	3.2	3.7	4.1	3
	PYSL	Head Capsule Depth	0.5	0.6	2.4	15	0.5	0.7	0.8	10	0.5	0.6	2.4	25
		Head Capsule Width	0.3	0.5	2.0	15	0.4	0.5	0.8	10	0.3	0.5	2.0	25
		Max Body Depth	0.5	0.5	1.8	15	0.5	0.6	0.7	10	0.5	0.5	1.8	25
		Notochord Length	3.5	4.0	10.8	15	3.5	4.2	5.4	10	3.5	4.0	10.8	25
		Total Length	3.7	4.1	12.0	15	3.7	4.3	5.6	10	3.7	4.2	12.0	25
Yellow Perch	YSL	Head Capsule Depth	0.9	1.0	1.0	4	0.9	0.9	1.0	3	0.9	1.0	1.0	7
		Head Capsule Width	0.8	1.0	1.1	4	1.0	1.0	1.1	3	0.8	1.0	1.1	7
		Max Body Depth	0.7	1.0	1.2	4	0.8	1.0	1.1	3	0.7	1.0	1.2	7
		Max Body Width	0.6	0.8	1.0	4	0.9	0.9	1.0	3	0.6	0.9	1.0	7
		Notochord Length	5.1	5.4	5.7	4	5.0	5.7	5.9	3	5.0	5.7	5.9	7
		Total Length	5.3	5.6	5.9	4	5.1	6.0	6.1	3	5.1	5.8	6.1	7
	PYSL	Head Capsule Depth					1.0	1.0	1.0	2	1.0	1.0	1.0	2
		Head Capsule Width					0.4	0.5	0.6	2	0.4	0.5	0.6	2
		Max Body Depth					0.6	0.7	0.8	2	0.6	0.7	0.8	2
		Notochord Length					5.9	6.3	6.7	2	5.9	6.3	6.7	2
		Total Length					6.1	6.6	7.0	2	6.1	6.6	7.0	2

Table 4-7. Estimated Percent Exclusion of Finfish at North Anna Power Station (Years 1 and 2 Combined)

Taxa	Percent Exclusion based on maximum opening dimension of 0.56 inches (14.2 mm; a diagonal opening of ¼ x ½ inch mesh) - Baseline Screen				Percent Exclusion based on North Anna Power Station's Actual Screen Mesh Size of 1/8 x ½ inch			
	Post Yolk Sac Larvae	UIDL	Juveniles	Adults	Post Yolk Sac Larvae	UIDL	Juveniles	Adults
Blueback Herring				100.0				100.0
Bluegill			100.0				100.0	
Channel Catfish					10.0			
Common Sunfishes							80.0	
Largemouth Bass							44.4	
Unidentified Finfish			16.0		0.4	0.4	48.0	

Note:

1. Organisms with body depth greater than 14.2 mm (0.56 inch) are excluded from the raw entrainment data as these organisms would be impinged, and not entrained by the EPA rule mesh size.
2. Organisms with head capsule width less than 3.2 mm represent actual entrainment with the current NAPS mesh size.
3. For unidentified life stages of finfish species identified to the genus and higher taxonomic levels, the morphometric data for all identified early life stages (e.g., yolk sac larvae and post yolk sac larvae) for that particular species are combined; for unidentified finfish species with identified life stages, the morphometric data for all identified species for each life stage (e.g., yolk sac larvae, post yolk sac larvae, juveniles or adults) are combined, and the fraction excluded by each screen was estimated.

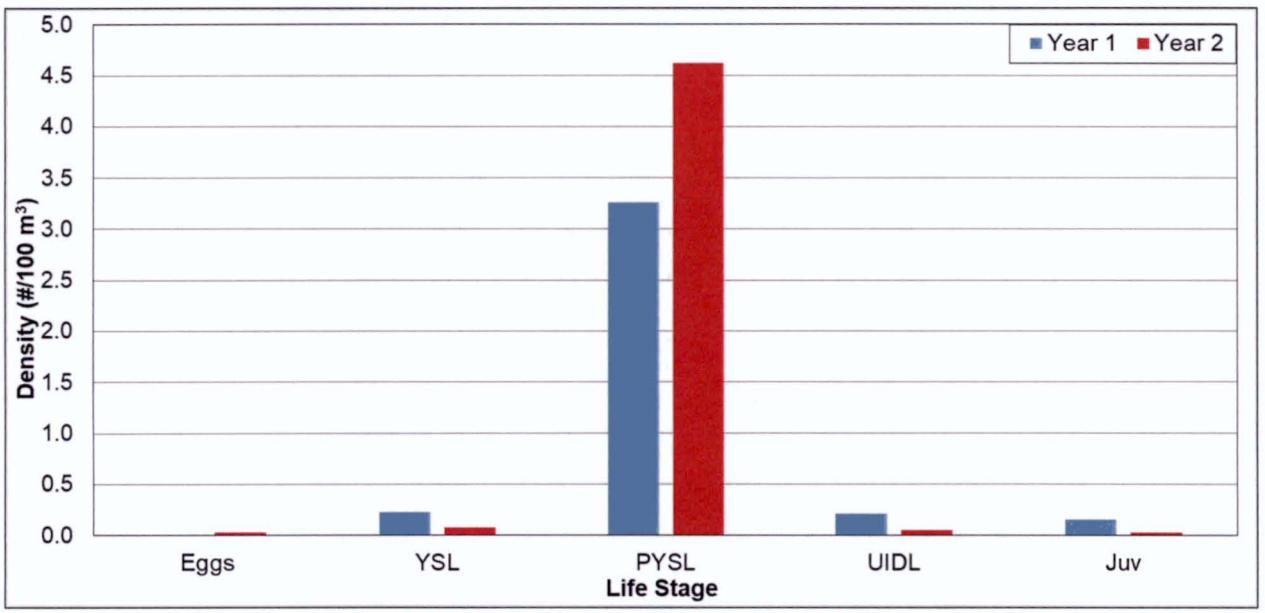
4.4 Sample Density

Overall, post yolk sac larvae dominated the finfish life stages in the entrainment samples during the two years of sampling (Table 4-8; Figure 4-3). The mean sample densities (excluding impingeable organisms that would have been retained on the baseline screen mesh) by life stage and sample date, expressed as number of organisms entrained per 100 m^3 (0.0264 million gallons) of intake water, are presented in Figures B-1 and B-2 in Appendix B. The highest sample densities occurred for post yolk sac larvae in late May and late July. In general, entrainment of finfish was lowest near the surface (Figure 4-4).

Table 4-8. Baseline Depth-Averaged Sample Density by Life Stage for Finfish at North Anna Power Station, 2016-2017

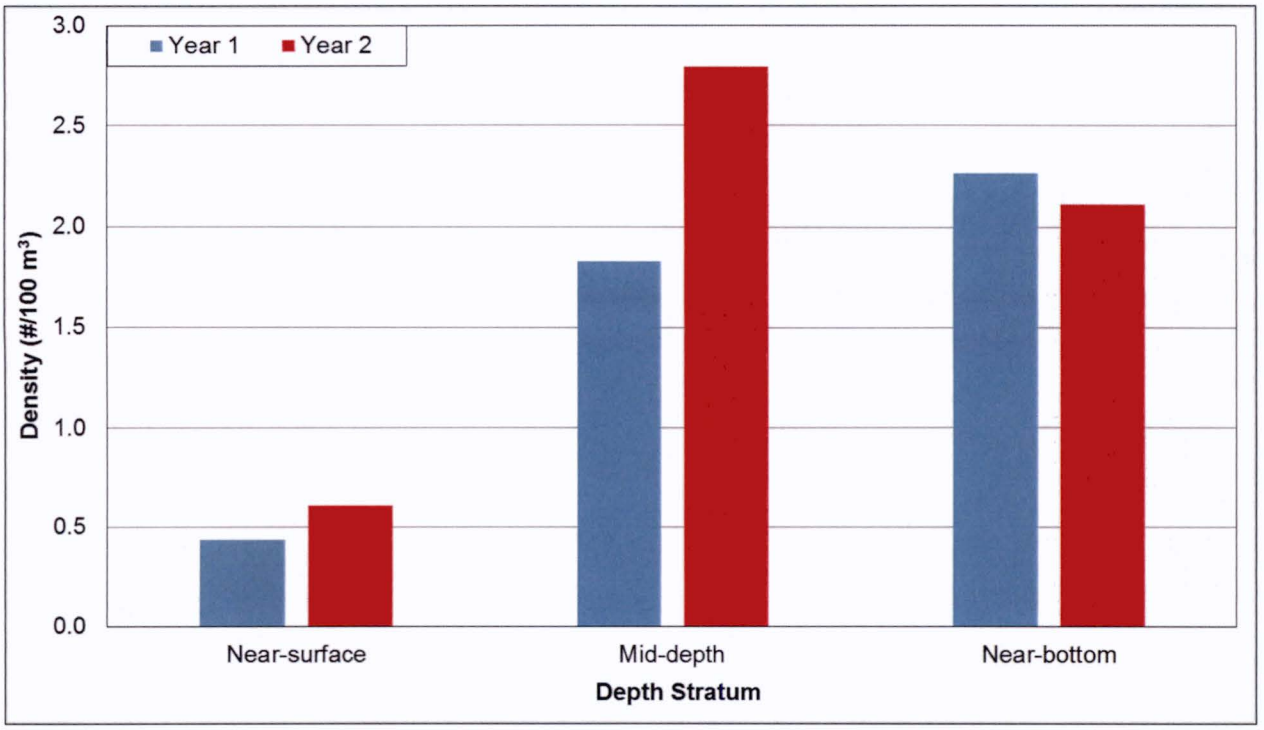
Group	Life Stage	Year 1 Sample Density (#/100 m^3)	Year 2 Sample Density (#/100 m^3)	Average Sample Density (#/100 m^3)
Finfish	Eggs*	0.008	0.032	0.020
	Yolk Sac Larvae	0.232	0.076	0.154
	Post Yolk Sac Larvae	3.257	4.617	3.937
	Unidentified Life Stage Larvae	0.215	0.050	0.132
	Juveniles	0.153	0.032	0.092

Note:
*The numbers reported in this table do not include non-viable eggs (NVE).
Sample densities exclude impingeable organisms that would have been retained on the baseline screen mesh.



Note: The numbers reported in this figure do not include non-viable eggs (NVE).

Figure 4-3. Baseline Depth-Averaged Sample Density (#/100 m^3 or 0.0264 million gallons) by Life Stage at North Anna Power Station, 2016-2017



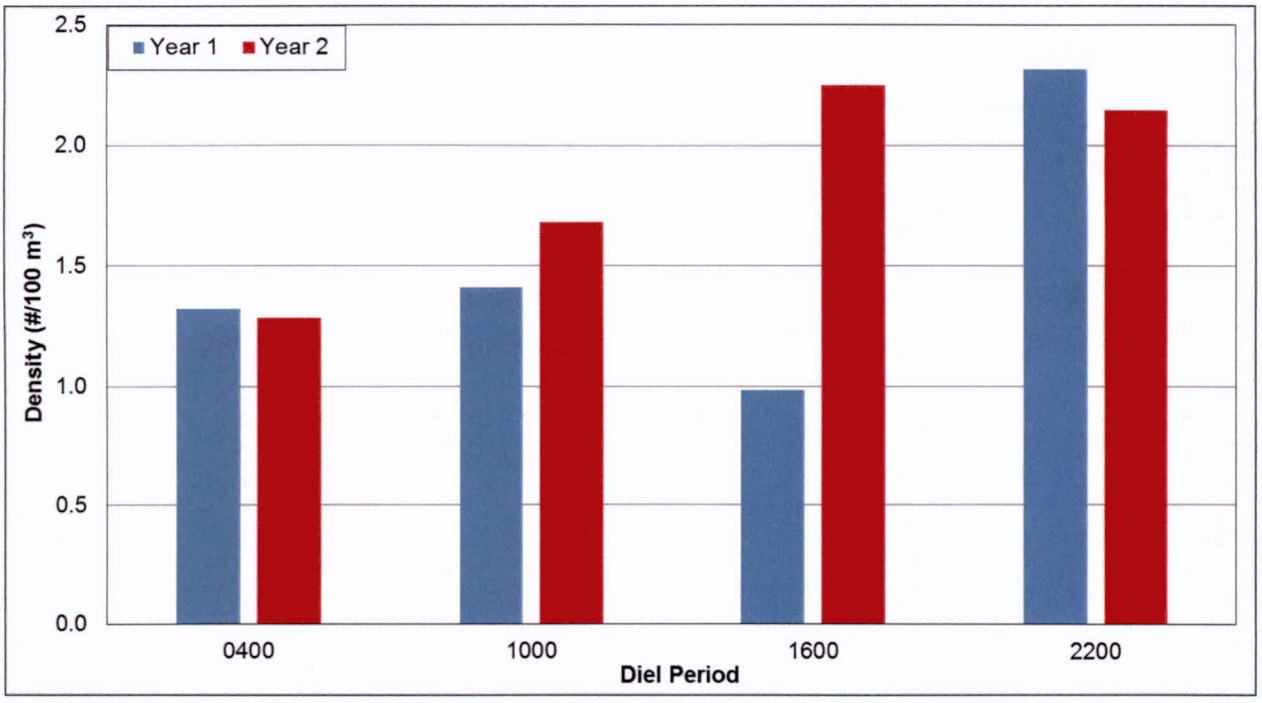
Note: The numbers reported in this figure do not include non-viable eggs (NVE).

Figure 4-4. Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) by Depth Stratum at North Anna Power Station, 2016-2017

4.5 Diel Density

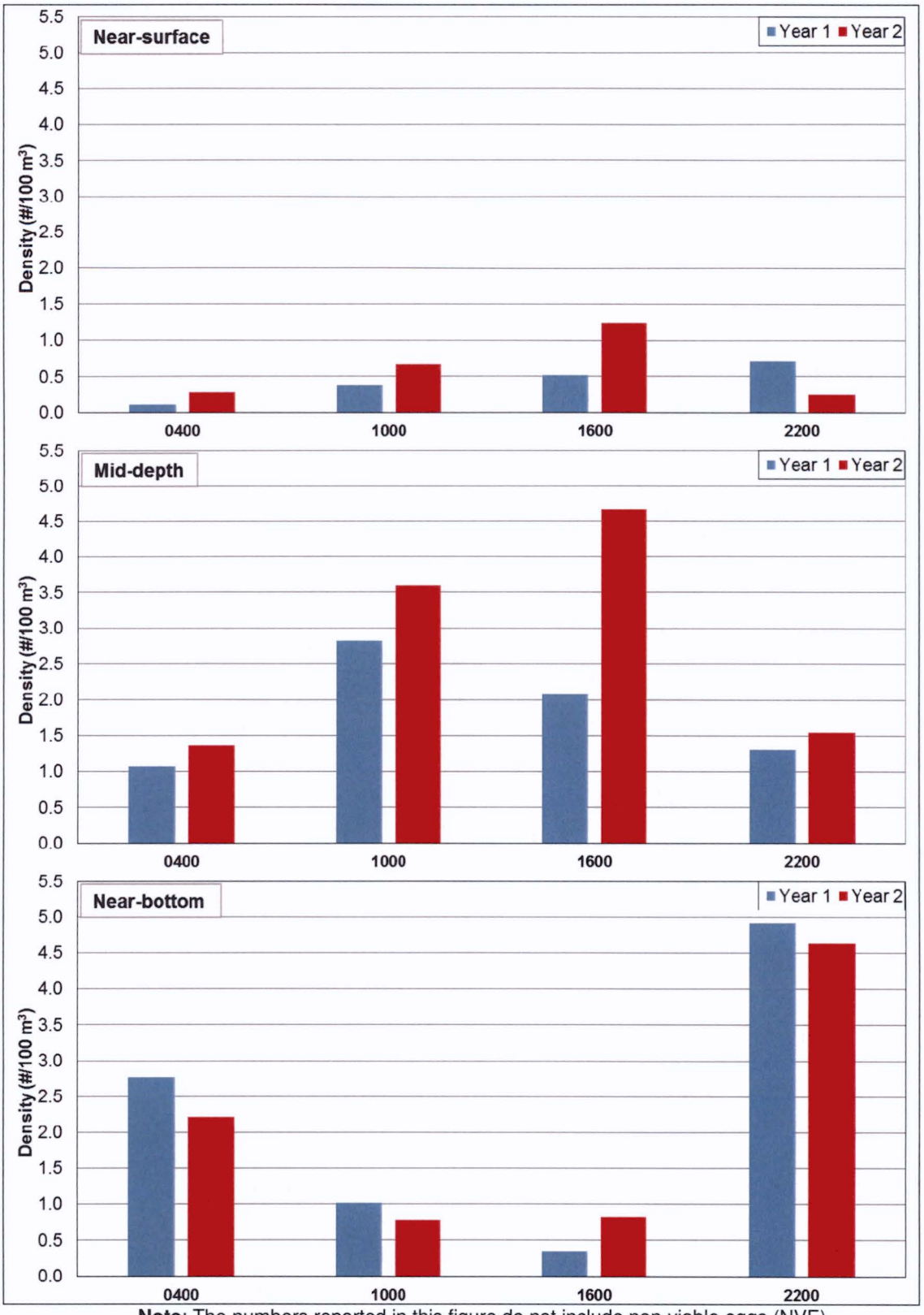
Diel densities (excluding impingeable organisms that would have been retained on the baseline screen mesh) for all life stages combined are presented in Figure 4-5. Entrainment densities for the 0400 hour diel period are the average density of samples taken from 0100 hours to 0700 hours of each sampling event; the 1000 hour diel period is for data from 0700 hours to 1300 hours; the 1600 hour diel period is for data from 1300 hours to 1900 hours; and the 2200 hour diel period is for data from 1900 hours to 0100 hours.

In general, entrainment densities (excluding impingeable organisms on the baseline screen mesh) of finfish were higher at night (2200 hours) during the first year of sampling. During the second year of sampling, entrainment of finfish was similarly high late afternoon (1600 hours) and at night (2200 hours) (Figure 4-5). The diel pattern was inconsistent by depth strata. Entrainment densities were highest at night in near-bottom samples and lowest in the early morning in near-surface samples (Figure 4-6).



Note: The numbers reported in this figure do not include non-viable eggs (NVE).

Figure 4-5. Average Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) During Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017



Note: The numbers reported in this figure do not include non-viable eggs (NVE).

Figure 4-6. Average Baseline Entrainment Density (#/100 m³ or 0.0264 million gallons) during Four Diel Periods (0400, 1000, 1600 and 2200 hours) at North Anna Power Station, 2016-2017

4.6 Monthly Density

Table 4-9 presents the monthly entrainment densities (excluding impingeable organisms that would have been retained on the baseline screen mesh) for finfish for both years of sampling. Appendix B provides monthly average densities (unadjusted monthly average total densities without impingeable organisms that would have been retained on the baseline screen mesh) for each year of sampling by species, life stage, and depth strata. In general, the two years of sampling exhibited similar trends for finfish entrainment, with the highest depth-averaged entrainment densities in May, June and July of both years (Table 4-9). These peak densities were attributed primarily to post yolk sac larval Herrings and Shad (May to July), Common Sunfishes (June and July, extending into August of the first year of sampling), and Threadfin/Gizzard Shad (May to July of second year of sampling) (Tables B-1 and B-2, Appendix B). The lowest depth-averaged monthly densities generally occurred during early spring (March and April) and September (Table 4-9). White Perch contributed to the early spring densities (April) primarily during the first year of sampling.

The entrainment densities were also evaluated for trends associated with depth strata, which varied by year, taxa, and month. Overall, mid-depth and near-bottom samples accounted for the majority of entrained organisms; however the contribution of each varied by year. During the first year of sampling, slightly more organisms were collected mid-depth (48%) compared to near-bottom (46%). During the second year of sampling, more organisms were collected at the mid-depth (56%) compared to near-bottom (33%). Nearly all taxa and life stages were collected at all three depth strata and there were few consistent trends of entrainment rates by depth, with high variability by taxa and by month to month within the same taxa and life stage. For example, highest densities of post yolk sac Herrings and Shad were collected at mid-depth in May and July but in near-bottom samples in June and August during the first year of sampling (Table B-1, Appendix B). During the second year of sampling, post yolk sac Herrings and Shad were collected at greatest densities in mid-depth samples for nearly all months. Threadfin/Gizzard Shad were collected at similar densities in mid-depth and near-bottom samples and at lowest densities at near-surface. Post yolk sac larval Common Sunfishes were collected primarily in near-bottom samples of both years, which accounted for the peak densities in near-bottom samples in August (Tables B-1 and B-2, Appendix B).

Table 4-9. Monthly Average Baseline Density (#/100 m^3 or 0.0264 million gallons) of Finfish by Depth Stratum at North Anna Power Station, 2016-2017

Month>>	Mar	Apr	May	Jun	Jul	Aug	Sep
Year 1 (April 2016 – September 2016)							
Near-surface		0.22	1.77	1.50	0.84	0.49	0.00
Mid-depth		5.77	8.90	3.55	10.30	1.61	0.00
Near-bottom		1.46	5.36	9.21	5.10	7.43	0.48
Depth-Averaged		**2.49**	**5.34**	**4.75**	**5.41**	**3.18**	**0.16**
Year 2 (March 2017 – September 2017)							
Near-surface	0.12	1.11	5.92	1.49	1.61	0.24	0.00
Mid-depth	0.49	2.21	10.28	14.64	24.45	0.00	0.00
Near-bottom	0.73	2.35	3.10	6.03	17.72	1.12	0.25
Depth-Averaged	**0.45**	**1.89**	**6.43**	**7.39**	**14.59**	**0.45**	**0.08**

4.7 Monthly and Annual Entrainment Estimates

4.7.1 Cooling Water Intake Flows

Using daily heat rejection values, the daily average circulating water flows were calculated by unit-specific pump for each month during the study. These data were used in all subsequent equations where the NAPS's actual intake flows were incorporated into the annual entrainment estimates. As mentioned in Section 2.2, NAPS withdraws service water in addition to circulating water withdrawal; however, the service water flow (estimated to be approximately 0.016 percent of circulating water flows based on 2016-2017 plant operation) is insignificant so that it was not included in the estimate of total entrainment.

Throughout the two-year study, the actual intake flows at Units 1 and 2 were higher during late spring and summer months (May to August), but slightly lower during March, April, and September (Figure 4-7).

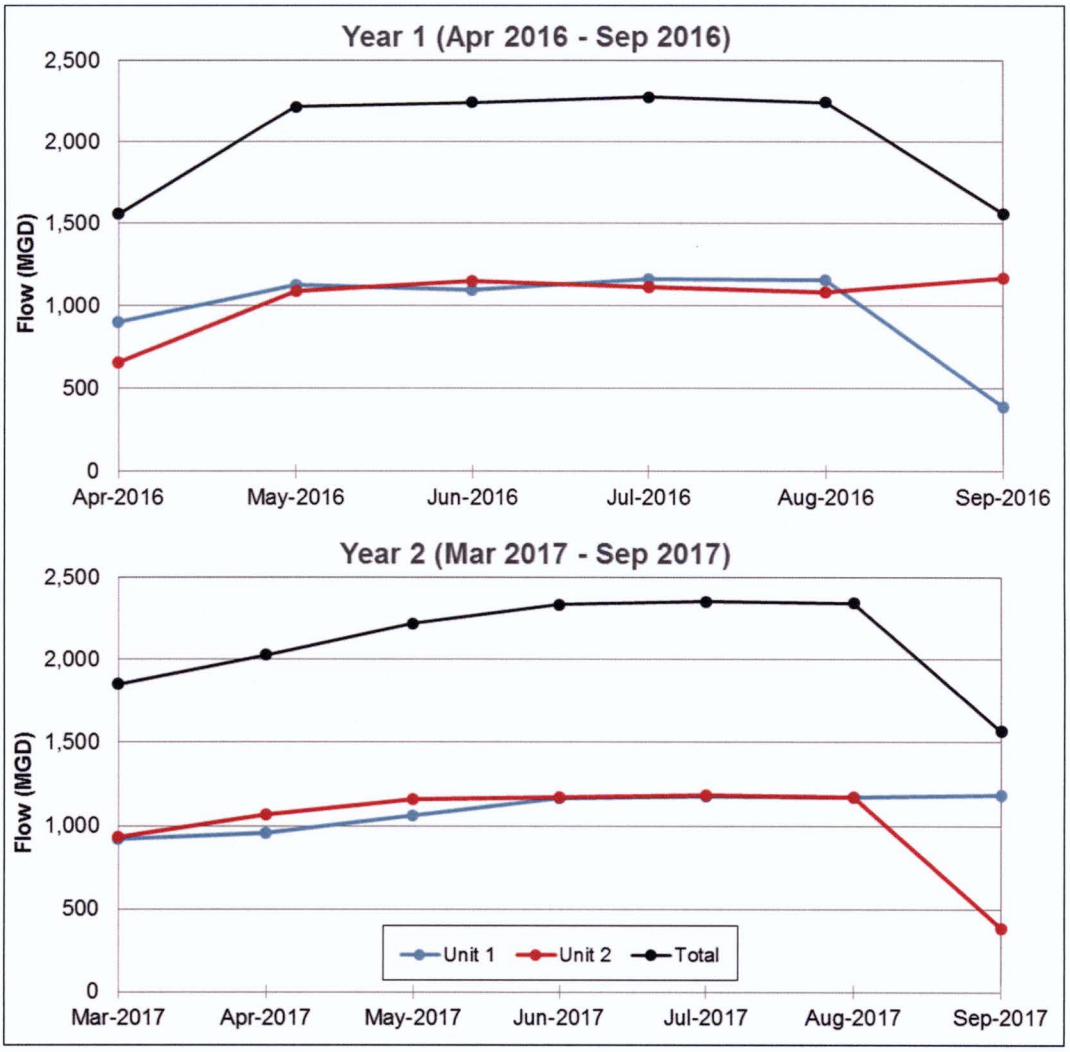


Figure 4-7. Monthly Average Actual Intake Flows by Unit at North Anna Power Station, 2016-2017

4.7.2 Numbers Entrained

Numbers Entrained in 2016 (Year 1) Based on Actual Flows

Entrainment was estimated based on the Rule-prescribed screen size (Baseline Entrainment) and actual intake flows during 2016 (Table 4-10). Estimates of converts and entrainment based on the current screen mesh size at NAPS (Actual Entrainment) were provided for information only. An estimated annual (April 2016 through September 2016) baseline entrainment is 53,593,333 fish at NAPS (Table 4-10). Herrings and Shad accounted for 44 percent of the estimated annual total baseline entrainment based on the first year of sampling. Common Sunfishes were the next abundant taxa contributing approximately 36 percent to the total entrainment. White Perch, Gizzard Shad, and Threadfin/Gizzard Shad were the only other taxa contributing at least two percent to the total baseline entrainment.

Table 4-10. Estimated Annual Entrainment Based on Actual Intake Flows in Year 1 (April 2016 – September 2016)

Taxon	Life Stage	Baseline Entrainment	Converts	Actual Entrainment
Finfish				
Blueback Herring	Juv	529,870	-	529,870
Channel Catfish	PYSL	657,642	65,764	591,878
Common Sunfishes	PYSL	18,576,046	-	18,576,046
	Juv	536,828	429,463	107,366
Crappie	PYSL	383,429	-	383,429
Darters	PYSL	213,696	-	213,696
Gizzard Shad	YSL	937,037	-	937,037
	PYSL	750,834	-	750,834
Threadfin/Gizzard Shad	PYSL	1,620,776	-	1,620,776
Golden Shiner	PYSL	66,007	-	66,007
Herrings and Shad	Egg	108,097	-	108,097
	YSL	1,235,293	-	1,235,293
	PYSL	20,276,410	-	20,276,410
	UIDL	1,767,519	-	1,767,519
Largemouth Bass	PYSL	100,376	-	100,376
	Juv	1,130,569	502,475	628,094
Minnow	PYSL	71,631	-	71,631
Sunfish	PYSL	424,748	-	424,748
Threadfin Shad	PYSL	769,285	-	769,285
Unidentified Finfish	UIDL	922,339	3,507	918,832
White Catfish	PYSL	111,407	-	111,407
White Perch	YSL	216,976	-	216,976
	PYSL	1,833,833	-	1,833,833
Yellow Perch	YSL	352,685	-	352,685
Total		**53,593,333**	**1,001,209**	**52,592,124**

Note:
1. The numbers reported in this table do not include non-viable eggs (NVE);
2 YSL = Yolk Sac Larvae, PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

Numbers Entrained in 2017 (Year 2) Based on Actual Flows

Entrainment was estimated based on the Rule-prescribed screen size (Baseline Entrainment) and actual intake flows during 2017 (Table 4-11). Estimates of converts and entrainment based on the current screen mesh size at NAPS (Actual Entrainment) were provided for information only. An estimated annual (March 2017 through September 2017) baseline entrainment is 83,421,119 fish at NAPS (Table 4-11). Herrings and Shad accounted for 70 percent of the estimated annual total baseline entrainment based on the second year of sampling. Threadfin/Gizzard Shad were the next most abundant taxa contributing approximately 13 percent to the total entrainment followed by Common Sunfishes (9%). Threadfin Shad and White Perch were the only other taxa contributing at least 2 percent to the total baseline entrainment.

Table 4-11. Estimated Annual Entrainment Based on Actual Intake Flows In Year 2 (March 2017 – September 2017)

Taxon	Life Stage	Baseline Entrainment	Converts	Actual Entrainment
Finfish				
Blueback Herring	PYS	188,656	-	188,656
Channel Catfish	PYS	458,461	45,846	412,615
Common Sunfishes	PYS	7,290,097	-	7,290,097
Darters	YS	190,379	-	190,379
Gizzard Shad	YS	107,943	-	107,943
	PYS	114,673	-	114,673
	Juv	114,781	-	114,781
Threadfin/Gizzard Shad	PYS	11,153,969	-	11,153,969
Herrings and Shad	Egg	536,756	-	536,756
	YS	107,494	-	107,494
	PYS	57,056,877	-	57,056,877
	UIDL	310,189	-	310,189
Largemouth Bass	Juv	322,916	143,518	179,398
Minnow	PYS	331,503	-	331,503
Spottail Shiner	PYS	89,595	-	89,595
Threadfin Shad	PYS	2,062,885	-	2,062,885
	Juv	114,933	-	114,933
Unidentified Finfish	UIDL	511,562	1,945	509,617
White Perch	YS	376,372	-	376,372
	PYS	1,342,639	-	1,342,639
Yellow Perch	YS	368,159	-	368,159
	PYS	270,280	-	270,280
Total		**83,421,119**	**191,309**	**83,229,810**

Note:
1. The numbers reported in this table do not include non-viable eggs (NVE)
2. YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

Numbers Entrained in 2016 (Year 1) Based on Design Flows

Entrainment was estimated based on the Rule-prescribed screen size (Baseline Entrainment) and the current screen mesh size at NAPS (Actual Entrainment) under design flows during 2016. An estimated annual baseline entrainment is 67,924,622 finfish based on the maximum design circulating water flows (excluding service water pumps) at NAPS in 2016 (Table 4-12). The percent contributions of each taxon to the total abundance remains consistent with the entrainment estimates derived from 2016 actual intake flows, but the abundances change in response to a larger design flow volume used to calculate the estimated entrainment total. The five taxa with the highest estimated annual baseline entrainment based on actual intake flow were the same under the design intake flow analysis. Herrings and Shad was the most abundant taxa with almost 30 million organisms estimated entrained followed by more than 23 million Common Sunfishes, more than 3 million White Perch, and 2 million each of Gizzard Shad and Threadfin/Gizzard Shad. The remaining taxa contributed approximately 7 million organisms to the annual total entrainment estimates based on design flows.

Table 4-12. Estimated Annual Entrainment Based on Design Flows in Year 1 (April 2016 – September 2016)

Taxon	Life Stage	Baseline Entrainment	Converts	Actual Entrainment
Finfish				
Blueback Herring	Juv	654,786	-	654,786
Channel Catfish	PYSL	801,184	80,118	721,066
Common Sunfishes	PYSL	22,782,012	-	22,782,012
	Juv	655,672	524,538	131,134
Crappie	PYSL	511,387	-	511,387
Darters	PYSL	264,075	-	264,075
Gizzard Shad	YSL	1,194,464	-	1,194,464
	PYSL	911,339	-	911,339
Threadfin/Gizzard Shad	PYSL	1,974,952	-	1,974,952
Golden Shiner	PYSL	116,183	-	116,183
Herrings and Shad	Egg	133,580	-	133,580
	YSL	1,834,390	-	1,834,390
	PYS	25,177,317	-	25,177,317
	UIDL	2,489,468	-	2,489,468
Largemouth Bass	PYS	124,039	-	124,039
	Juv	1,395,689	620,306	775,383
Minnow	PYS	126,083	-	126,083
Sunfish	PYS	518,415	-	518,415
Threadfin Shad	PYS	927,403	-	927,403
Unidentified Finfish	UIDL	1,247,958	4,745	1,243,213
White Catfish	PYS	134,015	-	134,015
White Perch	YS	381,915	-	381,915
	PYS	2,947,510	-	2,947,510
Yellow Perch	YS	620,785	-	620,785
Total		**67,924,622**	**1,229,707**	**66,694,915**

Note:
1. The numbers reported in this table do not include non-viable eggs (NVE)
2. YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

Numbers Entrained in 2017 (Year 2) Based on Design Flows

Entrainment was estimated based on the Rule-prescribed screen size (Baseline Entrainment) and the current screen mesh size at NAPS (Actual Entrainment) under the maximum design circulating water flows (excluding service water pumps) during 2017. An estimated annual baseline entrainment is 99,915,115 finfish based on the design flows at NAPS in 2017 (Table 4-13). The percent contributions of each taxon to the total abundance remains consistent with the entrainment estimates derived from 2017 actual intake flows, but the abundances change in response to a larger flow volume. The five taxa with the highest estimated annual entrainment based on actual intake flows during the second year of sampling were the same under the design flow analysis. Herrings and Shad were the most abundant taxa with more than 69 million organisms estimated entrained followed by 13 million Threadfin/Gizzard Shad, more than 8.5 million Common Sunfishes, 2.5 million Threadfin Shad, and more than 2 million White Perch. The remaining taxa contributed approximately 4 million organisms to the annual total entrainment estimates based on the design flows.

Table 4-13. Estimated Annual Entrainment Based on Design Flows in Year 2 (March 2017 – September 2017)

Taxon	Life Stage	Baseline Entrainment	Converts	Actual Entrainment
Finfish				
Blueback Herring	PYS	255,331	-	255,331
Channel Catfish	PYS	534,724	53,472	481,252
Common Sunfishes	PYS	8,675,534	-	8,675,534
Darters	YS	257,664	-	257,664
Gizzard Shad	YS	133,495	-	133,495
	PYS	133,585	-	133,585
	Juv	133,711	-	133,711
Threadfin/Gizzard Shad	PYS	13,005,138	-	13,005,138
Herrings and Shad	Egg	663,813	-	663,813
	YS	132,939	-	132,939
	PYS	68,122,521	-	68,122,521
	UIDL	394,620	-	394,620
Largemouth Bass	Juv	392,423	174,410	218,013
Minnow	PYS	389,173	-	389,173
Spottail Shiner	PYS	121,260	-	121,260
Threadfin Shad	PYS	2,403,106	-	2,403,106
	Juv	133,888	-	133,888
Unidentified Finfish	UIDL	654,911	2,490	652,420
White Perch	YS	521,051	-	521,051
	PYS	1,801,572	-	1,801,572
Yellow Perch	YS	521,217	-	521,217
	PYS	400,852	-	400,852
Finfish Total		**99,782,529**	**230,373**	**99,552,157**

Note:
1. The numbers reported in this table do not include non-viable eggs (NVE)
2. YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

4.8 Water Quality

Results of water quality data collected during entrainment surveys are presented in Appendix D. Monthly average water quality parameters for the entrainment sample locations (bottom-, mid- and surface-depths), with monthly minimums and maximums indicated by range bars, are presented on Figure 4-8 for the first year of entrainment sampling and Figure 4-9 for the second year of entrainment sampling.

During the first year of entrainment sampling, monthly average water temperatures measured at the entrainment location ranged from 17.0-degrees ºC (in April 2016) to 31.7ºC (in July 2016). The lowest single temperature reading was 14.6 ºC in April 2016, while the highest was 34.6ºC in July 2016. Monthly average DO was highest in April 2016 at 8.8 milligrams per liter (mg/L) and lowest in August 2016 at 5.4 mg/L. Individual DO readings ranged from a minimum of 4.2 mg/L in July 2016 to a maximum of 10.1 mg/L in April 2016. Monthly average specific conductivity ranged from a low of 70.4 microSiemens per centimeter (µS/cm) in September 2016 to a high of 73.1 µS/cm during April 2016. Individual specific conductivity readings were as low as 68.0 µS/cm in May 2016 and as high as 78.0 µS/cm in April 2016. pH values were highest during April at 8.3 units and lowest during July at 6.0 units[5].

During the second year of entrainment sampling, monthly average water temperatures measured at the entrainment location ranged from 11.5 ºC (in March 2017) to 30.5 ºC (in July 2017). The lowest single temperature reading was 10.2 ºC in March 2017, while the highest was 31.6 ºC in July 2017. Monthly average DO was highest in March 2017 at 10.5 mg/L and lowest in August 2017 at 6.2 mg/L. Individual DO readings ranged from a minimum of 5.0 mg/L in July 2017 to a maximum of 11.5 mg/L in March 2017. Monthly average specific conductivity ranged from a low of 67.4 µS/cm in April 2017 to a high of 72.5 µS/cm during July 2017. Individual specific conductivity readings were as low as 62.0 µS/cm in April 2017 and as high as 74.0 µS/cm in June and July 2017. pH values were highest during April and July 2017 at 8.0 units and lowest during April 2017 at 6.2 units[6].

[5] pH values are not reported as monthly averages because units represent a logarithmic scale.

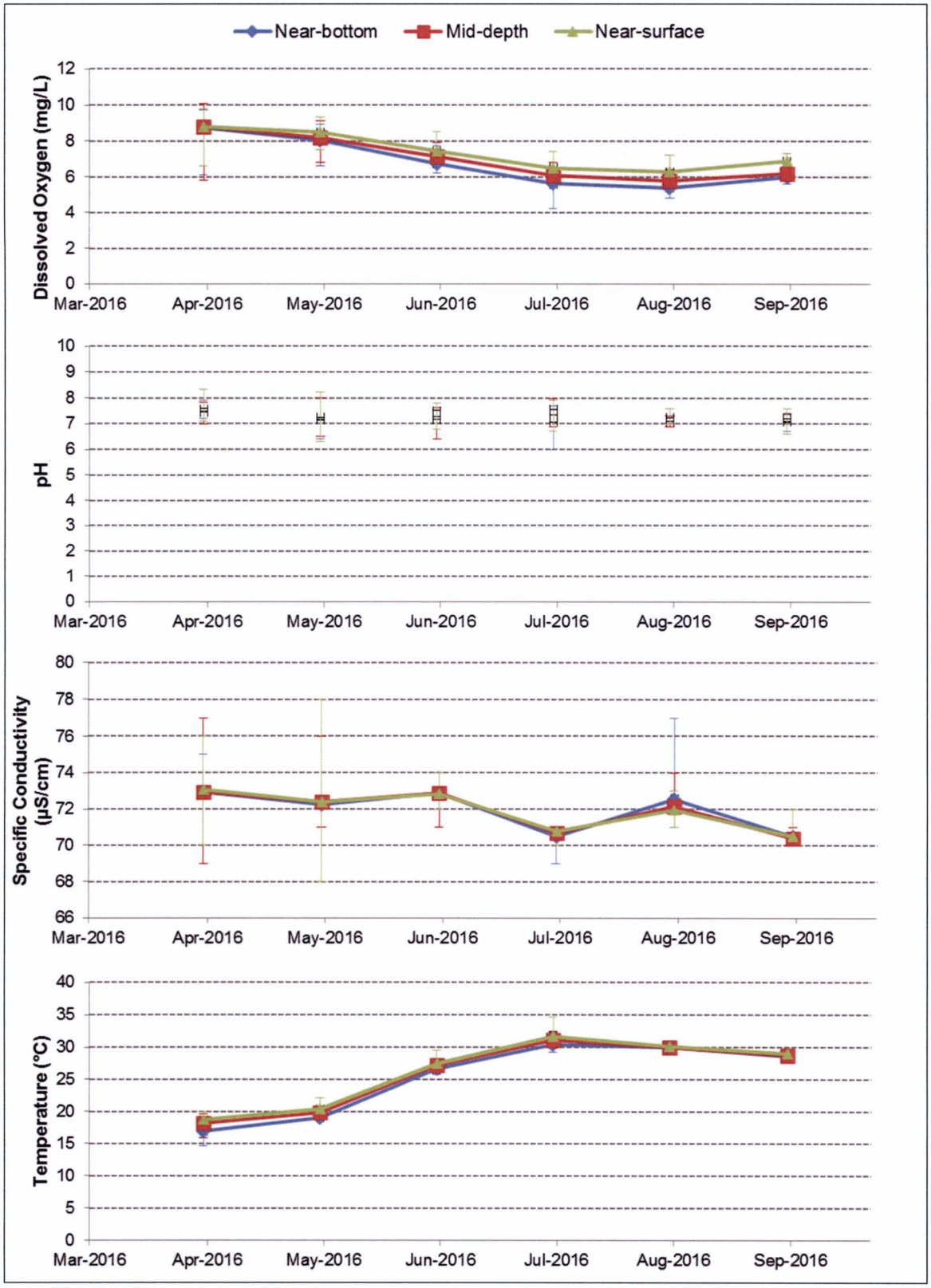


Figure 4-8. Monthly Average Water Quality Parameters with Monthly Minimum and Maximum at Near-Surface, Mid-, and Near-Bottom During 2016

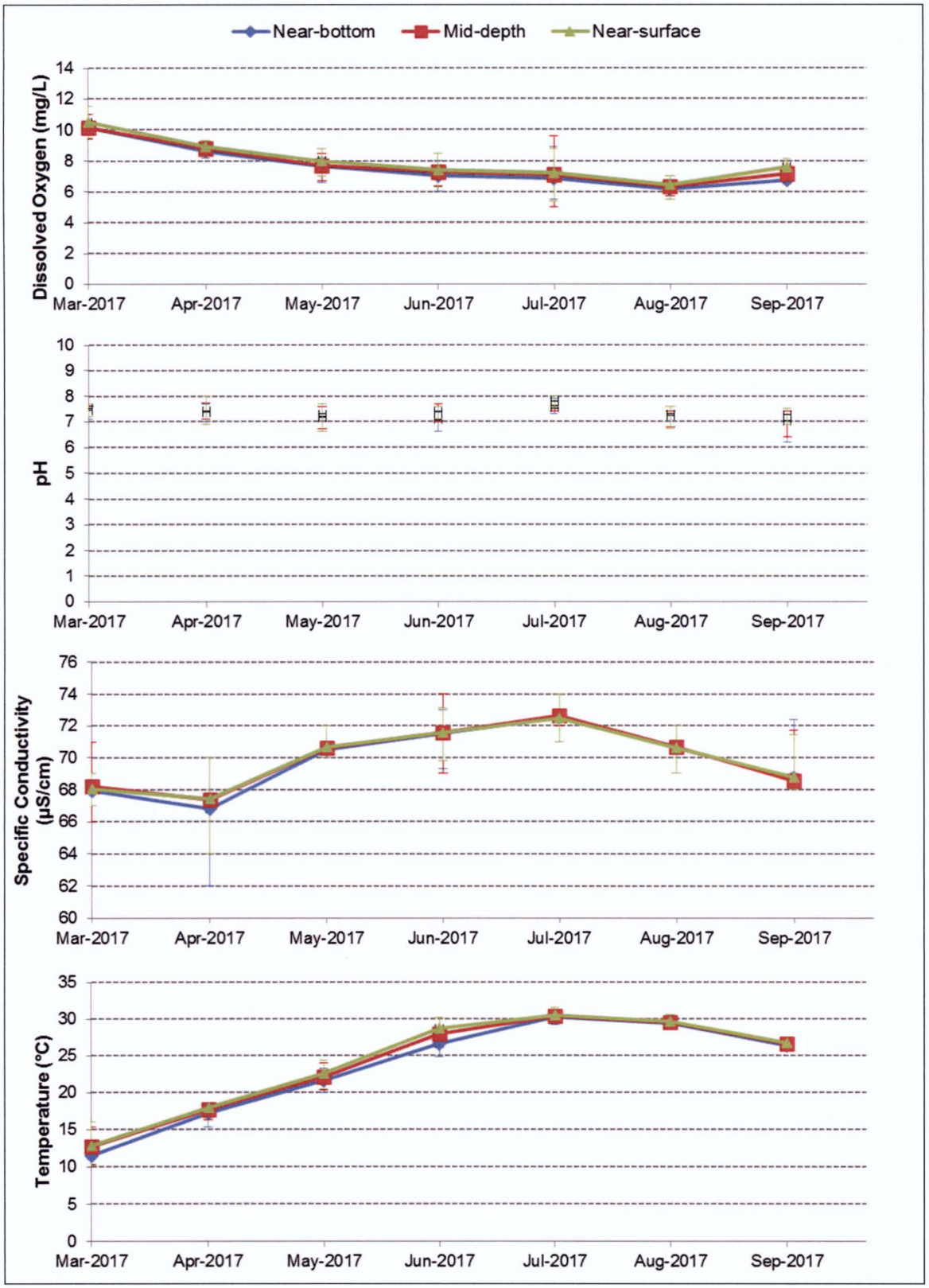


Figure 4-9. Monthly Average Water Quality Parameters with Monthly Minimum and Maximum at Near-Surface, Mid-, and Near-Bottom During 2017

5 Summary of Findings

Finfish species comprised 100 percent of the total entrainment sample collection for both years of the study. A total of 986 organisms were collected during the first year of entrainment sampling and included finfish distributed among 12 distinct taxa. A number of fish eggs (464) collected primarily in April, were considered non-viable (e.g., unfertilized or dead/decaying); therefore, they would not have contributed to future fish populations. Adjusting the number of fish to remove the number of nonviable eggs reduces the total number of fish considered for entrainment to 522 during Year 1 entrainment sampling at NAPS. During the second year of entrainment sampling, a total of 795 organisms were collected and included finfish distributed among 10 distinct taxa. Removing the total number of NVE eggs (35) collected entirely in May reduces the total number of organisms considered for entrainment during the second year to 760. Overall, taxonomic diversity was low with the number of distinct taxa ranging from a monthly low of 1 in September of each year to a high of 7 in May 2016. The most taxonomically rich samples were collected in the spring months of April (5 each year) and May (7 and 5 in 2016 and 2017, respectively).

Post yolk sac larvae dominated the entrainment sample collections, accounting for 83 percent of the Year 1 total and 96 percent of the Year 2 total. Yolk sac larvae comprised 6 percent of the sample collection for Year 1 and 2 percent of the sample collection for Year 2. Very few juveniles, eggs, or adult fish were collected, with each comprising 5 percent or less of the total collection for both years of entrainment sampling.

Overall, Herrings and Shad, Threadfin/Gizzard Shad (including the distinct taxa Gizzard Shad and Threadfin Shad), and Common Sunfishes dominated the finfish collection, accounting for 43 percent, 7 percent, and 34 percent of the total number of organisms during Year 1 and 69 percent, 16 percent, and 9 percent during Year 2, respectively. White Perch accounted for 5 percent and 2 percent of the total sample collection in Year 1 and Year 2, respectively. All remaining taxa contributed no more than 1 percent of the finfish collection. No endangered or threatened species were collected.

Average densities for all finfish taxa and life stages by month and depth strata were reviewed for seasonal and spatial trends. In general, the two years of sampling exhibited similar trends with the highest depth-averaged entrainment densities in May, June and July of both years. These peak densities were attributed primarily to post yolk sac larval Herrings and Shad (May to July), Common Sunfishes (June and July, extending into August of the first year of sampling), and Threadfin/Gizzard Shad (May to July of second year of sampling). The lowest depth-averaged monthly densities generally occurred during early spring (March and April) and September. White Perch contributed to the early spring densities (April) primarily during the first year of sampling.

Overall, mid-depth and near-bottom samples accounted for the majority of entrained organisms; however the contribution of each varied by year. During the first year of sampling, slightly more organisms were collected mid-depth (48%) compared to near-bottom (46%). During the second year of sampling, more organisms were collected at the mid-depth (56%) compared to near-bottom (33%). There were few consistent trends of entrainment rates by depth and nearly all taxa and life stages were collected at all three depth strata. For example, peak densities of post yolk sac Herrings and Shad were collected at mid-depth in May and July but in near-bottom samples

in June and August during the first year of sampling and were collected at greatest densities in mid-depth samples for nearly all months during the second year of sampling. Post yolk sac Herrings and Shad and Threadfin/Gizzard Shad were collected at similar densities in mid-depth and near-bottom samples and at lowest densities at near-surface during the first year of sampling but were more abundant in mid-depth samples during the second year of sampling. Post yolk sac larval Common Sunfishes were collected primarily in near-bottom samples of both years.

In general for both years combined, entrainment densities (excluding impingeable organisms on baseline screen mesh) were higher at night (2200 hours). During the second year of sampling, entrainment of finfish was similarly high during the late afternoon (1600 hours) and at night (2200 hours). The diel pattern was inconsistent by depth strata. Entrainment densities were highest at night at near-bottom samples, and lowest at early morning in near-surface samples

Annual baseline entrainment at NAPS during 2016 (April through September) was estimated at 53,593,333 finfish and 67,924,622 finfish under actual intake flows and design flows, respectively, based on the first year of sampling. Annual baseline entrainment for 2017 (March through September) was estimated at 83,421,119 finfish and 99,782,529 finfish under actual intake flows and design flows, respectively, based on the second year of sampling.

Comparison to Historical Data

Overall, the entrainment composition collected in 2016-2017 compares well with the entrainment study data conducted from March 1978 through July 1983 (VEPCO 1985) and described in Section 1.2. The dominant taxa for both studies were Gizzard Shad, White Perch, and Sunfishes. The current study contained a higher taxonomic grouping of Herrings and Shad, which include Gizzard Shad, Threadfin Shad, and Blueback Herring. The previous study noted that changes in total numbers entrained from year to year were generally reflected in the numbers of Gizzard Shad, Sunfishes, and White Perch collected and this is consistent with the current study. Blueback Herring and Threadfin Shad were introduced to Lake Anna in the 1980's and therefore would not have been available for collection in the earlier entrainment study. It could not be determined if Gizzard Shad were a large component of the Herrings and Shad taxon in the current study, as it was in the previous study, due to the condition of the specimens. Both studies reported peak Clupeidae taxa and White Perch densities in spring months followed by Sunfishes in summer months.

The previous entrainment study (VEPCO 1985) reported no fish eggs and attributed this to the dominance of species with demersal and adhesive eggs, which reduced the potential for entrainment. This is consistent with the current study which only collected a total of six viable fish eggs during the two-year study.

The previous study noted that entrainment densities overall were highest in the midnight samples (VEPCO 1985) based primarily on the abundance of Gizzard Shad and White Perch. However, Sunfish were collected at higher densities during the day. Diel entrainment densities were highly variable during the current study. Overall, entrainment densities were higher at night during the first year of sampling while equally abundant in the late afternoon and evening during the second year of sampling. In contrast to the previous study, Common Sunfishes were entrained at highest

densities at night during the first year of sampling but collected at similar densities throughout the diel periods during the second year of sampling, while Herrings and Shad were collected at highest densities during the day during both years of the current study.

Entrainment densities by depth were highly variable by taxon and study year for both studies. The combined data of the previous study indicate overall densities were similar for each depth strata with 33 percent of densities collected in surface samples, 35 percent in mid-depth samples, and 32 percent in near-bottom samples (VEPCO 1985). Results of the current study indicate densities were highest at mid-depth but percentages varied by year. During the first year of sampling, 48 percent of organisms were collected in the mid-depth samples and 46 percent were collected in near-bottom samples. During the second year of sampling, 56 percent of organisms were collected at the mid-depth compared to 33 percent in near-bottom samples. Densities were lowest in near-surface samples, accounting for 6 percent and 11 percent during the first and second year of sampling, respectively. Gizzard Shad were collected at higher densities at mid-depth and near-bottom samples for both studies, and this trend continued for the Herrings and Shad in the current study. In contrast, Sunfish were typically collected at higher densities in surface samples in the previous study but were collected at higher densities in near-bottom samples in the current study.

Brief life history summaries are provided below for the most abundant taxa.

5.1 Herrings and Shad (Clupeidae)

The Family Clupeidae includes numerous species of herring, shad, menhaden, and sardines. This large group of fishes is typically marine, coastal, and often anadromous, undergoing regular migrations up rivers to spawn. There is a wide variation in biology and ecology of clupeids and also in body shape and depth. They are typically small fishes that form large schools. Their great abundance supports sizeable fisheries; they also serve as important prey species for larger predatory fish. As adults, clupeids generally scatter pelagic eggs that hatch planktonic larvae, though some species lay adhesive eggs that stay near bottom substrate. Many species are filter-feeders that feed on small planktonic animals (mainly crustaceans). Two species of Shad identified in NAPS entrainment samples are Gizzard Shad and Threadfin Shad. Blueback Herring is the only Herring species known to occur in Lake Anna. Both Blueback Herring and Threadfin Shad were introduced in the 1980's and their populations in Lake Anna can be highly variable year to year (Odenkirk 2016). Together, Gizzard Shad, Threadfin Shad and Blueback Herring form the primary forage base for the sport fish managed in Lake Anna.

5.1.1 Gizzard Shad (*Dorosoma cepedianum*)

Gizzard Shad are a widely distributed species, extending from southeastern South Dakota and Central Minnesota throughout the Mississippi and Great Lakes drainages to as far north as the St. Lawrence River near Quebec, from southern New York along the Atlantic Coast to the Gulf of Mexico and west through the Gulf States to portions of New Mexico and Colorado east of the Continental Divide. Gizzard Shad are a short-lived (typical life span is up to age 3 or 4), fast maturing, and prolific species. The standard length of adult Gizzard Shad is 175-350 mm (6.9 – 13.8 inches; Helfrich et al. 2005). They are a pelagic schooling fish that inhabit a wide variety of habitats, including pools and runs of medium to large rivers, reservoirs, lakes, swamps, estuaries,

brackish bays, and occasionally marine waters (Jenkins and Burkhead 1994) and are relatively tolerant of silted bottoms (Helfrich et al. 2005). Spawning generally takes place with rising water temperature from April to June with a range from mid-March to late August depending on the region (VaFWIS 2017). Spawning has been described as occurring in low gradient tributaries, near the mouths of tributaries, and in large reservoirs primarily in groups near the surface during the day (Helfrich et al. 2005) or primarily at night (VaFWIS 2017). Eggs are demersal and adhere to algae, rocks, or other objects (Jenkins and Burkhead 1994). The total length at hatching is 3.25-5.0 mm, and rapid growth rates are characteristic of some southern populations in shallow, fertile impoundments with abundant food and long growing seasons (VaFWIS 2017). As with other herring species, the Gizzard Shad is a filter feeders, feeding primarily on plankton.

5.1.2 Threadfin Shad (*Dorosoma petenense*)

Similar to Gizzard Shad, Threadfin Shad are a short-lived (typical life span is up to age 3 or 4), fast maturing, and prolific species. Females may mature at less than 4 months of age (VaFWIS 2017). In Virginia, spawning occurs from April to July when water temperatures are between 14.4-27.2 °C. They are known for explosive reproductive capabilities. Spawning typically occurs in the morning within large roving schools and takes place in shallow water over floating brush, vegetation, logs, or almost any floating object; eggs are demersal and adhesive (VaFWIS 2017). Similar to other clupeid species, Threadfin Shad are sensitive to temperatures below 7 °C and have been known to experience large die-offs when temperatures decrease to 5 °C. Threadfin Shad feed on plankton similar to other Shad species but may also feed benthically (VaFWIS 2017).

5.1.3 Blueback Herring (*Alosa aestivalis*)

Found from Nova Scotia to Florida, Blueback Herring are an anadromous, highly migratory, euryhaline, pelagic, schooling species. Closely associated with Alewife (*Alosa pseudoharengus*), these two species can be difficult to tell apart and are often grouped together as River Herring. The Blueback Herring is in the diverse Herring group (Clupeidae). It is an anadromous species that has been stocked as forage fish in reservoirs where they have established landlocked populations. Maximum adult total length for Blueback Herring is 5.9 to 9.8 inches (150-250 mm [total length]) (VaFWIS 2017). Spawning typically occurs in the spring when adults from coastal waters migrate up rivers to spawn in moderate currents over a hard substrate (VFWIS 2017). Optimal spawning temperature range appears to be 70 to 77 °F (21 to 25 °C) (Greene et al. 2009). Blueback Herring typically spawn three to four weeks after peak Alewife spawning, or early March in South Carolina. Spawning activity is highest from late afternoon into evening when a female and two or more males swim in circles increasing their speed to a point when they dive to the bottom and the gametes are released (Greene et al. 2009). The eggs are adhesive but become detached after the water hardening period. Fecundity ranges from 45,800 to 349,700 eggs per female (VaFWIS 2017). Juveniles of anadromous populations typically migrate back to coastal waters in late summer or fall while landlocked populations remain in open water pelagic area during the day and will move to littoral zone at night to feed (VaFWIS 2017). Similar to other herring species, Blueback Herring are filter feeders and feed on plankton such as copepods, aquatic insects, and fish larvae. Adults may also consume small fish.

5.2 Common Sunfishes (*Lepomis* spp.)

Sunfishes (e.g. Bluegill, Pumpkinseed, Redear) are relatively small fish that are among the most common fish in lakes and ponds. They have been widely introduced throughout the country and serve as prey for larger sport fish and are also popular sport fish as adults. Depending on the species, Sunfish spawn throughout the spring and summer months when males build shallow nests scooped out of the pond or protected stream bottom. Sunfish feed on plankton and bottom invertebrates, and small fish.

Bluegill was one of the Sunfishes identified in the NAPS entrainment samples. This species is most commonly found in clear waters with bank cover and aquatic vegetation in quiet waters, and typically builds nests in large groups or colonies (Helfrich et al. 2005; VDGIF 2016). The standard length of Bluegill adults is 80- to 220-mm and they spawn multiple times between May and August (Helfrich et al. 2005). Adults move to deeper water as temperatures increase, but young will remain in shallow waters to feed (VDGIF 2017).

6 References

Greene, K.E., J.L. Zimmerman, R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: Chapter 5 – Blueback Herring (*Alosa aestivalis*). Atlantic States Marine Fisheries Commission Habitat Management Series No. 9, Washington, D.C. https://www.asmfc.org/files/Habitat/HMS9_Diadromous_Habitat_2009.pdf

HDR. 2017. Entrainment Characterization Study Standard Operating Procedures. North Anna Power Station, April 7, 2017. Prepared for Dominion Energy, Inc.

Helfrich, L., Newcomb, T., Hallerman, E., and Stein, K. 2005. EFISH: The Virtual Aquarium. Virginia Polytechnic Institute and State University. http://web1.cnre.vt.edu/efish/. Accessed December 2017.

Jenkins, R.E. and N.M. Burkhead. 1994. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, MD. 1079 pgs.

Odenkirk, J. 2016. Lake Anna Fisheries Management Report. Federal Aid Project - F111R. Virginia Department of Game and Inland Fisheries. Fredericksburg, Virginia. https://www.dgif.virginia.gov/wp-content/uploads/Lake-Anna-Popular-Report-2016.pdf. Accessed January 2018.

U.S. Geological Survey (USGS). 2015. Accessed June 25, 2015. http://waterdata.usgs.gov/nwis/wys_rpt?dd_parm_cds=001_00060&wys_water_yr=2014&site_no=01670400&agency_cd=USGS&adr_water_years=2007%2C2008%2C2009%2C2010%2C2011%2C2012%2C2013%2C2014&referred_module=

Virginia Electric and Power Company (VEPCO). 1985. Impingement study for North Anna Power Station 1978-1983. Virginia Power Corporate Technical Assessment, Water Quality Department.

VEPCO. 1986. North Anna Power Station Section 316 (a) Demonstration. Virginia Power Water Quality Department.

Virginia Department of Game and Inland Fisheries (VDGIF). 2016. Bluegill. https://www.dgif.virginia.gov/wildlife/fish/bluegill/ Accessed December 15, 2016.

Virginia Fish and Wildlife Information Service (VaFWIS). 2017. Virginia Department of Game and Inland. Species Information Report, https://vafwis.dgif.virginia.gov/fwis/?Title=VaFWIS+Report+BOVA&lastMenu=Home.Species+Information&tn=.1&geoArea=&sppName=&geoType=None&geoVal=no+selection&sppTax=01&status.

Appendix A

Data Analysis Calculations

Sample Density

Sample densities for each species and life stage, expressed as number per 100 m^3, are calculated from entrainment data for each six-hour interval (e.g., 0400, 1000, 1600, and 2200 hours) in a 24-hour sampling event and each h^{th} stratum (e.g., near-surface, mid-depth or near-bottom). Species and life stage-specific entrainment sample densities ($D_{t,h}$) are calculated as the number of individuals collected ($C_{t,h}$) divided by the sample volume in 100 m^3 ($q_{t,h}$) for the relevant six-hour time interval (t) and stratum (h).

$$D_{t,h} = \frac{C_{t,h}}{q_{t,h}}$$

where:

$D_{t,h}$ = density (#/100 m^3) in the t^{th} six-hour interval in the h^{th} stratum

$C_{t,h}$ = number of individuals collected by species and life stage in the t^{th} six-hour interval in the h^{th} stratum; adjusted for split fractions (f_s) where required ($C_{t,h}/f_s$)

$q_{t,h}$ = sample volume (100 m^3) in the t^{th} six-hour interval in the h^{th} stratum

t = six-hour time interval

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Sample Event Density

Sample event densities ($D_{d,h}$), expressed as number per 100 m^3, are calculated as the average of all 6-hour interval sample densities ($D_{t,h}$) for each species and life stage over each 24-hour sampling event for the relevant stratum (h).

$$D_{d,h} = \frac{1}{n_d}\sum_{i=1}^{n_d} D_{t,h}(i)$$

where:

$D_{d,h}$ = average density (#/100 m^3) of all six-hour sample densities ($D_{t,h}$) over a 24-hour sampling event for the h^{th} stratum

$D_{t,h}(i)$ = i^{th} six-hour sample density within a 24-hour sampling event for the h^{th} stratum

n_d = total number of six-hour samples within a 24-hour sampling event (e.g., typically 4 valid samples) for the h^{th} stratum

d = 24-hour time interval

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Monthly Density

Monthly densities ($D_{m,h}$), expressed as number per 100 m^3, are calculated as the average of all 6-hour interval sample densities ($D_{t,h}$) in each calendar month for each species and life stage for the relevant stratum (h).

$$D_{m,h} = \frac{1}{n_m} \sum_{j=1}^{n_m} D_{t,h}(j)$$

where:

$D_{m,h}$ = monthly density (#/100 m^3) for the h^{th} stratum

$D_{t,h}(j)$ = j^{th} six-hour sample density in a calendar month for the h^{th} stratum

n_m = total number of six-hour samples in a calendar month (e.g., typically 8 valid samples) for the h^{th} stratum

m = calendar month

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Exclusion Fraction

The U.S. Environmental Protection Agency (EPA) defines impingeable organisms as those that would be collected or retained in a sieve with a maximum opening dimension of 0.56 inches (14.2 millimeters [mm]; baseline screen mesh). Only organisms that would pass through the maximum opening of 0.56 inches, and thus be entrained, are used to estimate entrainment losses. Dominion Energy conducted entrainment sampling at North Anna Power Station using pumped samplers withdrawing directly in front of the intake structures. The orifices of the sample pipes are much larger than the Rule-defined maximum opening dimension of 0.56 inches, or a current mesh size of 1/8 x 1/2 inch installed at North Anna Power Station. As a result, during sampling, impingeable-sized organisms were collected in the entrainment samples. Below are methods used to separate these impingeable-size organisms from the others in the data and then excluded them from the calculation of densities and numbers entrained.

Even though the current mesh size (1/8 x 1/2-inch) at North Anna Power Station is finer than the Rule-defined screen mesh size, there is no fish return system at the facility so that the "converts" (i.e., organisms that would be entrainable by the Rule-definition of entrainment, but retained by the NAPS screens) would not be saved from the intake system. Therefore, entrainment density and annual loss estimates are adjusted for the maximum opening dimension of 0.56 inches based

on the regulatory definition of entrainment. Finfish with a maximum body depth (BD) greater than 14.2 mm (0.56 inches) were treated as impingeable and removed from the entrainment estimate.

For finfish species, the fraction ($F_{ei}(FF)$) of each identified life stage (yolk sac larvae, post yolk sac larvae, juveniles and adults[6]) excluded by the baseline screen mesh is estimated based on morphometric data collected as a part of the 2016-2017 entrainment study.

$$F_{ei}(FF) = \frac{C_{BDi}}{N_{BDi}}$$

where:

$F_{ei}(FF)$ = fraction of exclusion of the i^{th} identified finfish and life stage (yolk sac larvae, post yolk sac larvae, juveniles and adults)

C_{BDi} = count of organisms measured with BD greater than the limiting mesh size dimension of 14.2 mm (0.56 inches) for the i^{th} identified finfish and early life stage in all month combined morphometric data

N_{BDi} = total count of organisms measured for BD data for the i^{th} identified finfish and early life stage in all months combined morphometric data.

For unidentified life stages of finfish species identified to the genus and higher taxonomic levels, the morphometric data for all identified early life stages (e.g., yolk sac larvae and post yolk sac larvae) for that particular species are combined, and the fraction ($F_{eUIDL}(FF)$) excluded by the baseline screen mesh is estimated as follows.

$$F_{eUIDL}(FF) = \frac{\sum_{i=1}^{ni} C_{BDi}}{\sum_{i=1}^{ni} N_{BDi}}$$

where:

$F_{eUIDL}(FF)$ = fraction excluded of unidentified life stage of the subject finfish species

C_{BDi} = count of organisms measured with BD greater than the limiting mesh size dimension of 14.2 mm (0.56 inches) for the i^{th} identified early life stage of the subject finfish species in all month combined morphometric data

N_{BDi} = total count of organisms measured for BD data for the i^{th} identified early life stage of the subject finfish species in all months combined morphometric data

ni = total number of identified early life stages of the identified finfish species in all months combined morphometric data.

[6] It is assumed that no eggs will be retained on the baseline screen mesh.

For unidentified finfish species with identified life stages, the morphometric data for all identified species for each life stage (e.g., yolk sac larvae, post yolk sac larvae, juveniles or adults) are combined, and the fraction (F_{eUID} *(FF)*) excluded by the baseline screen mesh is estimated as follows.

$$F_{eUID}(FF) = \frac{\sum_{i=1}^{nj} C_{BDi}}{\sum_{i=1}^{nj} N_{BDi}}$$

where:

$F_{eUID}(FF)$ = fraction excluded of unidentified finfish species

C_{BDi} = count of organisms measured with BD greater than the limiting mesh size dimension of 14.2 mm (0.56 inches) for the i^{th} identified finfish and life stage in all month combined morphometric data

N_{BDi} = total count of organisms measured for BD data for the i^{th} identified finfish and life stage in all month combined morphometric data

nj = total number of the identified finfish and life stage in all month combined morphometric data.

Monthly Density with Exclusion

Monthly densities ($De_{m,h}$) of entrainment accounting for exclusion and expressed as number per 100 m^3, are calculated as the average of all 6-hour interval sample densities ($D_{t,h}$) in each calendar month for each species and life stage for the relevant stratum (*h*) multiplied by the fraction of organisms not excluded, i.e., the fraction of organisms projected to pass through the intake screens.

$$De_{m,h} = \frac{1}{n_m} \sum_{j=1}^{n_m} \{D_{t,h}(j) \cdot (1 - Fe)\}$$

where:

$De_{m,h}$ = monthly density (#/100 m^3) for the h^{th} stratum with exclusion

$D_{t,h}(j)$ = j^{th} six-hour sample density within a calendar month for the h^{th} stratum

n_m = total number of six-hour samples within a calendar month (e.g., typically 8 valid samples) for the h^{th} stratum

m = calendar month

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Fe = fraction excluded where:

- $Fe = F_{ei}$ *(FF)* for each identified finfish species and life stage
- $Fe = F_{eUIDL}$ *(FF)* for unidentified life stage larvae of an identified finfish species
- $Fe = F_{eUID}$ *(FF)* for unidentified finfish species

Depth-Stratified Diel Density with Exclusion

Depth-stratified diel densities with exclusion, expressed as number per 100 m^3, are calculated as the average of all densities for each 6-hour sample period (samples centered around 0400, 1000, 1600, or 2200 hours) for each species and life stage during the entire sampling program for the relevant stratum (*h*) multiplied by the fraction of organisms not excluded, i.e., the fraction of organisms projected to pass through the intake screen.

$$De_{t,h} = \frac{1}{N}\sum_{k=1}^{N}\{D_{t,h}(k)\cdot(1-Fe)\}$$

where:

$De_{t,h}$ = average density (#/100m^3) of all densities of each 6-hour sample period for the h^{th} stratum with exclusion

$D_{t,h}(k)$ = k^{th} six-hour sample density in an entire sampling program for the h^{th} stratum

N = total number of six-hour samples in an entire sampling program (e.g., ideally 192 samples if all samples are valid) for the h^{th} stratum

h = stratum (e.g., near-surface, mid-depth or near-bottom)

Fe = fraction excluded where:

- $Fe = F_{ei}$ *(FF)* for each identified finfish species and life stage
- $Fe = F_{eUIDL}$ *(FF)* for unidentified life stage larvae of an identified finfish species
- $Fe = F_{eUID}$ *(FF)* for unidentified finfish species

Depth-Averaged Diel Density with Exclusion

Depth-averaged diel densities with exclusion, expressed as number per 100 m^3, are calculated as the average of all stratum densities for each 6-hour sample period (samples centered around 0400, 1000, 1600, or 2200 hours) for each species and life stage during the entire sampling program multiplied by the fraction of organisms not excluded, i.e., the fraction of organisms projected to pass through the intake screens.

$$De_t = \frac{1}{H}\sum_{h=1}^{H}[\{\frac{1}{N}\sum_{k=1}^{N}D_{t,h}(k)\}\cdot(1-Fe)]$$

where:

De_t = depth-averaged density (#/100 m^3) of all densities of each 6-hour sample period with exclusion

$D_{t,h}(k)$ = k^{th} six-hour sample density in an entire sampling program for the h^{th} stratum

N = total number of six-hour samples in an entire sampling program (e.g., ideally 192 samples if all samples are valid) for the h^{th} stratum

h = stratum (e.g., near-surface, mid-depth or near-bottom)

H = total number of strata sampled (e.g., 3 for North Anna Power Station)

Fe = fraction excluded where:

- $Fe = F_{ei}$ *(FF)* for each identified finfish species and life stage
- $Fe = F_{eUIDL}$ *(FF)* for unidentified life stage larvae of an identified finfish species
- $Fe = F_{eUID}$ *(FF)* for unidentified finfish species

Annual Entrainment with Exclusion under Actual Flows

Monthly entrainment densities are used to estimate the year specific total number of organisms entrained (E_{ai}) for each species and life stage under actual flow rates as:

$$E_{ai} = \sum_{m=1}^{M} [\sum_{h=1}^{H} \{\frac{De_{m,h}(i)}{100} \cdot \frac{V_{a,m}}{H}\}]$$

where:

E_{ai} = annual entrained for the i^{th} species and life stage under actual intake flows

$De_{m,h}(i)$= monthly density (#/100 m^3) for the h^{th} stratum with exclusion for the i^{th} species and life stage

$V_{a,m}$ = monthly total volume (m^3) of water withdrawn by the station based on actual operations

h = stratum (e.g., near-surface, mid-depth or near-bottom)

H = total number of strata sampled (e.g., 3 for North Anna Power Station)

m = calendar month

M = total number of months in a year

The yearly total number of organisms entrained (E_a) is then estimated by summing the total numbers of organisms entrained (E_{ai}) for all species and life stage under actual flow rates as:

$$E_a = \sum_{i=1}^{NN} E_{ai}$$

where:

E_a = annual entrained of all species and life stage under actual intake flows

E_{ai} = annual entrained for the i^{th} species and life stage under actual intake flows

NN = total number of all species and life stages collected.

Annual Entrainment with Exclusion under Design Flows

Monthly entrainment densities are used to estimate the year specific total number of organisms entrained (E_{di}) for each species and life stage under design flow rates as:

$$E_{di} = \sum_{m=1}^{M} [\sum_{h=1}^{H} \{\frac{De_{m,h}(i)}{100} \cdot \frac{V_{d,m}}{H}\}]$$

where:

E_{di} = annual entrained for the i^{th} species and life stage under design intake flows

$De_{m,h(i)}$= monthly density (#/100 m^3) for the h^{th} stratum with exclusion for the i^{th} species and life stage

$V_{d,m}$ = monthly total volume (m^3) at full design flows for the station

h = stratum (e.g., near-surface, mid-depth or near-bottom)

H = total number of strata sampled (e.g., 3 for North Anna Power Station)

m = calendar month

M = total number of months in a year

The yearly total number of organisms entrained (E_d) is then estimated by summing the total numbers of organisms entrained (E_{di}) for all species and life stage under design flow rates as:

$$E_d = \sum_{i=1}^{NN} E_{di}$$

where:

E_d = annual entrained of all species and life stage under design intake flows

E_{di} = annual entrained for the i^{th} species and life stage under design intake flows

NN = total number of all species and life stages collected

Appendix B

Entrainment Collection Data

Table B. Entrainment Sample Density and Total Number of Organisms Collected

Sample Date	Sample ID	Stratum	Taxon	Scientific Name	Life Stage	Total Number of Organisms Caught	Density (#/100m^3)
4/20/2016	NAPS_2_20160420_15	Near-bottom	White Perch	*Morone americana*	PYS	1	0.996
	NAPS_2_20160420_21	Mid-depth	Crappie	*Pomoxis sp.*	PYS	1	0.971
			Minnow	Cyprinidae	PYS	1	0.971
		Near-bottom	Non-Viable Egg	(blank)	NVE	3	2.986
			White Perch	*Morone americana*	PYS	1	0.995
4/21/2016	NAPS_2_20160421_03	Mid-depth	Herrings and Shad	Clupeidae	PYS	1	0.991
	NAPS_2_20160421_09	Mid-depth	Herrings and Shad	Clupeidae	PYS	4	3.806
			White Perch	*Morone americana*	YS	1	0.952
					PYS	6	5.710
		Near-bottom	Gizzard Shad	*Dorosoma cepedianum*	YS	1	0.944
			Herrings and Shad	Clupeidae	UIDL	1	0.944
			Unidentified Finfish	Unidentified	UIDL	1	0.944
4/26/2016	NAPS_2_20160426_09	Near-surface	Non-Viable Egg	(blank)	NVE	9	8.957
		Mid-depth	Herrings and Shad	Clupeidae	YS	5	4.975
					PYS	3	2.985
					UIDL	3	2.985
			Non-Viable Egg	(blank)	NVE	12	11.941
			White Perch	*Morone americana*	PYS	3	2.985
		Near-bottom	Herrings and Shad	Clupeidae	UIDL	2	1.973
			Non-Viable Egg	(blank)	NVE	12	11.837
	NAPS_2_20160426_14	Near-surface	Non-Viable Egg	(blank)	NVE	4	3.974
		Mid-depth	Herrings and Shad	Clupeidae	YS	3	2.983
					PYS	4	3.978
					UIDL	2	1.989
			Non-Viable Egg	(blank)	NVE	4	3.978
			White Perch	*Morone americana*	PYS	5	4.972
		Near-bottom	Non-Viable Egg	(blank)	NVE	1	0.995
			Unidentified Finfish	Unidentified	UIDL	2	1.990
			White Perch	*Morone americana*	YS	2	1.990
	NAPS_2_20160426_21	Near-surface	Golden Shiner	*Notemigonus crysoleucas*	PYS	1	0.895
			Non-Viable Egg	(blank)	NVE	188	168.223
			Yellow Perch	*Perca flavescens*	YS	1	0.895
		Mid-depth	Non-Viable Egg	(blank)	NVE	90	87.966
			White Perch	*Morone americana*	PYS	2	1.955
			Yellow Perch	*Perca flavescens*	YS	1	0.977
		Near-bottom	Non-Viable Egg	(blank)	NVE	22	20.337
			Yellow Perch	*Perca flavescens*	YS	1	0.924
4/27/2016	NAPS_2_20160427_03	Near-surface	Non-Viable Egg	(blank)	NVE	26	24.390
		Mid-depth	Non-Viable Egg	(blank)	NVE	62	61.518
			Yellow Perch	*Perca flavescens*	YS	2	1.984
		Near-bottom	Non-Viable Egg	(blank)	NVE	26	25.033
5/10/2016	NAPS_2_20160510_09	Mid-depth	Crappie	*Pomoxis sp.*	PYS	3	2.872
			Herrings and Shad	Clupeidae	PYS	2	1.914
			Sunfish	Centrarchidae	PYS	1	0.957
			Unidentified Finfish	Unidentified	UIDL	1	0.957
			White Perch	*Morone americana*	PYS	1	0.957
		Near-bottom	Gizzard Shad	*Dorosoma cepedianum*	YS	1	0.994
			Non-Viable Egg	(blank)	NVE	1	0.994
			White Perch	*Morone americana*	PYS	2	1.987
	NAPS_2_20160510_15	Near-surface	Non-Viable Egg	(blank)	NVE	4	3.762
		Mid-depth	Herrings and Shad	Clupeidae	PYS	1	0.995
					UIDL	1	0.995
	NAPS_2_20160510_21	Near-surface	Largemouth Bass	*Micropterus salmoides*	PYS	1	0.924
		Mid-depth	Herrings and Shad	Clupeidae	PYS	1	0.972
5/11/2016	NAPS_2_20160511_03	Near-surface	Herrings and Shad	Clupeidae	PYS	1	0.997
		Mid-depth	Blueback Herring	*Alosa aestivalis*	Juv	1	0.989
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.989
5/24/2016	NAPS_2_20160524_09	Near-surface	Blueback Herring	*Alosa aestivalis*	Juv	1	0.928
			Unidentified Finfish	Unidentified	UIDL	1	0.928
		Mid-depth	Herrings and Shad	Clupeidae	PYS	19	18.873
		Near-bottom	Gizzard Shad	*Dorosoma cepedianum*	YS	7	6.995
			Herrings and Shad	Clupeidae	PYS	23	22.985
	NAPS_2_20160524_15	Near-surface	Herrings and Shad	Clupeidae	UIDL	1	0.965
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.995
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.995
			Herrings and Shad	Clupeidae	YS	6	5.970
					PYS	3	2.985
					UIDL	3	2.985
			Unidentified Finfish	Unidentified	UIDL	1	0.995
			White Perch	*Morone americana*	PYS	1	0.995
		Near-bottom	Herrings and Shad	Clupeidae	Egg	1	0.996
					UIDL	5	4.978
	NAPS_2_20160524_20	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	9	8.457
		Mid-depth	Blueback Herring	*Alosa aestivalis*	Juv	1	0.996
			Common Sunfishes	*Lepomis spp.*	PYS	8	7.965
			Herrings and Shad	Clupeidae	PYS	3	2.987
					UIDL	1	0.996
		Near-bottom	Darters	*Etheostoma spp.*	PYS	2	1.968

Sample Date	Sample ID	Stratum	Taxon	Scientific Name	Life Stage	Total Number of Organisms Caught	Density (#/100m^3)
			White Perch	*Morone americana*	PYS	1	0.984
5/25/2016	NAPS_2_20160525_03	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	1	0.994
		Mid-depth	Blueback Herring	*Alosa aestivalis*	Juv	1	0.986
			Common Sunfishes	*Lepomis spp.*	PYS	2	1.971
			Herrings and Shad	Clupeidae	PYS	8	7.885
		Near-bottom	Blueback Herring	*Alosa aestivalis*	Juv	1	0.982
6/14/2016	NAPS_2_20160614_10	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	4	3.823
			Unidentified Finfish	Unidentified	UIDL	1	0.956
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	3	2.946
			Herrings and Shad	Clupeidae	PYS	5	4.910
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.992
			Unidentified Finfish	Unidentified	UIDL	1	0.992
	NAPS_2_20160614_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	4	3.507
			Unidentified Finfish	Unidentified	UIDL	2	1.753
		Mid-depth	Herrings and Shad	Clupeidae	PYS	6	5.691
	NAPS_2_20160614_21	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	1	0.982
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	2	1.992
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.996
			Herrings and Shad	Clupeidae	PYS	1	0.996
			Sunfish	Centrarchidae	PYS	1	0.996
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	4	3.980
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.995
			Herrings and Shad	Clupeidae	PYS	7	6.965
6/15/2016	NAPS_2_20160615_03	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.994
			Herrings and Shad	Clupeidae	PYS	3	2.981
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	11	10.951
			Herrings and Shad	Clupeidae	PYS	10	9.955
6/28/2016	NAPS_2_20160628_09	Near-surface	Bluegill	*Lepomis macrochirus*	Juv	1	0.985
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.980
			Threadfin Shad	*Dorosoma petenense*	PYS	1	0.980
		Near-bottom	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.993
	NAPS_2_20160628_15	Near-surface	Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.979
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.991
	NAPS_2_20160628_21	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.996
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	20	19.956
			Gizzard Shad	*Dorosoma cepedianum*	PYS	2	1.996
			Herrings and Shad	Clupeidae	PYS	4	3.991
6/29/2016	NAPS_2_20160629_02	Mid-depth	Herrings and Shad	Clupeidae	PYS	2	1.950
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	8	7.965
			Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.996
			Herrings and Shad	Clupeidae	PYS	3	2.987
7/12/2016	NAPS_2_20160712_09	Near-surface	Bluegill	*Lepomis macrochirus*	Juv	1	0.942
		Mid-depth	Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.989
			Herrings and Shad	Clupeidae	PYS	1	0.989
		Near-bottom	Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.965
	NAPS_2_20160712_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	2	1.965
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
			Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.997
	NAPS_2_20160712_21	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	7	6.992
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.999
			Herrings and Shad	Clupeidae	PYS	1	0.999
			Threadfin Shad	*Dorosoma petenense*	PYS	1	0.999
			White Catfish	*Ameiurus catus*	PYS	1	0.999
7/13/2016	NAPS_2_20160713_03	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	8	7.950
			Herrings and Shad	Clupeidae	PYS	1	0.994
7/26/2016	NAPS_2_20160726_10	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	3	2.809
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	4	3.985
			Herrings and Shad	Clupeidae	PYS	37	36.862
		Near-bottom	Herrings and Shad	Clupeidae	PYS	2	1.994
	NAPS_2_20160726_14	Near-surface	Sunfish	Centrarchidae	PYS	1	0.945
		Mid-depth	Herrings and Shad	Clupeidae	PYS	30	29.822
	NAPS_2_20160726_21	Near-surface	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.982
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.991
			Threadfin Shad	*Dorosoma petenense*	PYS	2	1.981
		Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	1	0.995
			Common Sunfishes	*Lepomis spp.*	PYS	8	7.957
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.995
			Herrings and Shad	Clupeidae	PYS	1	0.995
			Threadfin Shad	*Dorosoma petenense*	PYS	3	2.984
7/27/2016	NAPS_2_20160727_03	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	3	2.856
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.952
			Herrings and Shad	Clupeidae	PYS	1	0.952
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	3	2.981
			Herrings and Shad	Clupeidae	PYS	1	0.994
8/9/2016	NAPS_2_20160809_09	Near-surface	Bluegill	*Lepomis macrochirus*	Juv	2	1.982
	NAPS_2_20160809_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	2	1.989
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	2	1.994
			Sunfish	Centrarchidae	PYS	1	0.997
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	2	1.990
	NAPS_2_20160809_20	Near-surface	Common Sunfishes	*Lepomis spp.*	Juv	1	0.967

Sample Date	Sample ID	Stratum	Taxon	Scientific Name	Life Stage	Total Number of Organisms Caught	Density (#/100m^3)
		Mid-depth	Common Sunfishes	*Lepomis spp.*	Juv	1	0.989
		Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	4	3.981
			Common Sunfishes	*Lepomis spp.*	PYS	24	23.888
			Gizzard Shads	*Dorosoma spp.*	PYS	3	2.986
8/10/2016	NAPS_2_20160810_03	Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	2	1.975
		Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	1	0.995
			Common Sunfishes	*Lepomis spp.*	PYS	12	11.945
8/23/2016	NAPS_2_20160823_09	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.990
	NAPS_2_20160823_15	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	3	2.984
			Herrings and Shad	Clupeidae	PYS	1	0.995
	NAPS_2_20160823_20	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
					Juv	1	0.997
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	7	6.941
8/24/2016	NAPS_2_20160824_03	Near-surface	Common Sunfishes	*Lepomis spp.*	Juv	1	0.979
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	6	5.729
					Juv	1	0.955
9/13/2016	NAPS_2_20160913_15	Near-surface	Bluegill	*Lepomis macrochirus*	Juv	1	0.971
9/14/2016	NAPS_2_20160914_03	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	2	1.922
3/16/2017	NAPS_2_20170316_10	Near-bottom	White Perch	*Morone americana*	YS	1	0.994
			Yellow Perch	*Perca flavescens*	PYS	1	0.994
	NAPS_2_20170316_15	Near-bottom	White Perch	*Morone americana*	PYS	1	0.878
	NAPS_2_20170316_21	Mid-depth	Yellow Perch	*Perca flavescens*	YS	1	0.995
		Near-bottom	Yellow Perch	*Perca flavescens*	PYS	2	1.994
3/17/2017	NAPS_2_20170317_03	Mid-depth	Herrings and Shad	Clupeidae	PYS	2	1.932
3/28/2017	NAPS_2_20170328_09	Near-bottom	Unidentified Finfish	Unidentified	UIDL	1	0.998
3/29/2017	NAPS_2_20170329_03	Near-surface	Yellow Perch	*Perca flavescens*	YS	1	0.961
		Mid-depth	White Perch	*Morone americana*	PYS	1	0.993
4/11/2017	NAPS_2_20170411_10	Mid-depth	Blueback Herring	*Alosa aestivalis*	PYS	1	0.980
			Herrings and Shad	Clupeidae	PYS	1	0.980
			White Perch	*Morone americana*	PYS	1	0.980
	NAPS_2_20170411_14	Near-surface	White Perch	*Morone americana*	PYS	2	1.982
		Mid-depth	Herrings and Shad	Clupeidae	PYS	2	1.919
			White Perch	*Morone americana*	PYS	1	0.960
	NAPS_2_20170411_21	Near-surface	White Perch	*Morone americana*	PYS	1	0.995
		Mid-depth	Blueback Herring	*Alosa aestivalis*	PYS	1	0.987
		Near-bottom	Yellow Perch	*Perca flavescens*	YS	2	1.993
4/12/2017	NAPS_2_20170412_03	Near-surface	White Perch	*Morone americana*	YS	3	2.986
					PYS	2	1.991
		Mid-depth	Herrings and Shad	Clupeidae	PYS	9	8.897
			White Perch	*Morone americana*	PYS	1	0.989
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.987
4/25/2017	NAPS_2_20170425_10	Near-bottom	Herrings and Shad	Clupeidae	PYS	3	2.989
	NAPS_2_20170425_15	Mid-depth	Herrings and Shad	Clupeidae	PYS	1	0.976
		Near-bottom	Herrings and Shad	Clupeidae	PYS	6	5.898
					UIDL	1	0.983
			White Perch	*Morone americana*	PYS	1	0.983
	NAPS_2_20170425_21	Near-surface	Spottail Shiner	*Notropis hudsonius*	PYS	1	0.934
		Near-bottom	Darters	*Etheostoma spp.*	YS	1	0.991
			Herrings and Shad	Clupeidae	PYS	2	1.982
4/26/2017	NAPS_2_20170426_03	Near-bottom	Darters	*Etheostoma spp.*	YS	1	0.993
			Herrings and Shad	Clupeidae	PYS	1	0.993
5/16/2017	NAPS_2_20170516_09	Near-surface	Herrings and Shad	Clupeidae	Egg	4	3.963
					YS	1	0.991
			Non-Viable Egg	(blank)	NVE	28	27.743
		Mid-depth	Herrings and Shad	Clupeidae	PYS	21	19.983
			Unidentified Finfish	Unidentified	UIDL	1	0.952
		Near-bottom	Herrings and Shad	Clupeidae	PYS	3	2.960
			Non-Viable Egg	(blank)	NVE	1	0.987
	NAPS_2_20170516_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	1	0.984
			Herrings and Shad	Clupeidae	Egg	1	0.984
					PYS	25	24.606
			Non-Viable Egg	(blank)	NVE	4	3.937
			Unidentified Finfish	Unidentified	UIDL	2	1.968
			White Perch	*Morone americana*	PYS	2	1.968
		Mid-depth	Herrings and Shad	Clupeidae	PYS	20	19.845
		Near-bottom	White Perch	*Morone americana*	PYS	1	0.996
	NAPS_2_20170516_20	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	1	0.963
			Unidentified Finfish	Unidentified	UIDL	1	0.963
		Mid-depth	Herrings and Shad	Clupeidae	PYS	10	9.686
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.972
5/17/2017	NAPS_2_20170517_03	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	1	0.996
			Non-Viable Egg	(blank)	NVE	2	1.991
		Mid-depth	Herrings and Shad	Clupeidae	PYS	6	5.968
		Near-bottom	Blueback Herring	*Alosa aestivalis*	Adult	1	0.988
			Herrings and Shad	Clupeidae	PYS	2	1.976
5/30/2017	NAPS_2_20170530_09	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	6	5.974
			Herrings and Shad	Clupeidae	PYS	2	1.991
		Mid-depth	Gizzard Shad	*Dorosoma cepedianum*	YS	1	0.995
			Herrings and Shad	Clupeidae	PYS	18	17.909
					UIDL	2	1.990

Sample Date	Sample ID	Stratum	Taxon	Scientific Name	Life Stage	Total Number of Organisms Caught	Density (#/100m^3)
		Near-bottom	Herrings and Shad	Clupeidae	PYS	17	16.934
	NAPS_2_20170530_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	1	0.978
		Mid-depth	Herrings and Shad	Clupeidae	PYS	1	0.949
5/31/2017	NAPS_2_20170531_02	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
			Herrings and Shad	Clupeidae	PYS	3	2.991
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.996
6/13/2017	NAPS_2_20170613_10	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	4	3.977
		Mid-depth	Herrings and Shad	Clupeidae	PYS	4	3.994
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.997
	NAPS_2_20170613_15	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	5	4.981
		Mid-depth	Herrings and Shad	Clupeidae	PYS	14	13.970
	NAPS_2_20170613_20	Mid-depth	Herrings and Shad	Clupeidae	PYS	14	13.737
		Near-bottom	Herrings and Shad	Clupeidae	PYS	1	0.996
6/14/2017	NAPS_2_20170614_02	Near-surface	Largemouth Bass	*Micropterus salmoides*	Juv	1	0.999
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.999
			Herrings and Shad	Clupeidae	PYS	5	4.996
			Minnow	Cyprinidae	PYS	1	0.999
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	1	0.999
			Herrings and Shad	Clupeidae	PYS	3	2.998
6/27/2017	NAPS_2_20170627_09	Near-surface	Minnow	Cyprinidae	PYS	1	0.999
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	3	2.997
			Herrings and Shad	Clupeidae	PYS	13	12.989
			Minnow	Cyprinidae	PYS	1	0.999
	NAPS_2_20170627_14	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	1	0.998
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	2	1.975
			Herrings and Shad	Clupeidae	PYS	41	40.496
		Near-bottom	Herrings and Shad	Clupeidae	PYS	5	4.989
	NAPS_2_20170627_20	Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.998
			Herrings and Shad	Clupeidae	PYS	7	6.988
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	6	5.975
			Gizzard Shads	*Dorosoma spp.*	PYS	3	2.987
			Herrings and Shad	Clupeidae	PYS	12	11.949
6/28/2017	NAPS_2_20170628_03	Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.997
			Herrings and Shad	Clupeidae	PYS	10	9.974
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	4	3.848
			Herrings and Shad	Clupeidae	PYS	13	12.507
7/11/2017	NAPS_2_20170711_09	Near-surface	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.979
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.992
			Gizzard Shads	*Dorosoma spp.*	PYS	18	17.850
			Herrings and Shad	Clupeidae	PYS	34	33.717
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	1	0.989
			Herrings and Shad	Clupeidae	PYS	11	10.875
	NAPS_2_20170711_15	Near-surface	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.977
			Threadfin Shad	*Dorosoma petenense*	PYS	1	0.977
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	2	1.987
			Gizzard Shads	*Dorosoma spp.*	PYS	10	9.934
			Herrings and Shad	Clupeidae	PYS	91	90.402
		Near-bottom	Gizzard Shads	*Dorosoma spp.*	PYS	4	3.970
			Herrings and Shad	Clupeidae	PYS	7	6.948
	NAPS_2_20170711_20	Near-surface	Herrings and Shad	Clupeidae	PYS	3	2.969
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	5	4.948
			Herrings and Shad	Clupeidae	PYS	12	11.875
		Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	2	1.991
			Common Sunfishes	*Lepomis spp.*	PYS	7	6.969
			Gizzard Shad	*Dorosoma cepedianum*	PYS	1	0.996
			Gizzard Shads	*Dorosoma spp.*	PYS	22	21.904
			Herrings and Shad	Clupeidae	PYS	32	31.860
			Threadfin Shad	*Dorosoma petenense*	PYS	6	5.974
7/12/2017	NAPS_2_20170712_03	Near-surface	Herrings and Shad	Clupeidae	PYS	1	0.984
		Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
			Gizzard Shad	*Dorosoma cepedianum*	Juv	1	0.997
			Gizzard Shads	*Dorosoma spp.*	PYS	2	1.993
			Herrings and Shad	Clupeidae	PYS	2	1.993
			Threadfin Shad	*Dorosoma petenense*	PYS	2	1.993
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	6	5.877
			Gizzard Shads	*Dorosoma spp.*	PYS	7	6.857
			Herrings and Shad	Clupeidae	PYS	18	17.631
7/25/2017	NAPS_2_20170725_09	Mid-depth	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
			Herrings and Shad	Clupeidae	PYS	2	1.994
	NAPS_2_20170725_14	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	2	1.989
			Gizzard Shads	*Dorosoma spp.*	PYS	2	1.989
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	5	4.958
			Herrings and Shad	Clupeidae	PYS	2	1.983
		Near-bottom	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.998
	NAPS_2_20170725_21	Near-surface	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.996
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	2	1.996
			Threadfin Shad	*Dorosoma petenense*	PYS	1	0.998
					Juv	1	0.998
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997
			Gizzard Shads	*Dorosoma spp.*	PYS	2	1.994

Sample Date	Sample ID	Stratum	Taxon	Scientific Name	Life Stage	Total Number of Organisms Caught	Density (#/100m^3)
			Herrings and Shad	Clupeidae	PYS	2	1.994
			Threadfin Shad	*Dorosoma petenense*	PYS	6	5.982
7/26/2017	NAPS_2_20170726_03	Near-surface	Threadfin Shad	*Dorosoma petenense*	PYS	1	0.994
		Mid-depth	Gizzard Shads	*Dorosoma spp.*	PYS	1	0.993
			Threadfin Shad	*Dorosoma petenense*	PYS	1	0.993
		Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	1	0.997
			Common Sunfishes	*Lepomis spp.*	PYS	3	2.992
			Gizzard Shads	*Dorosoma spp.*	PYS	2	1.995
			Herrings and Shad	Clupeidae	PYS	1	0.997
8/8/2017	NAPS_2_20170808_09	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	1	0.959
	NAPS_2_20170808_21	Near-bottom	Channel Catfish	*Ictalurus punctatus*	PYS	1	0.997
			Common Sunfishes	*Lepomis spp.*	PYS	2	1.993
			Gizzard Shads	*Dorosoma spp.*	PYS	1	0.997
8/9/2017	NAPS_2_20170809_03	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	2	1.992
8/22/2017	NAPS_2_20170822_15	Near-surface	Bluegill	*Lepomis macrochirus*	Juv	1	0.951
	NAPS_2_20170822_21	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	2	1.995
8/23/2017	NAPS_2_20170823_03	Near-surface	Common Sunfishes	*Lepomis spp.*	PYS	1	0.979
		Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	1	0.985
9/5/2017	NAPS_2_20170905_14	Near-bottom	Common Sunfishes	*Lepomis spp.*	PYS	1	0.997

Table B-1. Monthly Average Entrainment Density (#/100 m^3 or 0.0264 million gallons) at North Anna Power Station, 2016

Taxon	Scientific Name	Life Stage	Stratum	2016											
				Apr		May		Jun		Jul		Aug		Sep	
				Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables
Blueback Herring	*Alosa aestivalis*	Juv	Near-surface			0.116	0.116								
			Near-bottom			0.123	0.123								
			Mid-depth			0.371	0.371								
Bluegill	*Lepomis macrochirus*	Juv	Near-surface					0.123		0.118		0.248		0.243	
Channel Catfish	*Ictalurus punctatus*	PYS	Near-bottom							0.124	0.124	0.622	0.622		
Common Sunfishes	*Lepomis* spp.	PYS	Near-surface					0.916	0.916	0.597	0.597	0.249	0.249		
			Near-bottom					5.356	5.356	3.235	3.235	6.312	6.312	0.481	0.481
			Mid-depth			1.366	1.366	0.989	0.989	1.104	1.104	0.871	0.871		
		Juv	Near-surface									0.243	0.243		
			Near-bottom									0.119	0.119		
			Mid-depth									0.248	0.248		
Crappie	*Pomoxis* sp.	PYS	Mid-depth	0.121	0.121	0.359	0.359								
Darters	*Etheostoma* spp.	PYS	Near-bottom			0.246	0.246								
Gizzard Shad	*Dorosoma cepedianum*	YS	Near-bottom	0.118	0.118	0.999	0.999								
		PYS	Near-surface					0.122	0.122						
			Near-bottom					0.374	0.374	0.121	0.121				
			Mid-depth							0.248	0.248				
Threadfin/Gizzard Shad	*Dorosoma* spp.	PYS	Near-surface							0.123	0.123				
			Near-bottom					0.249	0.249	0.249	0.249	0.373	0.373		
			Mid-depth			0.248	0.248	0.248	0.248	0.119	0.119	0.247	0.247		
Golden Shiner	*Notemigonus crysoleucas*	PYS	Near-surface	0.112	0.112										
Herrings and Shad	Clupeidae	Egg	Near-bottom			0.124	0.124								
		YS	Mid-depth	0.995	0.995	0.746	0.746								
		PYS	Near-surface			0.125	0.125								
			Near-bottom			2.873	2.873	3.111	3.111	0.747	0.747				
			Mid-depth	1.470	1.470	4.576	4.576	2.066	2.066	8.578	8.578	0.124	0.124		
		UIDL	Near-surface			0.121	0.121								
			Near-bottom	0.365	0.365	0.622	0.622								
			Mid-depth	0.622	0.622	0.622	0.622								
Largemouth Bass	*Micropterus salmoides*	PYS	Near-surface			0.116	0.116								
		Juv	Near-surface			1.181	1.181	0.123	0.123						
Minnow	Cyprinidae	PYS	Mid-depth	0.121	0.121										
Sunfish	Centrarchidae	PYS	Near-surface							0.118	0.118				

Taxon	Scientific Name	Life Stage	Stratum	2016											
				Apr		May		Jun		Jul		Aug		Sep	
				Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables
			Mid-depth			0.120	0.120	0.125	0.125			0.125	0.125		
Threadfin Shad	*Dorosoma petenense*	PYS	Near-bottom							0.498	0.498				
			Mid-depth					0.123	0.123	0.248	0.248				
Unidentified Finfish	Unidentified	UIDL	Near-surface			0.116	0.116	0.339	0.339						
			Near-bottom	0.367	0.367			0.124	0.124						
			Mid-depth			0.244	0.244								
White Catfish	*Ameiurus catus*	PYS	Near-bottom							0.125	0.125				
White Perch	*Morone americana*	YS	Near-bottom	0.249	0.249										
			Mid-depth	0.119	0.119										
		PYS	Near-bottom	0.249	0.249	0.371	0.371								
			Mid-depth	1.953	1.953	0.244	0.244								
Yellow Perch	*Perca flavescens*	YS	Near-surface	0.112	0.112										
			Near-bottom	0.116	0.116										
			Mid-depth	0.370	0.370										
Depth Averaged Total				**2.486**	**2.486**	**5.343**	**5.343**	**4.796**	**4.755**	**5.450**	**5.411**	**3.260**	**3.178**	**0.241**	**0.160**
Near-surface Total				**0.224**	**0.224**	**1.774**	**1.774**	**1.623**	**1.500**	**0.956**	**0.838**	**0.740**	**0.492**	**0.243**	
Mid-depth Total				**5.771**	**5.771**	**8.897**	**8.897**	**3.550**	**3.550**	**10.296**	**10.296**	**1.615**	**1.615**		
Near-bottom Total				**1.463**	**1.463**	**5.359**	**5.359**	**9.214**	**9.214**	**5.099**	**5.099**	**7.426**	**7.426**	**0.481**	**0.481**

Note:

- Total Density = Unadjusted density for impingeables; Density w/o impingeables = density excluding organisms that would be retained in a sieve with a maximum opening dimension of 0.56 inches (14.2 millimeters [mm]) based on the regulatory definition of entrainment.
- The numbers reported in this table do not include non-viable eggs (NVE).
- YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

Table B-2. Monthly Average Entrainment Density (#/100 m^3 or 0.0264 million gallons) at North Anna Power Station, 2017

Taxon	Scientific Name	Life Stage	Stratum	2017													
				Mar		Apr		May		Jun		Jul		Aug		Sep	
				Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables
Blueback Herring	*Alosa aestivalis*	PYS	Mid-depth			0.246	0.246										
		Adult	Near-bottom					0.124									
Bluegill	*Lepomis macrochirus*	Juv	Near-surface											0.119			
Channel Catfish	*Ictalurus punctatus*	PYS	Near-bottom									0.374	0.374	0.125	0.125		
Common Sunfishes	*Lepomis spp.*	PYS	Near-surface					0.992	0.992	1.245	1.245	0.249	0.249	0.242	0.242		
			Near-bottom							1.353	1.353	2.228	2.228	0.871	0.871	0.249	0.249
			Mid-depth					0.125	0.125			0.622	0.622				
Darters	*Etheostoma* spp.	YS	Near-bottom			0.248	0.248										
Gizzard Shad	*Dorosoma cepedianum*	YS	Mid-depth					0.124	0.124								
		PYS	Near-bottom									0.124	0.124				
		Juv	Mid-depth									0.125	0.125				
Threadfin/Gizzard Shad	*Dorosoma* spp.	PYS	Near-surface									0.618	0.618				
			Near-bottom							0.373	0.373	4.715	4.715	0.125	0.125		
			Mid-depth							0.996	0.996	5.334	5.334				
Herrings and Shad	Clupeidae	Egg	Near-surface					0.618	0.618								
		YS	Near-surface					0.124	0.124								
		PYS	Near-surface					3.325	3.325			0.494	0.494				
			Near-bottom			1.606	1.606	2.980	2.980	4.305	4.305	8.788	8.788				
			Mid-depth	0.241	0.241	1.597	1.597	9.666	9.666	13.393	13.393	17.746	17.746				
		UIDL	Near-bottom			0.123	0.123										
			Mid-depth					0.249	0.249								
Largemouth Bass	*Micropterus salmoides*	Juv	Near-surface					0.245	0.245	0.125	0.125						
Minnow	Cyprinidae	PYS	Near-surface							0.125	0.125						
			Mid-depth							0.250	0.250						
Spottail Shiner	*Notropis hudsonius*	PYS	Near-surface			0.117	0.117										

Taxon	Scientific Name	Life Stage	Stratum	2017													
				Mar		Apr		May		Jun		Jul		Aug		Sep	
				Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables	Total Density	Density w/o Impingeables
Threadfin Shad	*Dorosoma petenense*	PYS	Near-surface									0.246	0.246				
			Near-bottom									1.494	1.494				
			Mid-depth									0.498	0.498				
		Juv	Mid-depth									0.125	0.125				
Unidentified Finfish	Unidentified	UIDL	Near-surface					0.366	0.366								
			Near-bottom	0.125	0.125												
			Mid-depth					0.119	0.119								
White Perch	*Morone americana*	YS	Near-surface			0.373	0.373										
			Near-bottom	0.124	0.124												
		PYS	Near-surface			0.621	0.621	0.246	0.246								
			Near-bottom	0.110	0.110	0.123	0.123	0.124	0.124								
			Mid-depth	0.124	0.124	0.366	0.366										
Yellow Perch	*Perca flavescens*	YS	Near-surface	0.120	0.120												
			Near-bottom			0.249	0.249										
			Mid-depth	0.124	0.124												
		PYS	Near-bottom	0.373	0.373												
Depth-Averaged Total				**0.447**	**0.447**	**1.889**	**1.889**	**6.476**	**6.435**	**7.388**	**7.388**	**14.593**	**14.593**	**0.494**	**0.454**	**0.083**	**0.083**
Near-surface Total				**0.120**	**0.120**	**1.111**	**1.111**	**5.916**	**5.916**	**1.494**	**1.494**	**1.607**	**1.607**	**0.361**	**0.242**		
Mid-depth Total				**0.490**	**0.490**	**2.208**	**2.208**	**10.283**	**10.283**	**14.639**	**14.639**	**24.448**	**24.448**				
Near-bottom Total				**0.732**	**0.732**	**2.349**	**2.349**	**3.228**	**3.104**	**6.031**	**6.031**	**17.723**	**17.723**	**1.120**	**1.120**	**0.249**	**0.249**

Note:

- Total Density = Unadjusted density for impingeables; Density w/o impingeables = density excluding organisms that would be retained in a sieve with a maximum opening dimension of 0.56 inches (14.2 millimeters [mm]) based on the regulatory definition of entrainment.
- The numbers reported in this table do not include non-viable eggs (NVE).
- YSL = Yolk Sac Larvae; PYSL = Post Yolk Sac Larvae; UIDL = Unidentified Life Stage Larvae; Juv = Juveniles

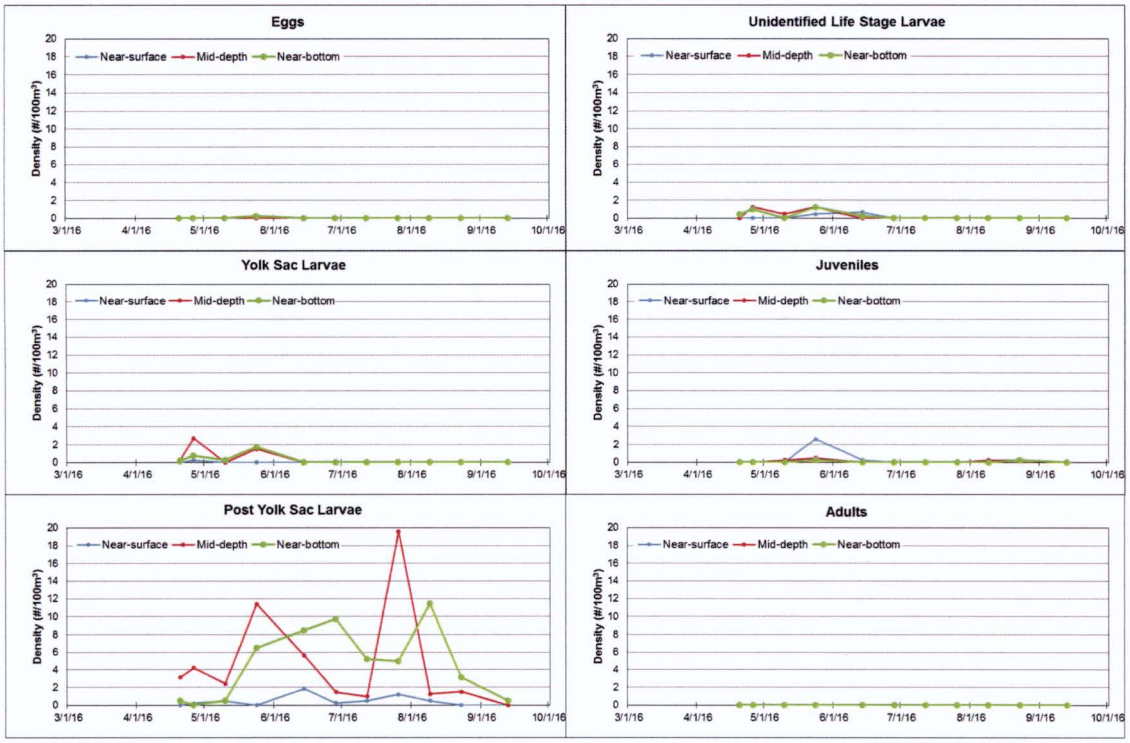


Figure B-1. Mean Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) of All Finfish by Life Stage and Sample Date at North Anna Power Station during 2016

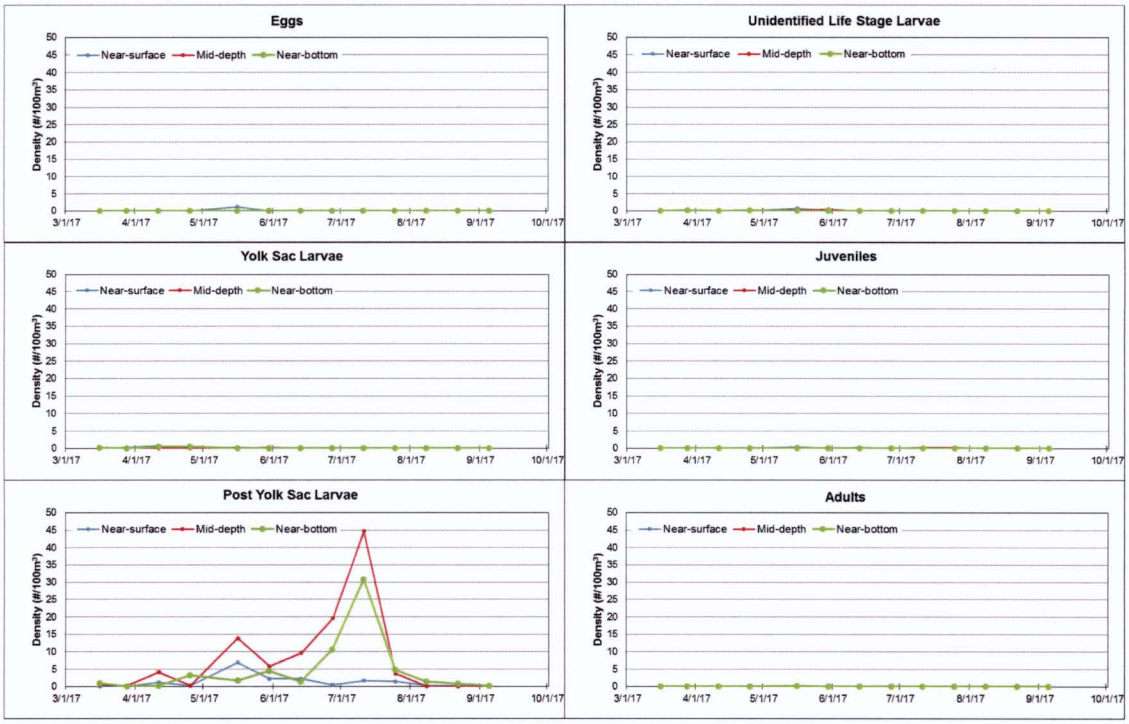


Figure B-2. Mean Baseline Entrainment Density (#/100 m^3 or 0.0264 million gallons) of All Finfish by Life Stage and Sample Date at North Anna Power Station during 2017

Appendix C

Morphometric Data and Length-Frequency Distribution Plots

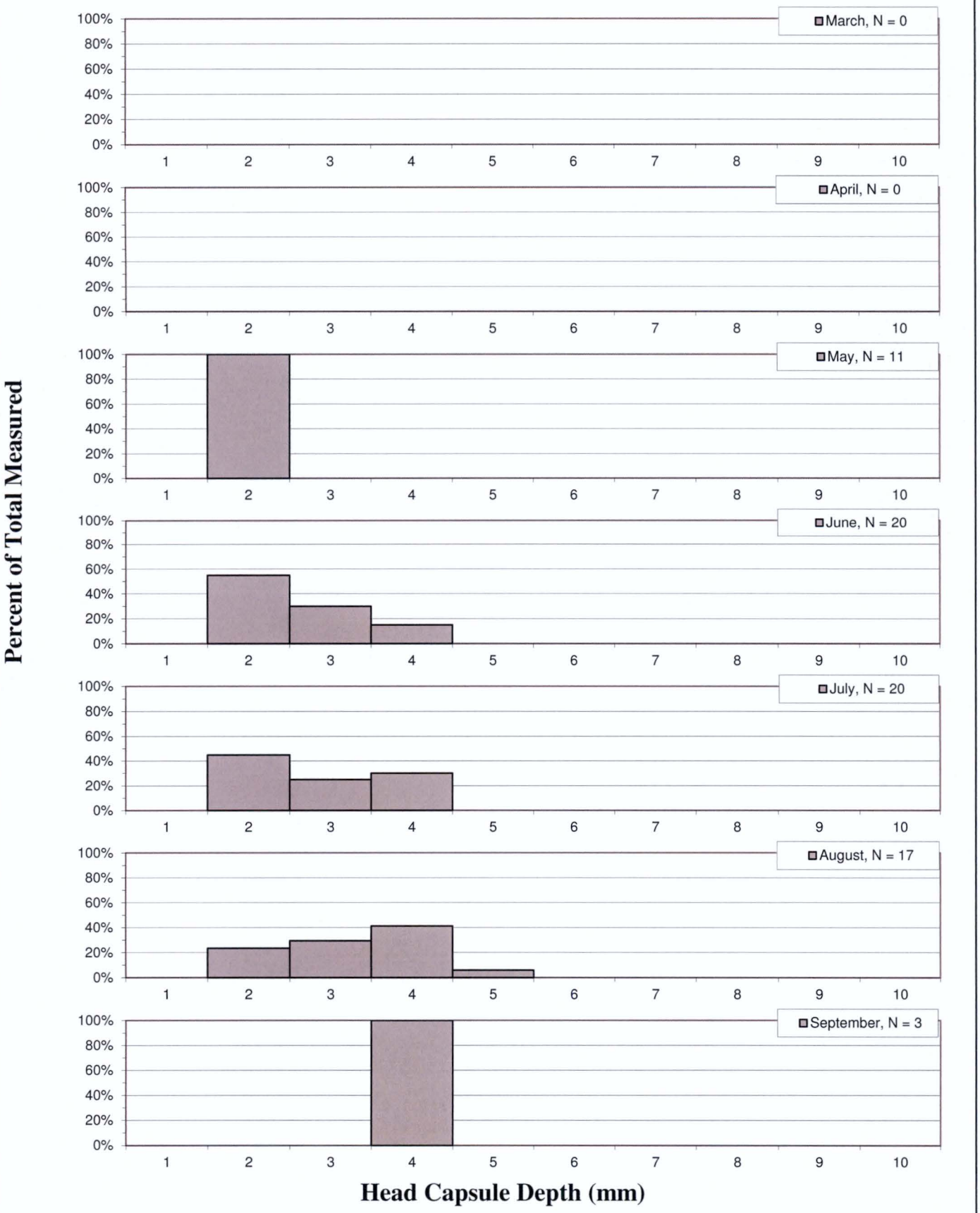
Table C. Morphometric Data by Sample

SampleID	Stratum	Taxon	Life Stage	Organism ID	Head Capsule Depth (mm)	Head Capsule Width (mm)	Body Depth (mm)	Body Width (mm)	Notochord Length (mm)	Total Lengh (mm)	Maximum Egg Diameter (mm)	Minimum Egg Diameter (mm)
NAPS_2_20160420_21	Mid-depth	Crappie	PYS	1	0.65	0.50	0.49		4.04	4.29		
		Minnow	PYS	1	0.79	0.70	0.69		5.62	5.78		
NAPS_2_20160421_09	Mid-depth	White Perch	PYS	1	0.58	0.30	0.50		3.49	3.72		
				2	0.49	0.40	0.55		4.02	4.22		
				3	0.60	0.30	0.52		3.79	3.91		
				4	0.65	0.30	0.55		3.96	4.12		
				5	0.58	0.30	0.52		3.64	3.91		
		Herrings and Shad	PYS	1	0.53	0.50	0.35		5.66	5.93		
				2	0.53	0.50	0.39		5.30	5.52		
				3	0.65	0.60	0.71		8.22	8.45		
NAPS_2_20160426_09	Mid-depth	White Perch	PYS	1	0.57	0.70	0.60		4.07	4.18		
				2	0.66	0.60	0.53		3.66	3.83		
				3	0.55	0.50	0.46		3.98	4.17		
		Herrings and Shad	PYS	1	0.53	0.60	0.48		6.16	6.30		
				2	0.52	0.60	0.53		6.83	6.92		
				3	0.62	0.60	0.55		7.71	7.85		
NAPS_2_20160426_14	Mid-depth	White Perch	PYS	4	0.65	0.70	0.49		3.97	4.05		
				5	0.58	0.60	0.51		3.95	4.21		
NAPS_2_20160426_21	Mid-depth	Yellow Perch	YS	1	1.04	1.00	1.08	0.90	5.70	5.94		
	Near-bottom	Yellow Perch	YS	2	0.96	1.10	1.22	1.00	5.67	5.83		
	Near-surface	Golden Shiner	PYS	1	0.82	1.10	0.52		5.80	6.12		
NAPS_2_20160427_03	Mid-depth	Yellow Perch	YS	3	0.89	0.80	0.71	0.60	5.06	5.33		
				4	1.05	0.90	0.93	0.70	5.21	5.40		
NAPS_2_20160510_09	Mid-depth	Crappie	PYS	1	0.85	0.60	0.40		4.52	4.69		
				2	0.74	0.80	0.55		4.10	4.21		
		White Perch	PYS	1	0.59	0.50	0.52		4.09	4.19		
		Herrings and Shad	PYS	2	0.47	0.60	0.46		6.53	6.76		
				3	0.31	0.40	0.32		4.85	5.13		
	Near-bottom	White Perch	PYS	2	0.55	0.50	0.55		3.71	3.93		
				3	0.64	0.60	0.55		3.57	3.80		
		Gizzard Shad	YS	1	0.34	0.40	0.44	0.30	4.04	4.26		
NAPS_2_20160510_21	Mid-depth	Herrings and Shad	PYS	4	0.75	0.40	0.78		9.28	9.54		
	Near-surface	Largemouth Bass	PYS	1	3.48	3.00	3.40		13.22	15.45		
NAPS_2_20160511_03	Mid-depth	Blueback Herring	Juv	1	2.00	2.00	3.00		19.00	22.00		
		Gizzard Shads	PYS	1	1.71	1.20	1.55		15.46	16.44		
	Near-surface	Herrings and Shad	PYS	1	0.58	0.40	0.49		6.37	6.43		
NAPS_2_20160524_09	Mid-depth	Herrings and Shad	PYS	1	0.45	0.50	0.32		5.23	5.32		
				2	0.43	0.50	0.32		4.86	4.94		
				3	0.50	0.60	0.51		7.11	7.14		
				4	0.55	0.50	0.34		5.42	5.55		
				5	0.43	0.40	0.33		4.69	4.78		
	Near-bottom	Gizzard Shad	YS	1	0.30	0.30	0.43	0.20	4.31	4.39		
				2	0.28	0.20	0.42	0.10	4.06	4.25		
				3	0.29	0.30	0.37	0.20	3.93	4.03		
				4	0.31	0.20	0.42	0.20	4.31	4.38		
				5	0.33	0.20	0.46	0.20	4.10	4.26		
	Near-surface	Blueback Herring	Juv	3	3.00	2.00	3.00		20.50	23.00		
NAPS_2_20160524_15	Mid-depth	White Perch	PYS	2	0.51	0.40	0.48		3.61	3.74		
	Near-bottom	Herrings and Shad	Egg	1							1.39	1.29
NAPS_2_20160524_20	Mid-depth	Blueback Herring	Juv	2	2.00	3.00	3.00		19.00	22.00		
		Common Sunfishes	PYS	1	0.82	0.90	0.53		5.13	5.30		
				2	0.92	1.10	0.82		5.68	5.95		
				3	0.82	0.90	0.63		5.19	5.36		
				4	0.76	0.80	0.62		5.16	5.28		
				5	0.98	1.00	0.82		5.65	5.85		
	Near-bottom	White Perch	PYS	1	2.41	2.00	1.83		10.79	11.99		
		Darters	PYS	1	0.94	1.00	0.58		5.44	5.63		
				2	1.06	1.10	0.75		6.16	6.38		
	Near-surface	Largemouth Bass	Juv	1	5.00	4.00	6.00		23.00	26.00		
				2	4.00	3.00	4.00		19.00	23.00		
				3	4.00	3.00	4.00		21.00	24.00		
				4	3.00	3.00	3.50		18.50	22.00		
				5	4.00	3.00	4.00		20.00	23.50		
NAPS_2_20160525_03	Mid-depth	Blueback Herring	Juv	4	1.50	2.00	2.00		17.50	20.00		
	Near-bottom	Blueback Herring	Juv	1	1.50	1.50	2.00		17.50	20.00		
NAPS_2_20160614_10	Near-surface	Common Sunfishes	PYS	1	0.90	0.70	0.86		5.55	5.73		
				2	1.09	1.10	0.84		5.90	6.10		
				3	1.13	0.80	0.85		6.04	6.26		
				4	0.99	1.00	0.71		5.61	5.98		
NAPS_2_20160614_15	Mid-depth	Herrings and Shad	PYS	1	1.19	1.30	1.01		12.60	12.85		
				2	0.93	1.00	0.98		10.21	10.51		
				3	0.93	1.10	0.86		10.66	11.02		
				4	1.06	1.20	0.91		10.53	11.02		
				5	1.65	1.50	1.61		15.02	16.63		
	Near-surface	Common Sunfishes	PYS	5	0.73	1.10	0.67		4.98	5.14		
NAPS_2_20160614_21	Near-bottom	Gizzard Shads	PYS	1	1.05	1.00	1.00		12.48	12.88		
	Near-surface	Largemouth Bass	Juv	1	4.50	3.50	5.00		22.00	25.00		
NAPS_2_20160628_09	Mid-depth	Common Sunfishes	PYS	2	1.11	0.90	0.88		6.30	6.46		
		Threadfin Shad	PYS	1	0.95	0.90	0.70		9.49	9.69		
NAPS_2_20160628_15	Near-surface	Gizzard Shad	PYS	1	1.92	2.10	2.16		16.74	18.74		
NAPS_2_20160628_21	Mid-depth	Common Sunfishes	PYS	1	2.29	1.90	1.93		10.57	12.33		
	Near-bottom	Gizzard Shad	PYS	3	2.50	2.00	3.00		19.50	22.00		
				4	2.00	2.00	3.00		19.00	21.00		
		Herrings and Shad	PYS	4	1.77	1.30	1.32		15.25	16.62		
				5	1.94	1.40	1.19		16.39	17.59		
NAPS_2_20160629_02	Mid-depth	Herrings and Shad	PYS	3	2.33	1.90	1.59		17.73	19.84		
	Near-bottom	Common Sunfishes	PYS	3	2.74	2.20	2.74		11.93	14.20		
				4	2.29	1.80	2.31		10.60	12.67		
				5	1.98	1.50	1.63		9.55	10.38		
		Gizzard Shad	PYS	2	2.47	1.90	2.44		18.05	20.52		
		Herrings and Shad	PYS	1	1.40	1.20	1.28		14.77	15.60		

SampleID	Stratum	Taxon	Life Stage	Organism ID	Head Capsule Depth (mm)	Head Capsule Width (mm)	Body Depth (mm)	Body Width (mm)	Notochord Length (mm)	Total Lengh (mm)	Maximum Egg Diameter (mm)	Minimum Egg Diameter (mm)
				2	1.76	1.70	1.41		17.03	17.40		
NAPS_2_20160712_09	Mid-depth	Gizzard Shad	PYS	3	1.22	1.30	0.96		12.75	13.51		
		Herrings and Shad	PYS	1	0.51	0.50	0.56		7.24	7.12		
	Near-bottom	Gizzard Shad	PYS	2	3.00	2.50	4.00		20.00	24.00		
	Near-surface	Bluegill	Juv	1	21.00	14.00	30.00		78.00	91.00		
NAPS_2_20160712_15	Mid-depth	Common Sunfishes	PYS	3	1.02	1.20	0.70		5.37	5.57		
		Gizzard Shad	PYS	1	3.00	2.00	3.00		20.00	23.50		
	Near-surface	Common Sunfishes	PYS	1	3.05	2.60	3.86		14.03	16.29		
				2	1.11	0.80	0.82		5.71	5.99		
NAPS_2_20160712_21	Near-bottom	Common Sunfishes	PYS	4	2.00	1.50	1.86		9.47	10.92		
				5	1.67	1.80	1.56		9.03	10.17		
		Gizzard Shads	PYS	1	2.30	2.10	1.91		17.09	19.26		
		Threadfin Shad	PYS	1	2.30	2.00	2.51		16.87	19.48		
		White Catfish	PYS	1	3.42	3.20	3.11		13.74	16.09		
		Herrings and Shad	PYS	2	0.72	0.70	0.57		7.66	7.85		
NAPS_2_20160713_03	Near-bottom	Herrings and Shad	PYS	3	1.25	1.10	0.91		11.00	11.88		
NAPS_2_20160726_10	Near-bottom	Herrings and Shad	PYS	2	0.69	0.70	0.71		9.14	9.27		
				3	0.63	0.70	0.63		7.78	7.88		
	Near-surface	Common Sunfishes	PYS	1	2.00	2.00	3.00		12.00	14.00		
				2	0.53	0.80	0.62		4.86	5.02		
				3	0.67	0.70	0.50		4.76	4.93		
NAPS_2_20160726_14	Mid-depth	Herrings and Shad	PYS	4	0.67	1.20	0.47		6.63	6.73		
				5	0.80	1.00	0.77		9.09	9.44		
NAPS_2_20160726_21	Mid-depth	Threadfin Shad	PYS	4	2.52	1.80	2.06		16.44	18.57		
				5	1.98	1.90	2.14		15.82	17.72		
	Near-bottom	Channel Catfish	PYS	1	3.22	3.00	3.30		14.39	16.91		
		Gizzard Shads	PYS	1	1.79	1.30	1.24		13.86	15.01		
		Threadfin Shad	PYS	1	3.00	2.00	4.00		18.00	22.00		
				2	2.21	2.00	2.47		15.91	18.44		
				3	2.19	1.90	2.14		15.76	18.16		
		Herrings and Shad	PYS	1	0.80	0.70	0.81		8.67	8.93		
	Near-surface	Gizzard Shads	PYS	2	1.21	2.00	0.90		13.39	14.32		
NAPS_2_20160727_03	Mid-depth	Common Sunfishes	PYS	4	2.78	2.00	2.39		11.06	13.24		
				5	2.43	1.70	2.33		10.64	12.66		
NAPS_2_20160809_09	Near-surface	Bluegill	Juv	1	20.00	13.00	29.00		74.00	91.00		
NAPS_2_20160809_15	Mid-depth	Common Sunfishes	PYS	3	2.69	1.10	2.61		11.53	13.81		
				4	1.31	2.30	1.13		7.23	7.43		
	Near-surface	Common Sunfishes	PYS	1	0.70	0.50	0.63		4.61	4.81		
				2	0.66	0.40	0.66		4.80	5.03		
NAPS_2_20160809_20	Mid-depth	Common Sunfishes	Juv	1	6.00	3.50	8.00		24.00	29.00		
	Near-bottom	Channel Catfish	PYS	2	3.36	3.60	3.29		14.00	16.71		
				3	2.61	3.20	2.69		13.80	16.73		
				4	2.90	3.20	2.90		13.58	16.18		
				5	3.16	3.10	2.79		13.58	16.34		
		Gizzard Shads	PYS	3	2.35	2.10	2.52		16.35	19.02		
				4	3.21	2.70	3.40		18.57	22.03		
				5	2.96	2.70	2.77		17.15	19.83		
	Near-surface	Common Sunfishes	Juv	2	8.00	4.50	11.00		30.00	36.00		
NAPS_2_20160810_03	Mid-depth	Gizzard Shads	PYS	1	2.11	1.50	1.79		14.19	16.09		
				2	1.42	1.00	1.22		12.10	13.55		
	Near-bottom	Common Sunfishes	PYS	5	2.39	2.10	2.31		10.40	12.34		
		Channel Catfish	PYS	1	3.31	3.00	2.92		14.18	16.69		
NAPS_2_20160823_09	Mid-depth	Common Sunfishes	PYS	5	3.02	2.20	3.52		12.26	15.18		
NAPS_2_20160823_15	Mid-depth	Common Sunfishes	PYS	1	1.59	1.40	1.16		7.99	8.22		
				2	1.25	0.90	1.03		6.74	6.99		
				3	1.67	1.30	1.40		8.17	9.29		
		Herrings and Shad	PYS	1	0.59	0.50	0.51		7.28	7.38		
NAPS_2_20160823_20	Mid-depth	Common Sunfishes	PYS	4	3.57	3.00	4.17		14.11	17.31		
			Juv	1	3.00	4.00	5.00		17.00	21.00		
NAPS_2_20160824_03	Near-bottom	Common Sunfishes	Juv	3	3.00	3.00	5.00		17.00	20.50		
	Near-surface	Common Sunfishes	Juv	2	9.00	5.00	12.00		30.00	37.50		
NAPS_2_20160913_15	Near-surface	Bluegill	Juv	1	9.00	8.00	17.00		46.00	55.00		
NAPS_2_20160914_03	Near-bottom	Common Sunfishes	PYS	1	3.00	3.00	5.00		16.00	19.00		
				2	3.09	2.70	3.20		11.85	14.50		
NAPS_2_20170316_15	Near-bottom	White Perch	PYS	1	0.64	0.50	0.49		3.77	3.82		
NAPS_2_20170316_21	Near-bottom	Yellow Perch	PYS	2	0.99	0.60	0.64		5.89	6.13		
NAPS_2_20170316_10	Near-bottom	White Perch	YS	1	0.45	0.40	0.50	0.30	3.97	4.08		
		Yellow Perch	PYS	1	0.99	0.40	0.76		6.73	7.03		
NAPS_2_20170329_03	Mid-depth	White Perch	PYS	1	0.65	0.60	0.50		4.14	4.26		
	Near-surface	Yellow Perch	YS	1	0.90	1.00	0.83	0.90	5.00	5.12		
NAPS_2_20170411_14	Mid-depth	Herrings and Shad	PYS	4	0.46	0.60	0.40		6.01	6.11		
				5	0.48	0.50	0.41		6.47	6.64		
	Near-surface	White Perch	PYS	1	0.66	0.50	0.58		4.30	4.42		
				2	0.71	0.40	0.60		4.16	4.31		
NAPS_2_20170411_21	Mid-depth	Blueback Herring	PYS	1	0.68	0.60	0.51		7.25	7.35		
	Near-bottom	Yellow Perch	YS	1	0.94	1.00	1.08	0.90	5.91	6.12		
				2	0.98	1.10	1.01	1.00	5.74	6.02		
	Near-surface	White Perch	PYS	3	0.82	0.40	0.56		4.20	4.30		
NAPS_2_20170411_10	Mid-depth	Blueback Herring	PYS	2	0.60	0.50	0.51		6.51	6.61		
NAPS_2_20170412_03	Mid-depth	White Perch	PYS	4	0.61	0.50	0.65		4.28	4.36		
		Herrings and Shad	PYS	2	0.47	0.50	0.39		5.73	5.80		
				3	0.37	0.50	0.40		5.28	5.29		
	Near-bottom	Herrings and Shad	PYS	1	0.56	0.60	0.48		7.90	7.95		
	Near-surface	White Perch	YS	1	0.65	0.60	0.56	0.60	3.50	3.72		
				2	0.52	0.70	0.50	0.70	3.09	3.25		
			PYS	5	0.52	0.60	0.52		3.96	4.12		
NAPS_2_20170425_15	Mid-depth	Herrings and Shad	PYS	1	0.37	0.40	0.31		5.05	5.12		
	Near-bottom	White Perch	PYS	1	0.77	0.70	0.71		4.78	4.96		
NAPS_2_20170425_21	Near-bottom	Darters	YS	1	0.92	1.00	1.00	1.00	5.21	5.33		
		Herrings and Shad	PYS	2	0.97	0.80	0.75		10.02	10.14		
				3	0.67	0.60	0.53		7.13	7.18		
	Near-surface	Spottail Shiner	PYS	1	0.83	0.90	0.72		5.57	5.93		
NAPS_2_20170516_09	Near-surface	Herrings and Shad	Egg	1							1.27	1.19

SampleID	Stratum	Taxon	Life Stage	Organism ID	Head Capsule Depth (mm)	Head Capsule Width (mm)	Body Depth (mm)	Body Width (mm)	Notochord Length (mm)	Total Lengh (mm)	Maximum Egg Diameter (mm)	Minimum Egg Diameter (mm)
				2							1.31	1.25
				3							1.27	1.26
				4							1.22	1.13
			YS	1	0.38	0.40	0.66	0.40	3.22	3.31		
NAPS_2_20170516_15	Near-bottom	White Perch	PYS	1	0.53	0.50	0.50		3.47	3.68		
	Near-surface	Common Sunfishes	PYS	1	1.14	1.20	1.07		6.82	7.06		
		White Perch	PYS	2	0.83	0.80	0.69		5.45	5.58		
		Herrings and Shad	Egg	5							1.29	1.28
NAPS_2_20170516_20	Mid-depth	Herrings and Shad	PYS	1	0.50	0.60	0.53		6.70	6.99		
				2	0.71	0.80	0.58		9.03	9.22		
				3	0.81	0.80	0.63		8.38	8.52		
				4	0.58	0.70	0.57		8.14	8.36		
				5	1.03	0.90	1.08		11.53	11.89		
	Near-surface	Largemouth Bass	Juv	1	5.00	4.00	7.00		27.50	31.00		
NAPS_2_20170517_03	Near-surface	Largemouth Bass	Juv	2	4.00	3.00	5.00		22.00	26.00		
NAPS_2_20170530_09	Near-bottom	Herrings and Shad	PYS	3	0.57	0.60	0.41		5.17	5.25		
				4	0.40	0.60	0.50		5.89	6.08		
				5	0.72	0.90	0.92		10.10	10.22		
	Near-surface	Common Sunfishes	PYS	2	1.07	0.90	0.91		5.98	6.13		
				3	1.00	0.60	0.72		5.21	5.39		
				4	0.78	0.70	0.75		5.03	5.36		
				5	0.85	0.80	0.85		5.46	5.53		
NAPS_2_20170531_02	Mid-depth	Common Sunfishes	PYS	1	0.59	0.80	0.80		6.65	6.85		
		Herrings and Shad	PYS	1	0.86	1.00	0.97		12.52	13.63		
				2	1.41	1.60	1.20		14.08	14.77		
NAPS_2_20170613_10	Near-surface	Common Sunfishes	PYS	1	0.72	0.40	0.71		5.20	5.25		
				2	0.71	0.40	0.52		4.95	5.01		
				3	0.60	0.40	0.61		4.76	4.86		
NAPS_2_20170613_15	Mid-depth	Herrings and Shad	PYS	1	0.59	0.30	0.56		7.14	7.37		
				2	0.83	0.50	0.84		9.40	9.65		
				3	0.78	0.40	0.60		8.80	9.14		
				4	1.03	0.60	0.91		10.30	10.69		
				5	0.68	0.40	0.62		8.57	8.89		
	Near-surface	Common Sunfishes	PYS	4	0.85	0.60	0.60		5.03	5.14		
				5	0.79	0.40	0.54		4.57	4.63		
NAPS_2_20170614_02	Mid-depth	Minnow	PYS	1	1.31	0.80	0.90		6.55	6.61		
		Gizzard Shads	PYS	1	2.00	1.00	2.38		17.06	18.68		
	Near-surface	Largemouth Bass	Juv	1	5.00	4.00	6.00		24.00	29.00		
NAPS_2_20170627_09	Mid-depth	Minnow	PYS	2	1.20	1.10	0.84		6.30	6.39		
		Gizzard Shads	PYS	3	0.71	0.70	0.81		8.32	8.52		
				4	0.63	0.60	0.65		7.10	7.28		
				5	2.07	1.50	1.54		15.06	16.32		
	Near-surface	Minnow	PYS	1	1.10	1.00	0.97		6.29	6.33		
NAPS_2_20170627_14	Mid-depth	Gizzard Shads	PYS	1	0.88	0.90	0.92		8.81	9.11		
				2	1.03	1.10	0.98		10.95	11.15		
		Herrings and Shad	PYS	5	0.50	0.50	0.38		5.14	5.26		
	Near-bottom	Herrings and Shad	PYS	1	0.64	1.00	0.60		6.87	7.00		
				2	0.90	0.90	0.70		10.30	10.44		
				3	0.72	0.90	0.69		8.54	8.69		
				4	2.47	2.10	1.78		18.91	20.10		
NAPS_2_20170627_20	Near-bottom	Common Sunfishes	PYS	1	2.85	2.30	2.73		11.54	13.79		
				2	2.60	2.00	2.69		11.09	13.33		
				3	1.87	1.90	1.97		9.16	10.59		
				4	2.32	1.80	2.22		10.53	11.82		
				5	2.05	1.70	1.76		9.48	10.79		
NAPS_2_20170711_09	Near-bottom	Common Sunfishes	PYS	1	0.81	0.50	0.60		5.12	5.26		
NAPS_2_20170711_15	Near-bottom	Gizzard Shads	PYS	1	0.74	0.80	0.60		7.89	7.98		
				2	0.74	0.70	0.61		8.29	8.40		
		Herrings and Shad	PYS	1	0.43	0.40	0.43		5.00	5.08		
				2	0.67	0.40	0.63		7.45	7.52		
				3	0.87	0.60	0.72		8.14	8.29		
				4	0.74	0.50	0.54		6.84	6.92		
				5	0.77	0.50	0.68		8.39	8.50		
NAPS_2_20170711_20	Mid-depth	Gizzard Shads	PYS	5	2.04	1.50	1.20		15.31	16.56		
	Near-bottom	Gizzard Shad	PYS	1	3.47	2.60	3.10		18.65	19.63		
		Channel Catfish	PYS	1	3.05	3.00	2.88		14.72	17.00		
				2	2.84	2.50	2.55		13.58	16.10		
		Threadfin Shad	PYS	3	2.24	1.50	2.20		15.94	17.72		
				4	2.55	1.50	2.59		16.69	18.39		
				5	2.53	1.70	2.61		17.16	18.74		
NAPS_2_20170712_03	Mid-depth	Common Sunfishes	PYS	2	1.36	1.00	1.32		8.11	8.78		
		Gizzard Shad	Juv	1	4.00	3.00	5.00		24.00	29.00		
		Gizzard Shads	PYS	3	1.52	1.50	1.49		13.36	13.95		
				4	1.25	1.30	1.26		13.06	13.68		
		Threadfin Shad	PYS	1	2.87	2.00	2.27		16.36	17.46		
				2	1.74	1.50	1.42		14.62	15.33		
	Near-bottom	Common Sunfishes	PYS	3	0.89	0.80	0.86		6.63	6.93		
				4	1.53	1.00	1.33		8.28	9.56		
				5	3.13	2.40	2.84		11.55	12.69		
NAPS_2_20170725_09	Mid-depth	Common Sunfishes	PYS	3	0.70	0.60	0.54		4.46	4.62		
		Herrings and Shad	PYS	2	0.37	0.50	0.35		5.13	5.25		
NAPS_2_20170725_14	Mid-depth	Gizzard Shads	PYS	5	1.83	1.50	1.59		15.46	16.64		
		Herrings and Shad	PYS	1	0.66	0.50	0.57		6.78	6.93		
	Near-bottom	Gizzard Shads	PYS	1	2.10	1.00	1.81		14.45	15.77		
	Near-surface	Common Sunfishes	PYS	5	0.66	0.50	0.63		4.54	4.71		
		Gizzard Shads	PYS	4	1.75	1.10	1.75		14.33	15.34		
NAPS_2_20170725_21	Mid-depth	Gizzard Shads	PYS	3	2.13	1.10	1.47		14.52	15.38		
		Threadfin Shad	PYS	3	2.57	1.50	2.02		16.40	17.92		
			Juv	1	4.00	3.00	5.00		23.00	26.00		
	Near-bottom	Common Sunfishes	PYS	4	2.58	1.50	2.71		10.80	12.11		
		Threadfin Shad	PYS	4	2.76	2.20	2.46		17.56	16.72		
				5	2.65	2.40	2.46		16.62	17.31		
		Herrings and Shad	PYS	3	0.76	0.40	0.75		8.83	9.06		

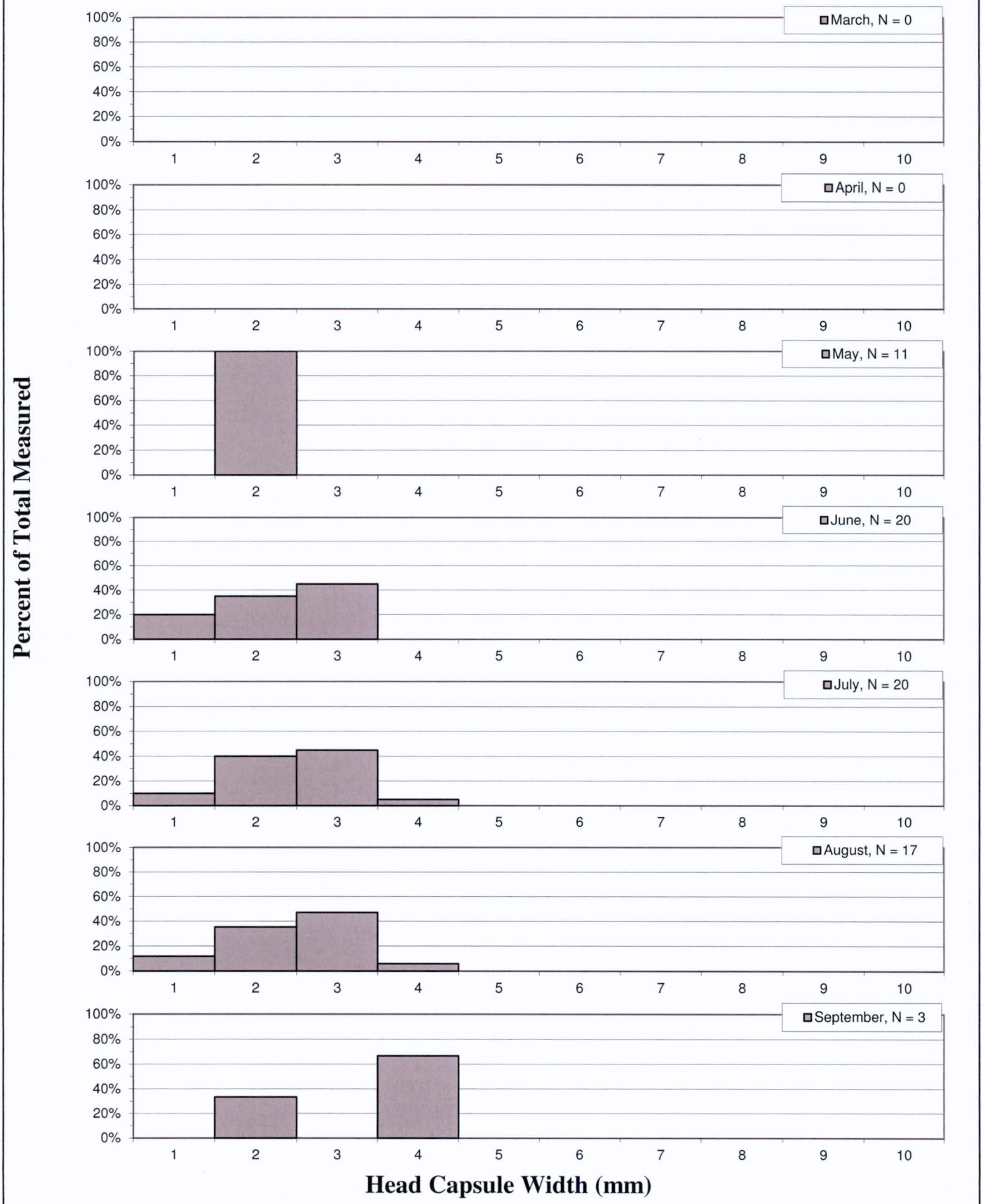
SampleID	Stratum	Taxon	Life Stage	Organism ID	Head Capsule Depth (mm)	Head Capsule Width (mm)	Body Depth (mm)	Body Width (mm)	Notochord Length (mm)	Total Lengh (mm)	Maximum Egg Diameter (mm)	Minimum Egg Diameter (mm)
NAPS_2_20170726_03	Mid-depth	Gizzard Shads	PYS	2	1.54	1.20	1.44		15.89	17.64		
		Threadfin Shad	PYS	2	2.85	1.50	2.54		17.26	18.43		
	Near-bottom	Common Sunfishes	PYS	1	2.51	1.50	2.75		10.53	11.96		
				2	2.53	1.50	2.32		9.85	10.93		
		Channel Catfish	PYS	1	2.81	3.00	2.51		13.83	15.31		
	Near-surface	Threadfin Shad	PYS	1	2.98	1.70	3.21		18.26	19.44		
NAPS_2_20170808_21	Near-bottom	Common Sunfishes	PYS	1	3.29	2.20	3.91		14.12	15.86		
				2	2.95	1.80	2.70		11.72	12.56		
		Channel Catfish	PYS	1	2.93	2.50	2.76		13.79	16.01		
		Gizzard Shads	PYS	1	1.78	1.00	1.39		14.02	14.91		
NAPS_2_20170809_03	Near-bottom	Common Sunfishes	PYS	3	2.20	1.30	2.11		9.74	10.46		
				4	3.37	2.00	3.01		12.39	13.38		
NAPS_2_20170822_15	Near-surface	Bluegill	Juv	1	20.00	13.00	29.00		60.00	75.00		
NAPS_2_20170822_21	Near-bottom	Common Sunfishes	PYS	2	3.21	1.90	3.52		14.15	15.77		
				3	2.34	1.20	2.29		10.87	11.80		
NAPS_2_20170823_03	Near-bottom	Common Sunfishes	PYS	1	3.39	2.00	3.57		14.18	15.97		
NAPS_2_20170905_14	Near-bottom	Common Sunfishes	PYS	1	2.54	1.30	2.89		11.26	12.17		



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Common Sunfishes**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

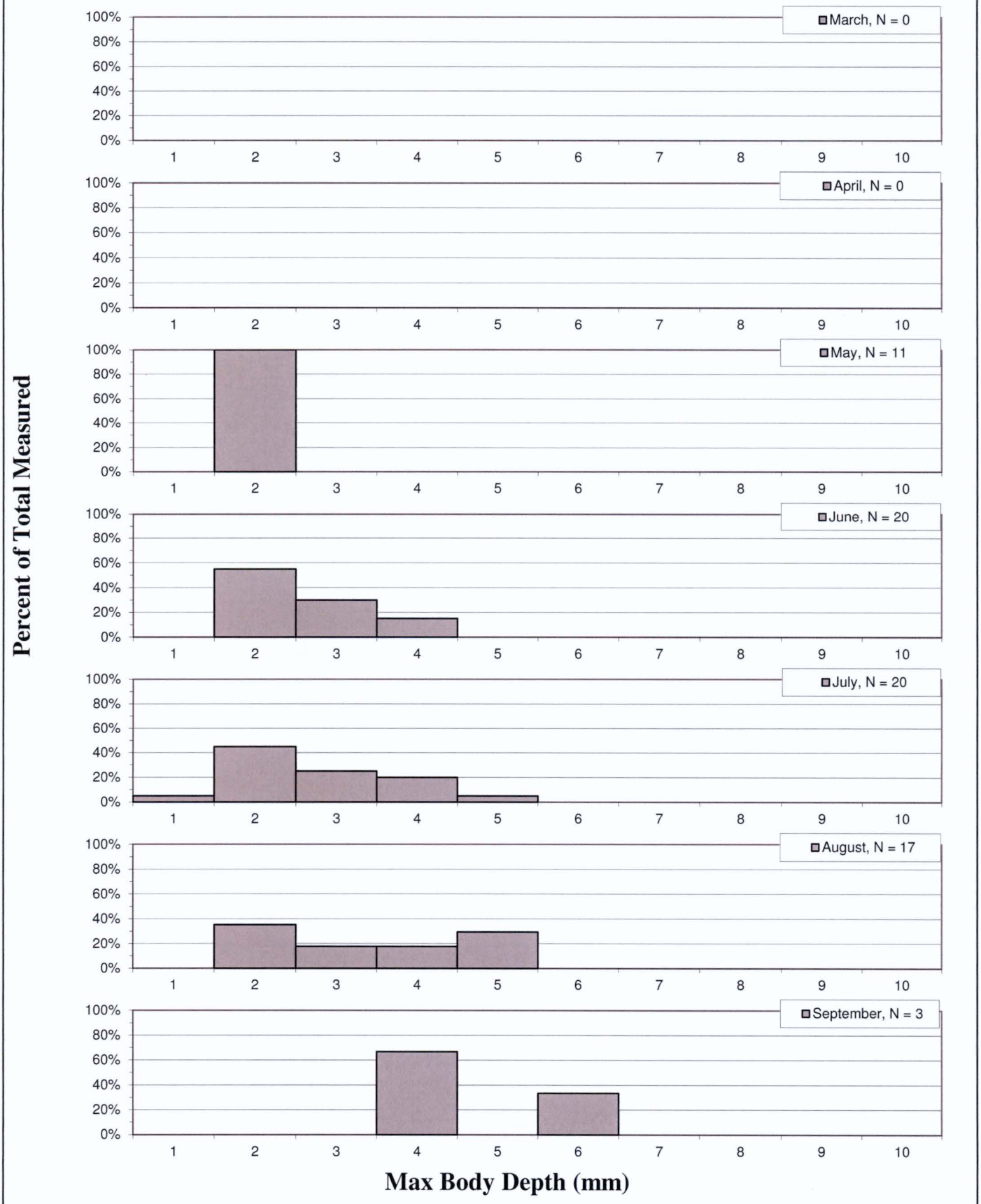
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Common Sunfishes_PYS_Head Capsule Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Common Sunfishes**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

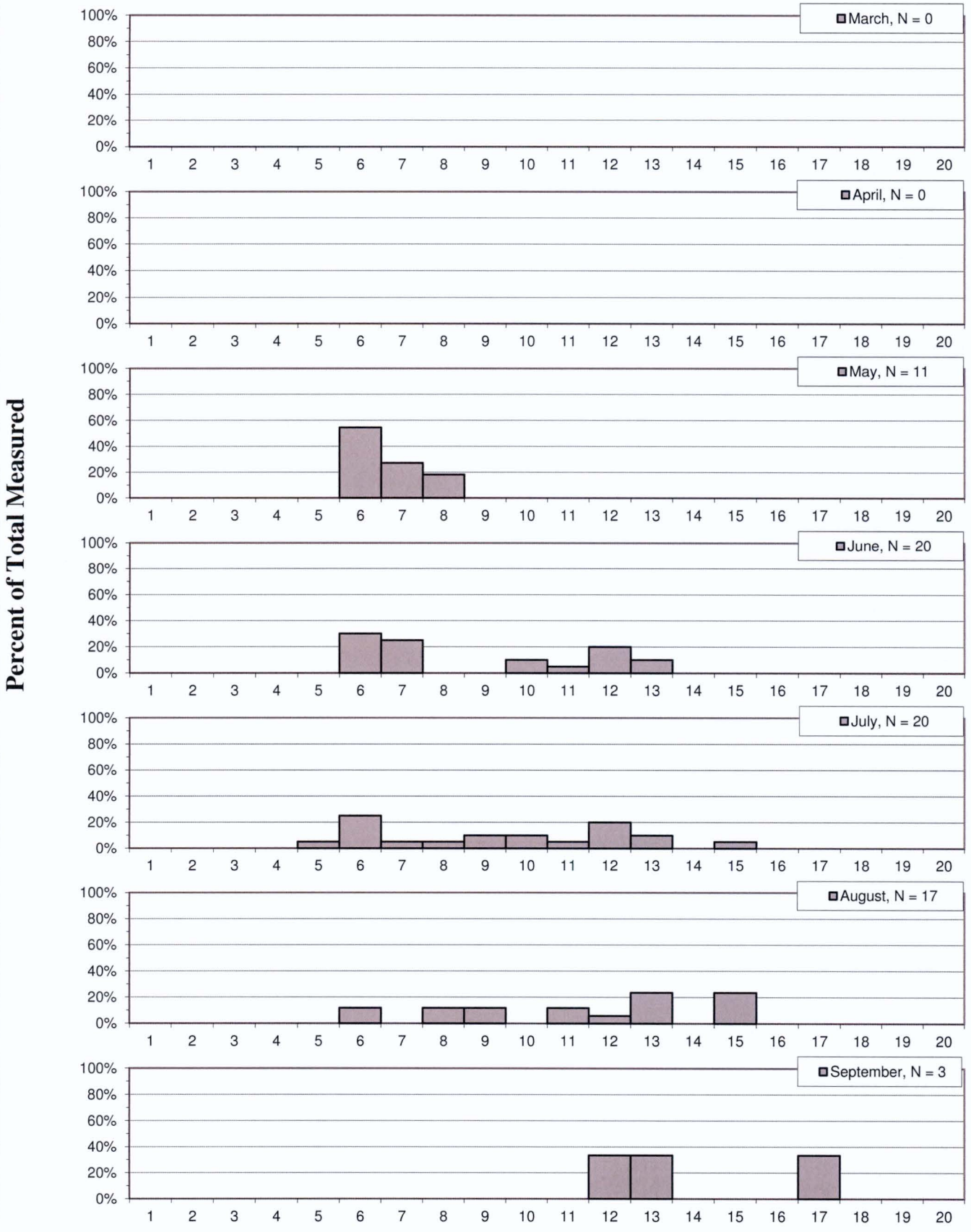
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Common Sunfishes_PYS_Head Capsule Width_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Common Sunfishes**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

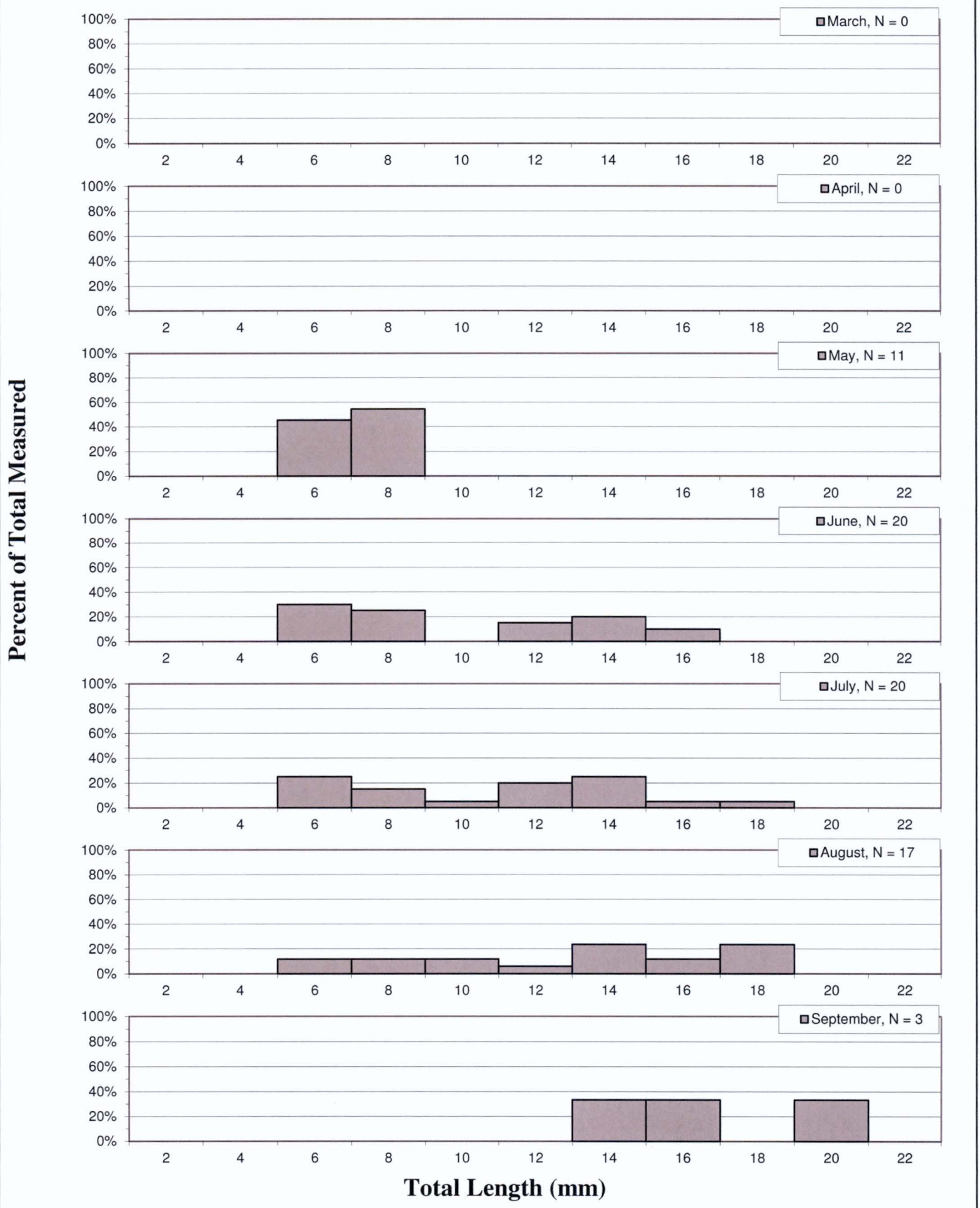
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Common Sunfishes_PYS_Max Body Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Common Sunfishes**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

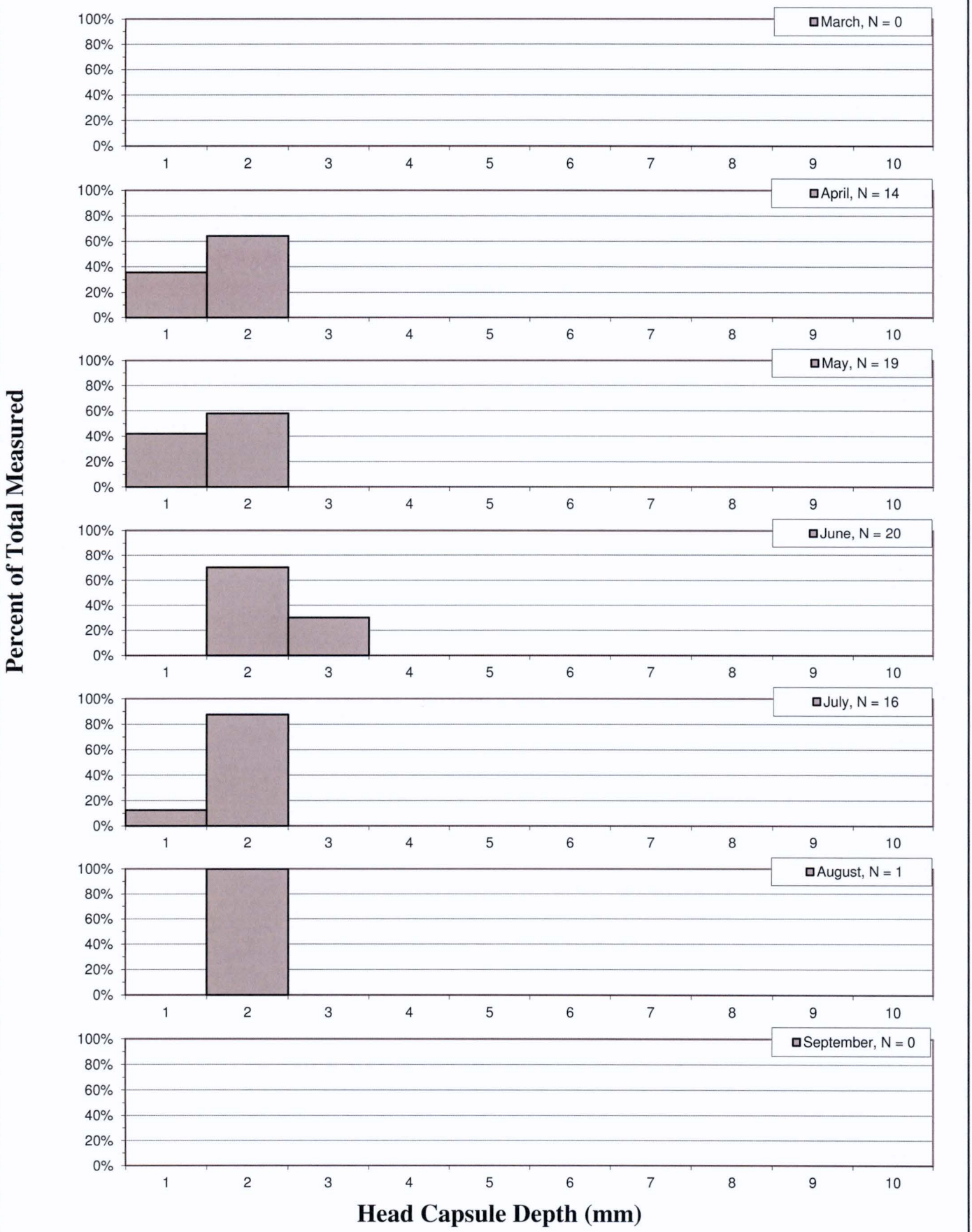
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Common Sunfishes_PYS_Notochord Length_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Common Sunfishes**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

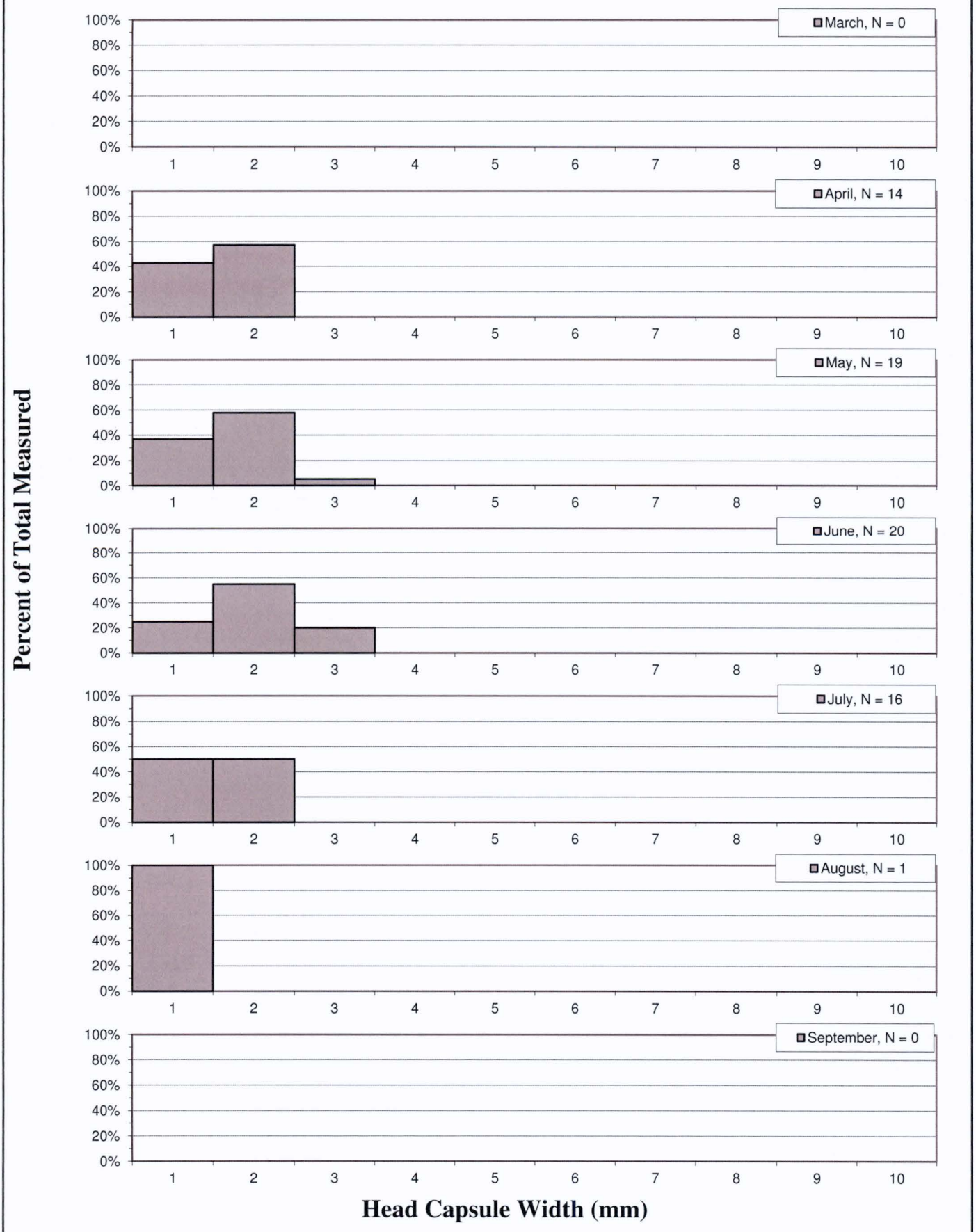
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Common Sunfishes_PYS_Total Length_2mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Herrings and Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

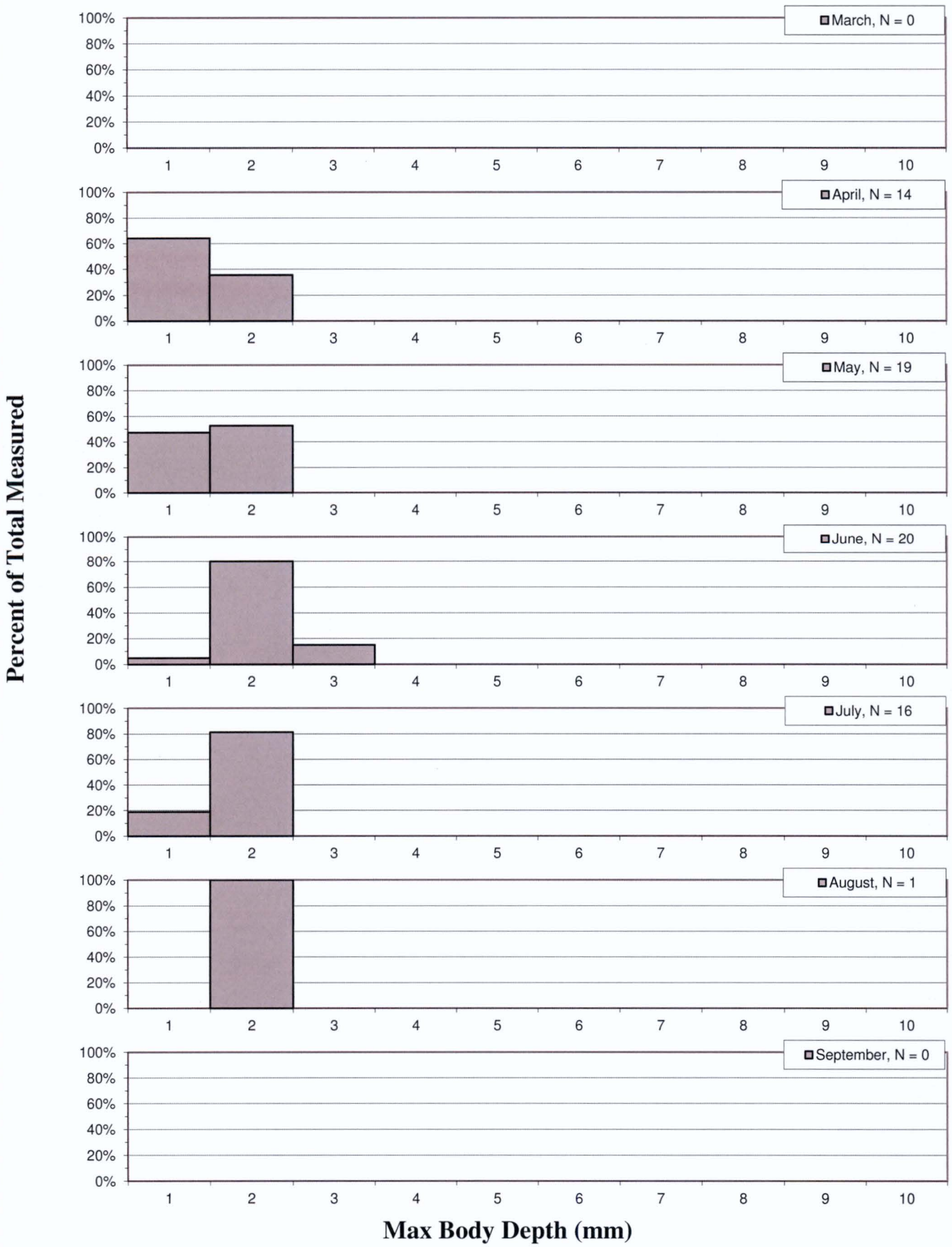
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Herrings_PYS_Head Capsule Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Herrings and Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

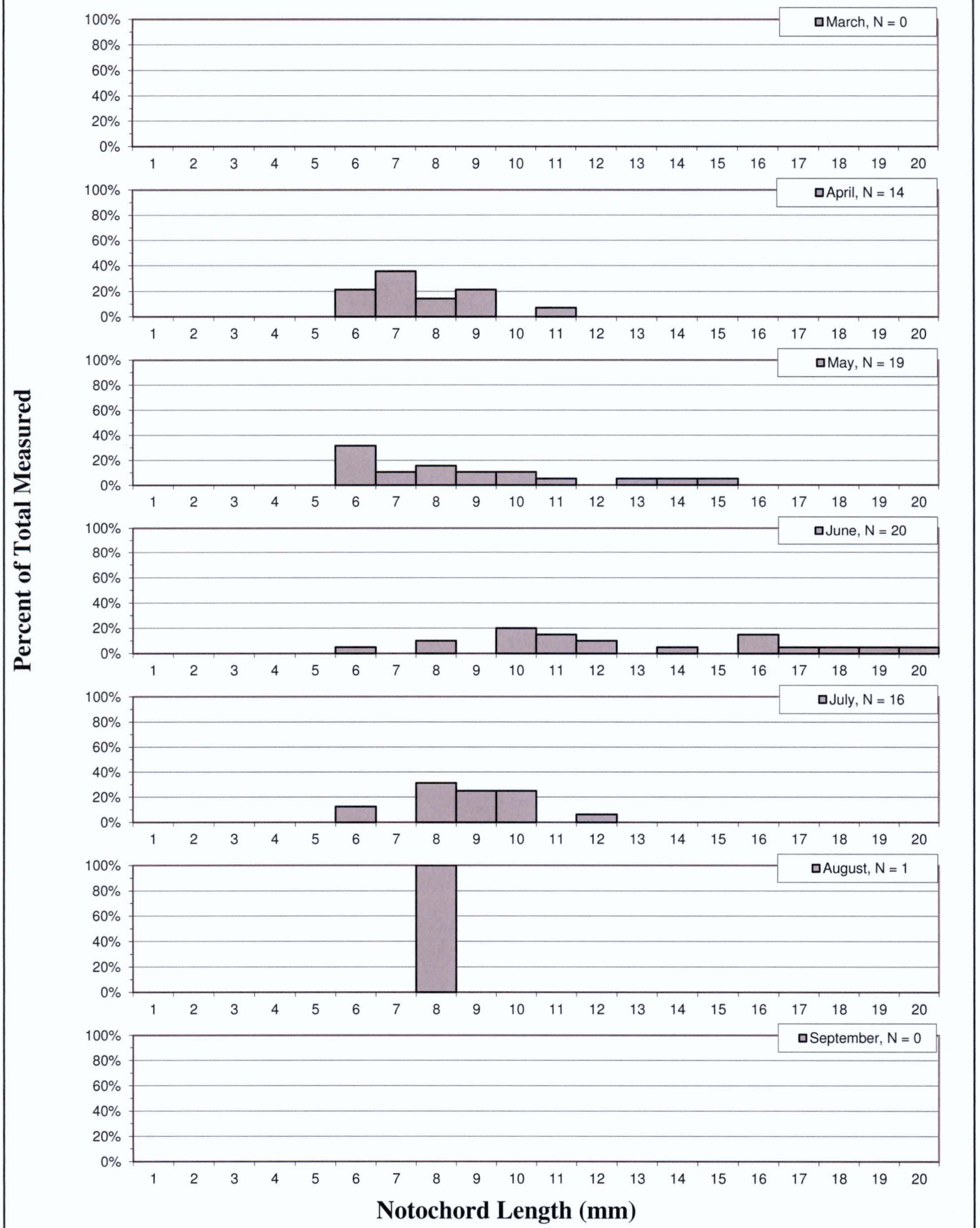
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Herrings_PYS_Head Capsule Width_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Herrings and Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

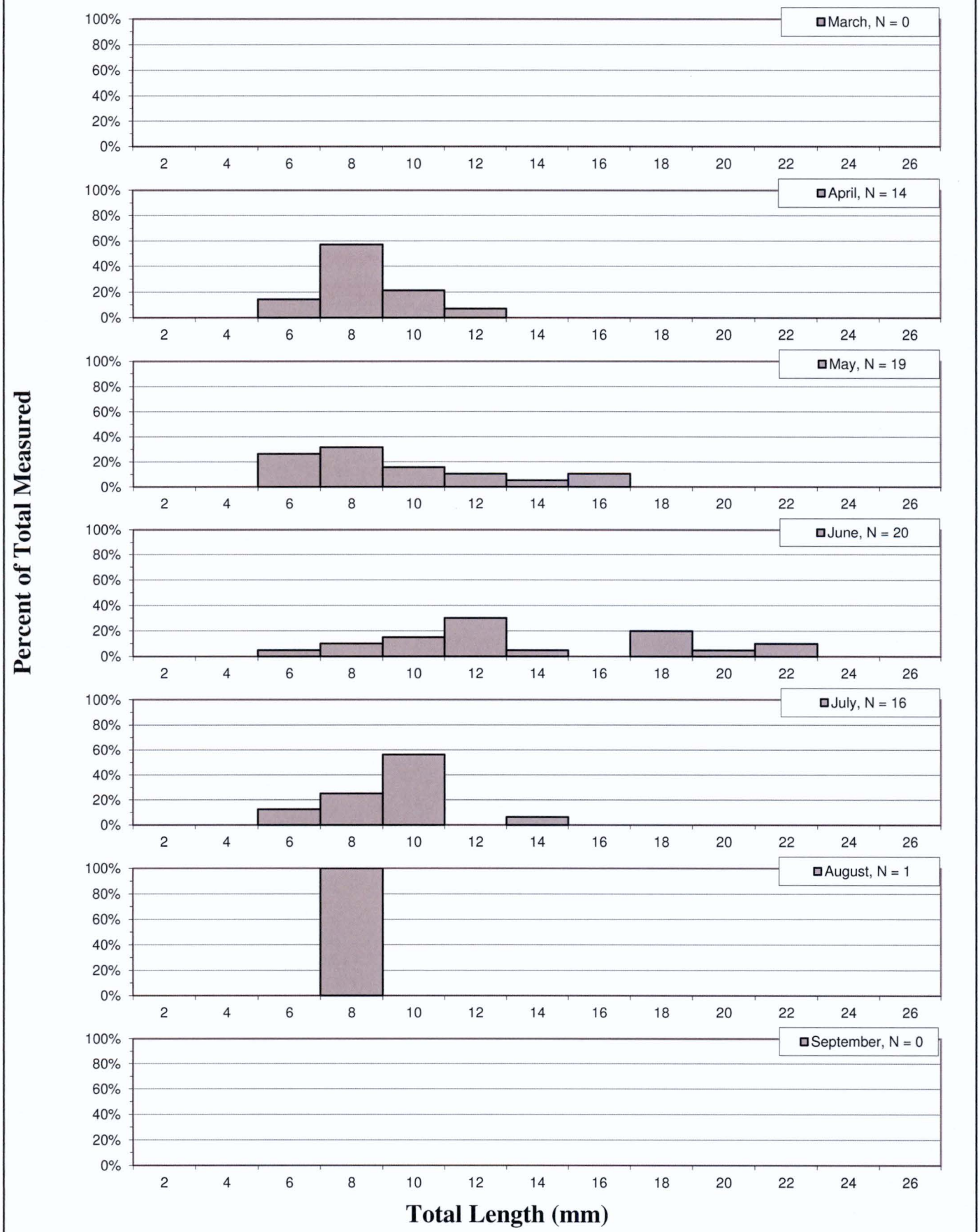
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Herrings_PYS_Max Body Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Herrings and Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

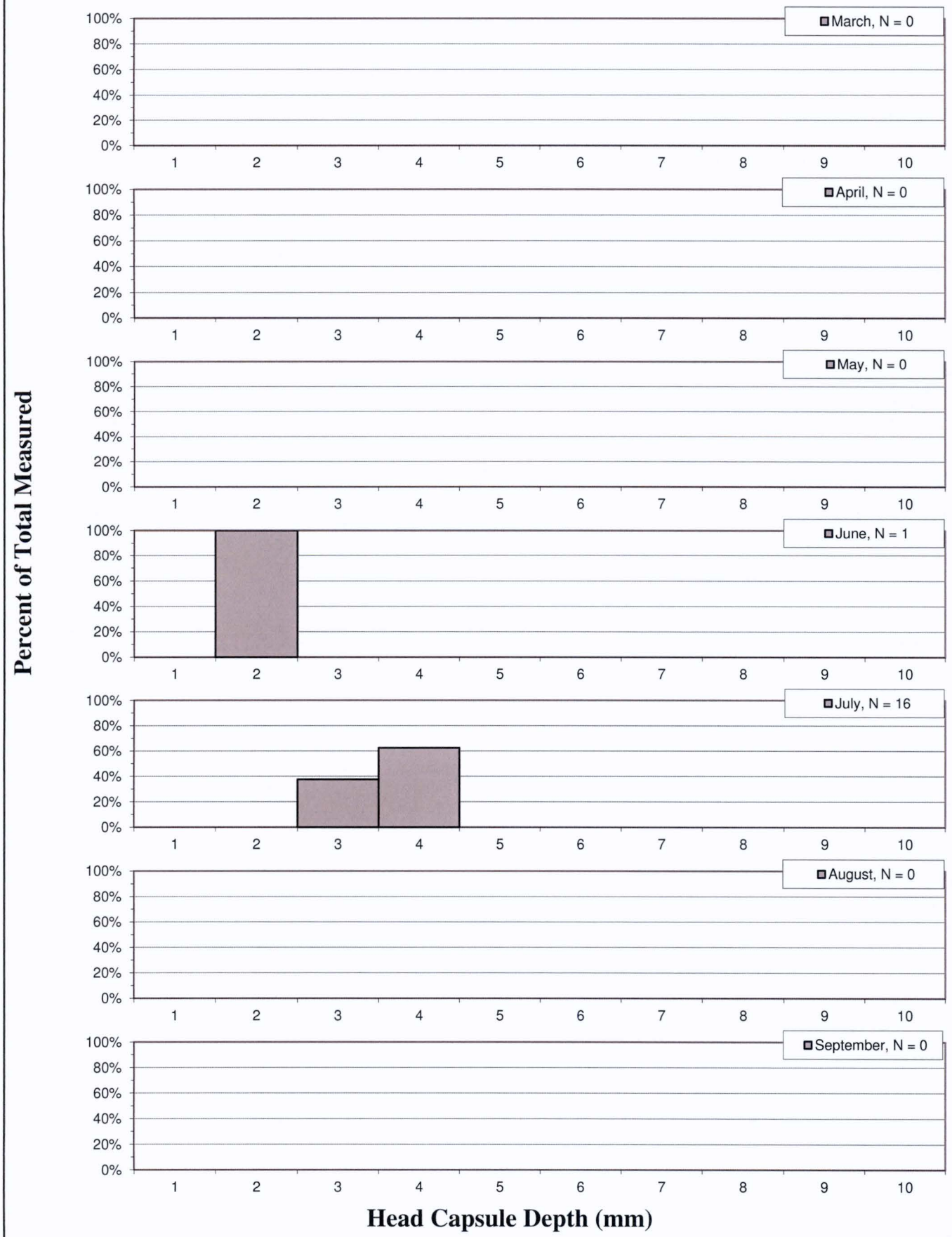
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Herrings_PYS_Notochord Length_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Herrings and Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

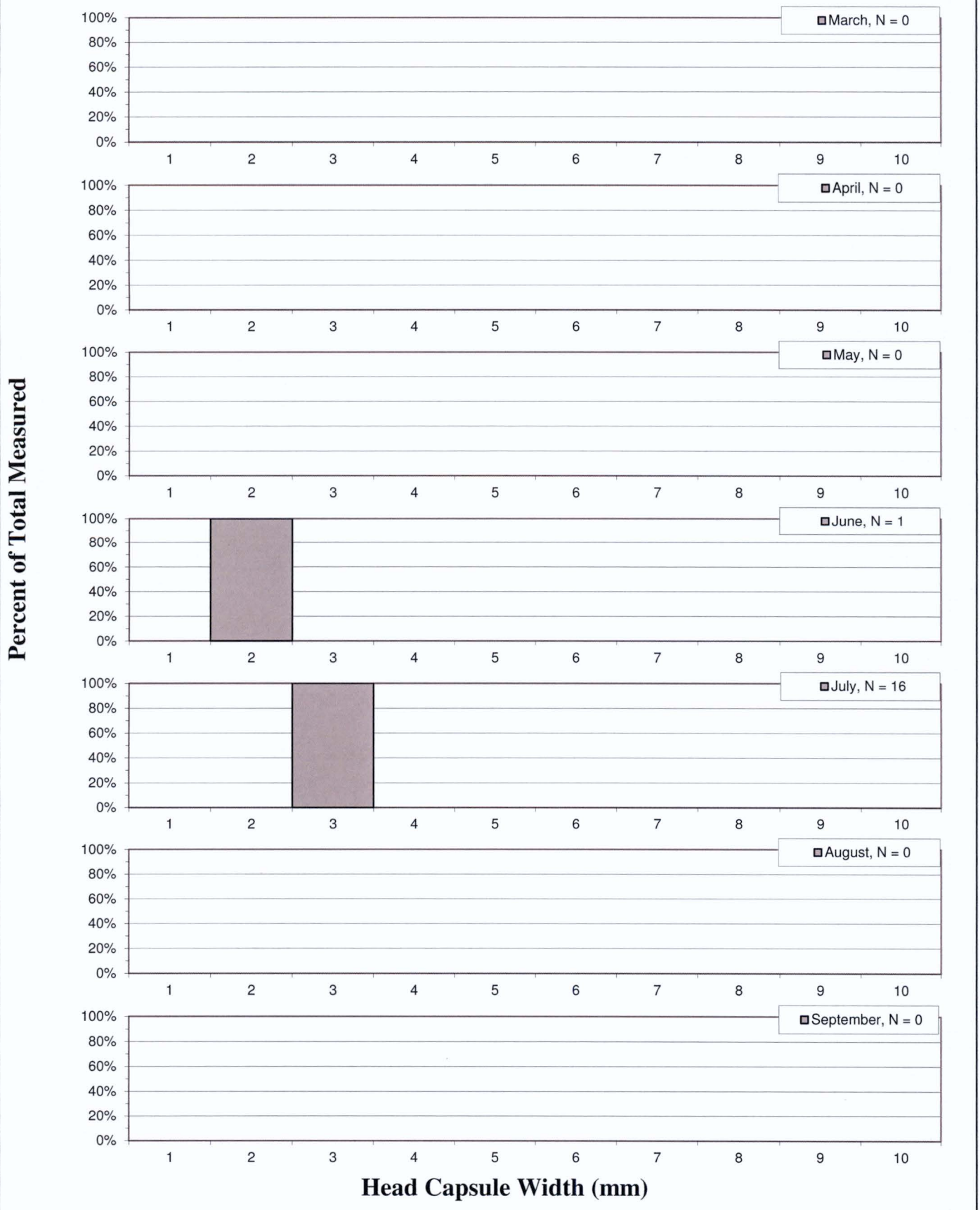
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Herrings_PYS_Total Length_2mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

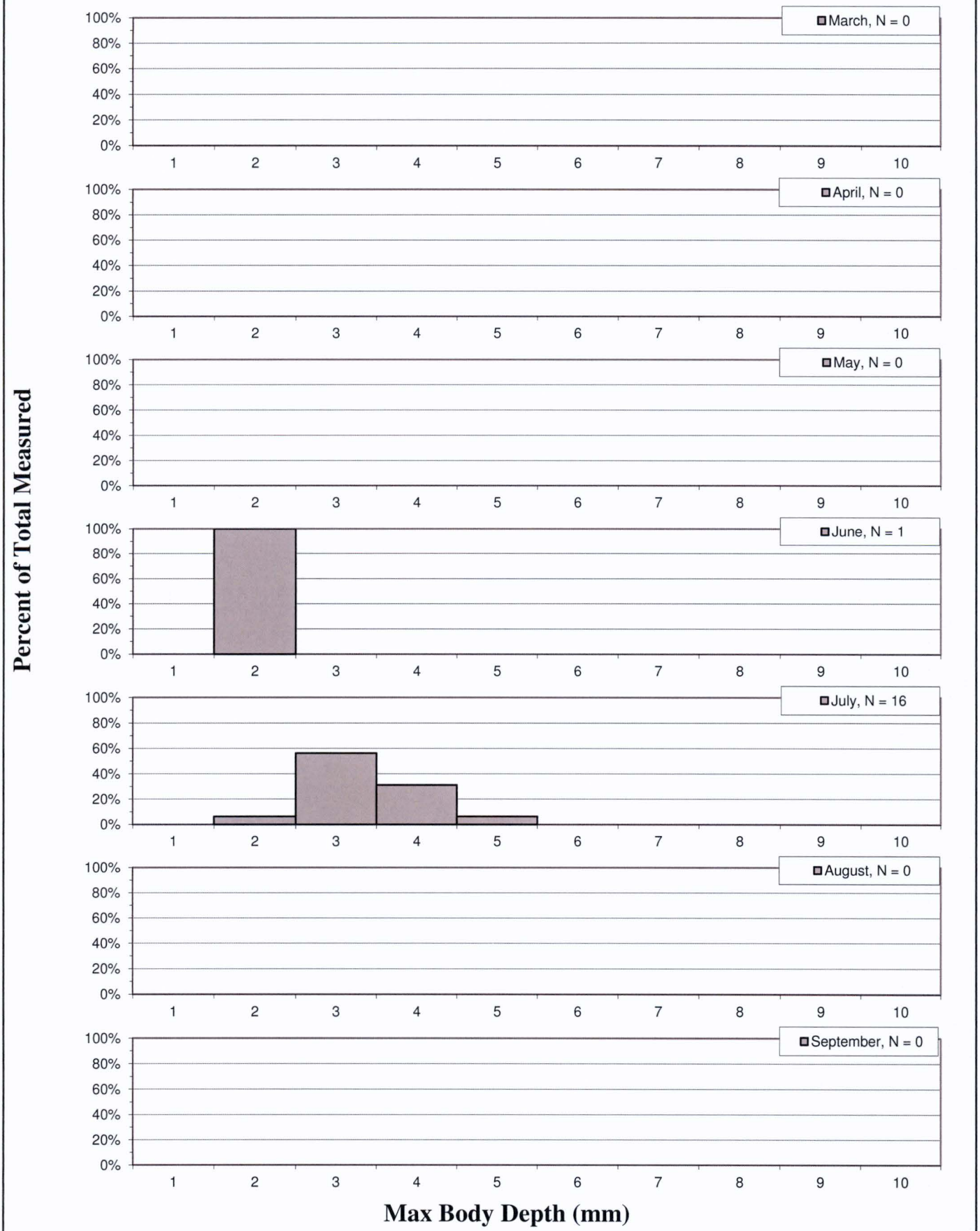
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Threadfin Shad_PYS_Head Capsule Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

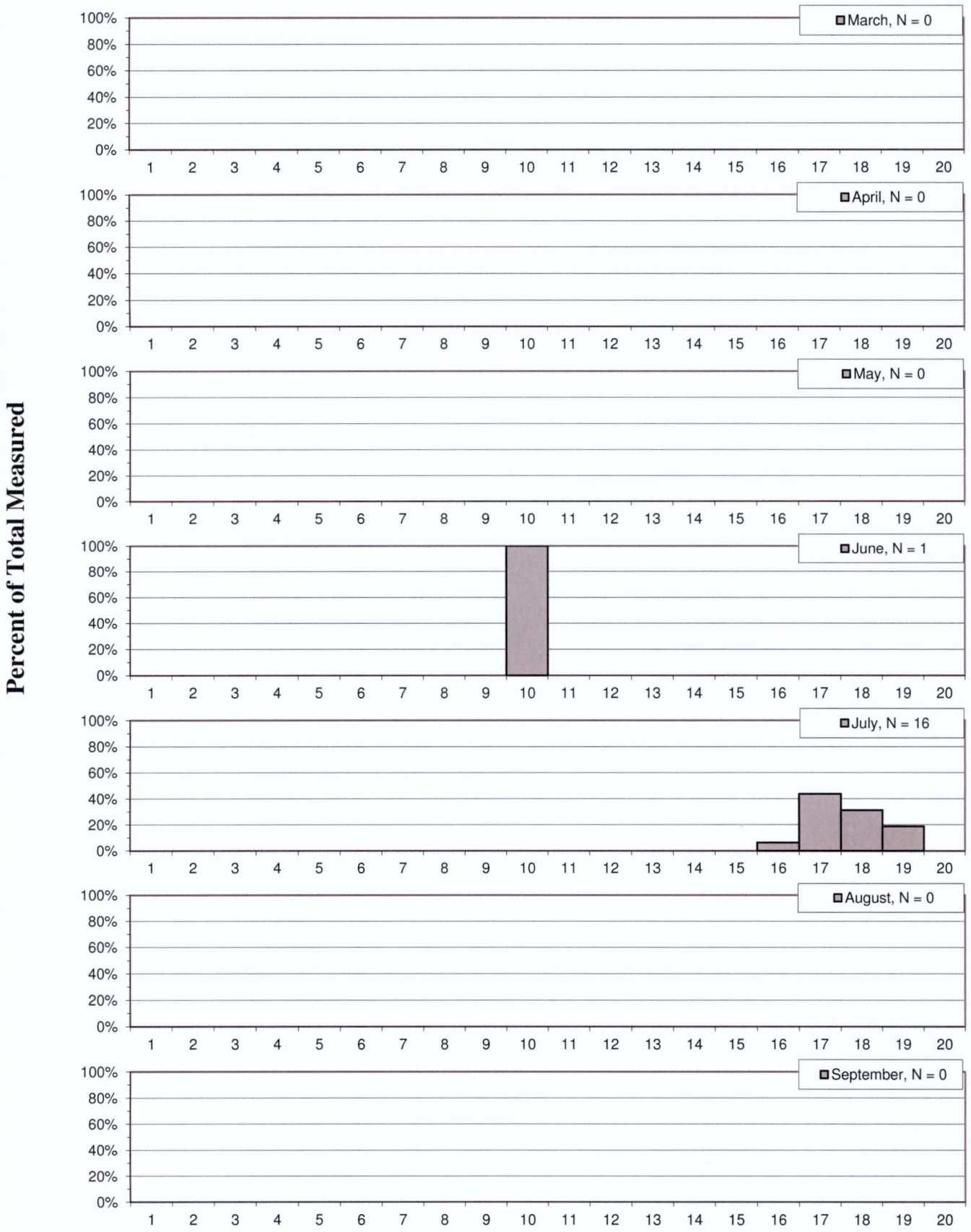
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Threadfin Shad_PYS_Head Capsule Width_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

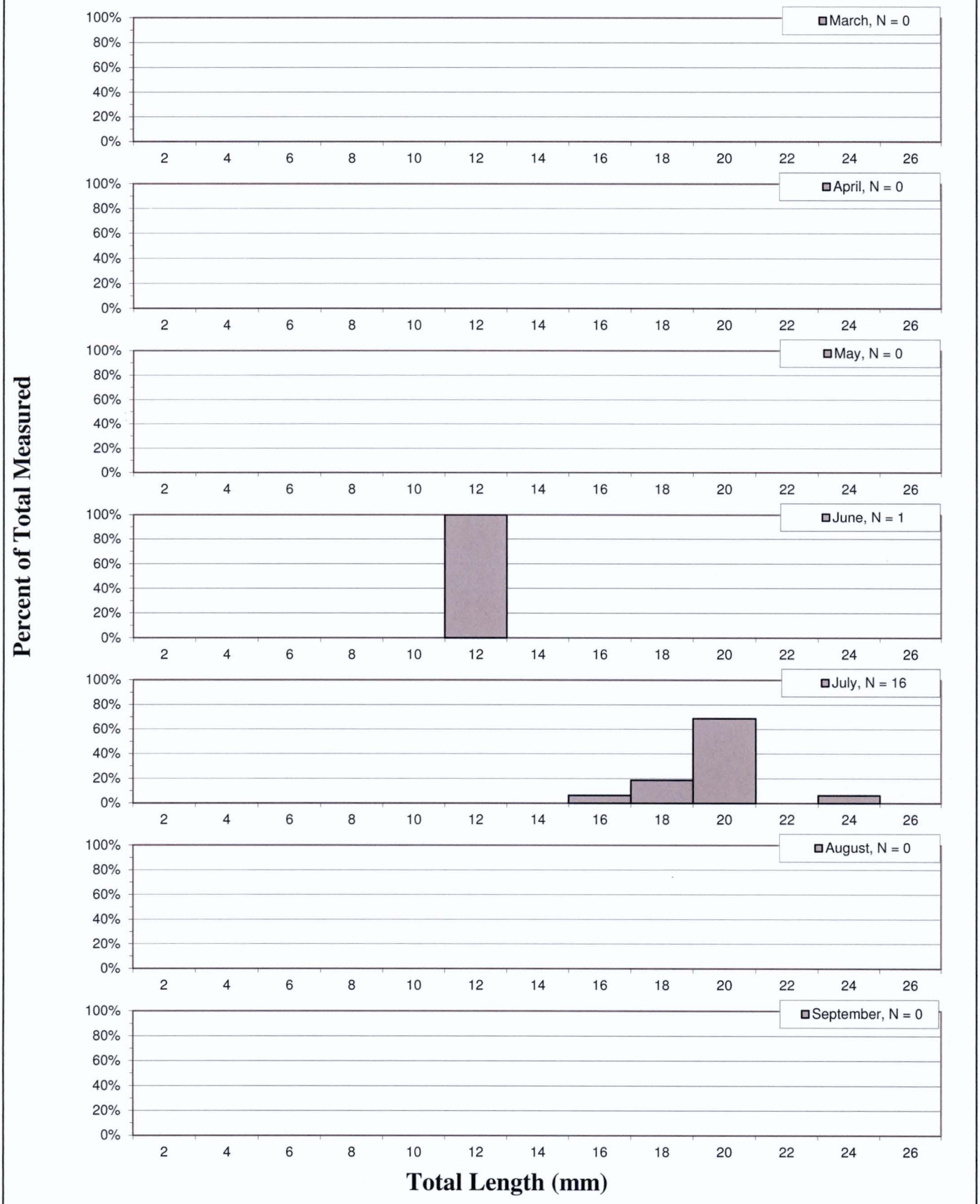
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Threadfin Shad_PYS_Max Body Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

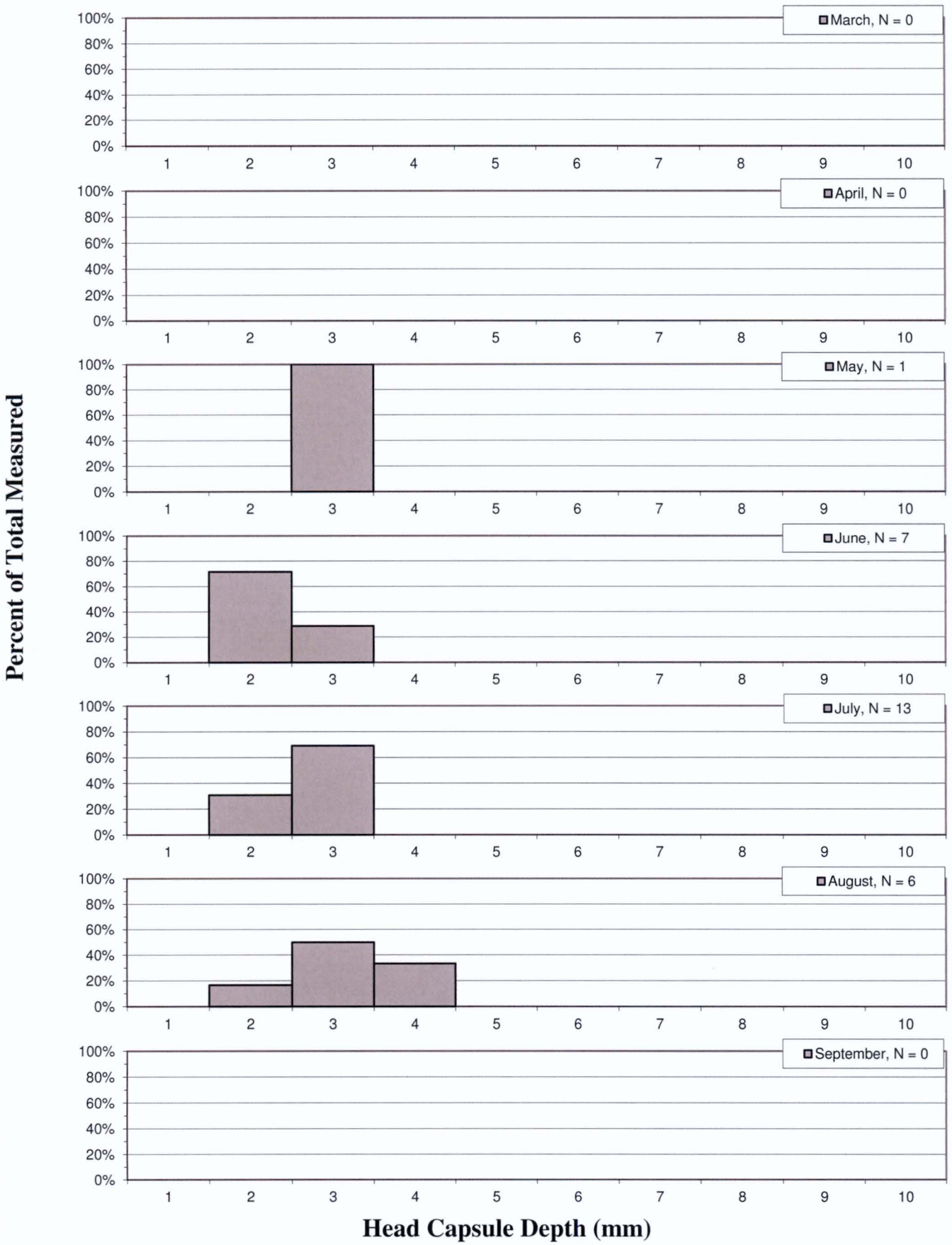
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Threadfin Shad_PYS_Notochord Length_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

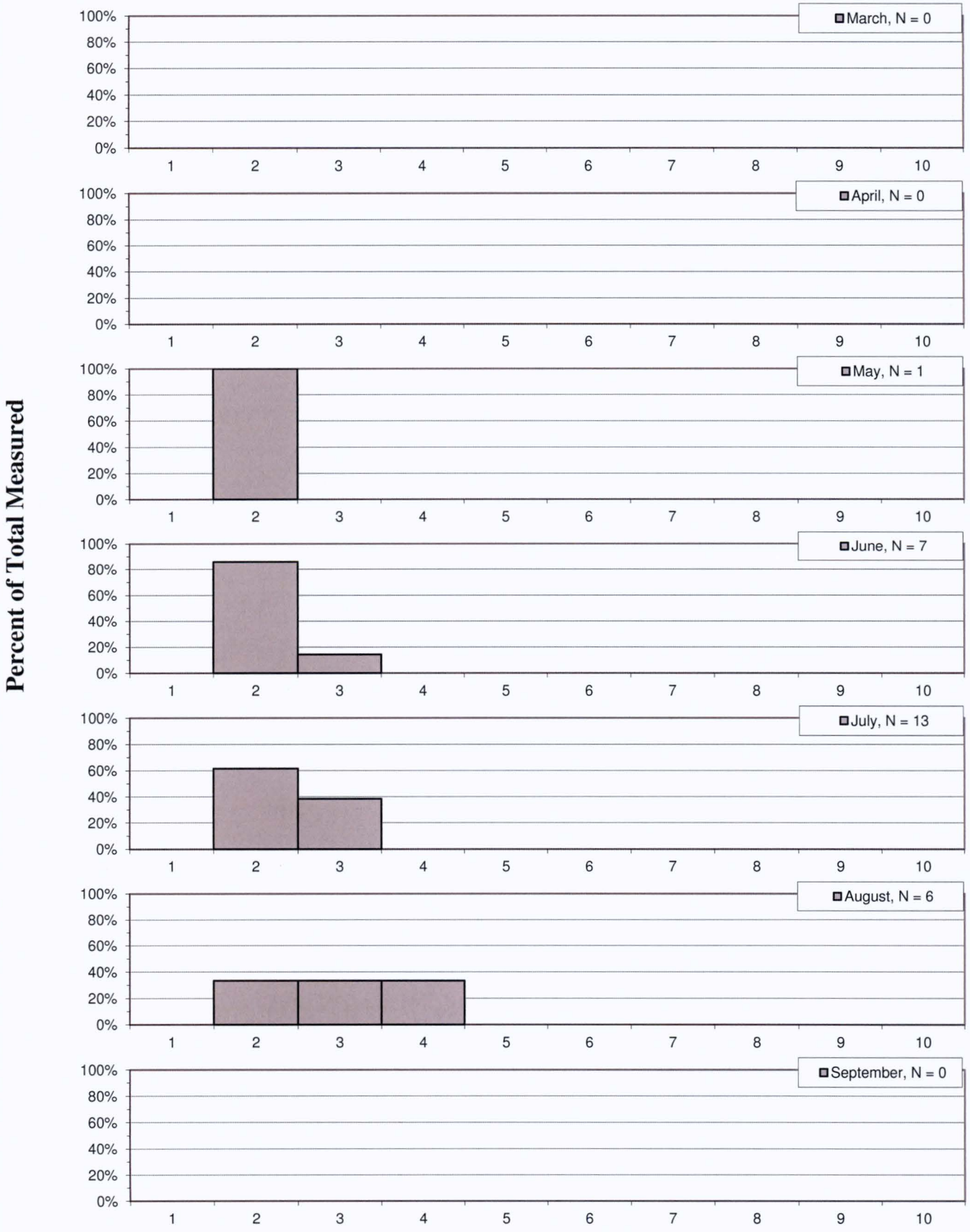
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Threadfin Shad_PYS_Total Length_2mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin/ Gizzard Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

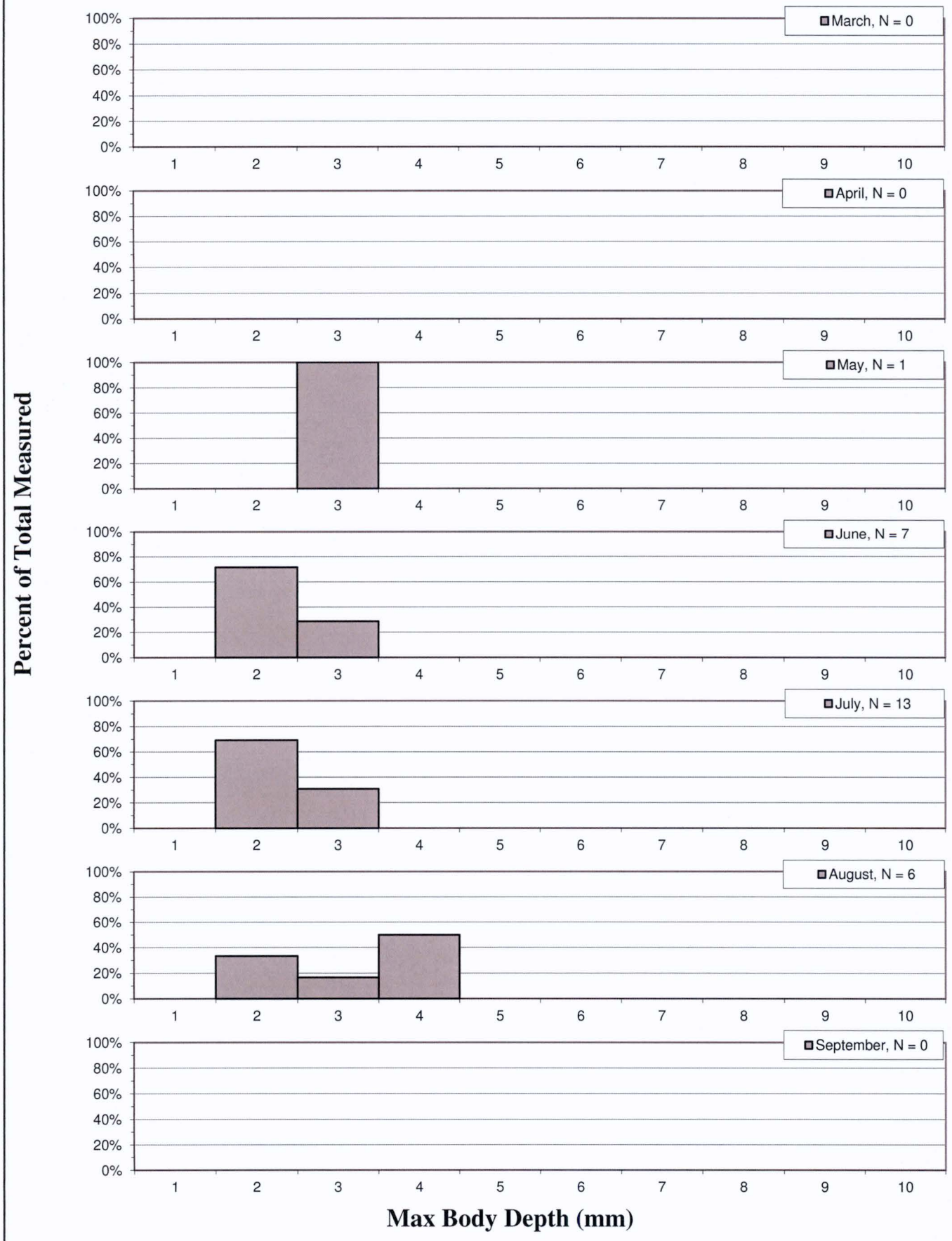
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Threadfin_Gizzard Shad_PYS_Head Capsule Depth_1mm



North Anna Power Station	Length-Frequency Distribution of Species Entrained	Common Name	Life Stage
Entrainment Characterization Study	Apr. - Sep. 2016 and Mar. - Sep. 2017	Threadfin/ Gizzard Shad	PYS

NOTE: PYS = Post Yolk Sac Larvae

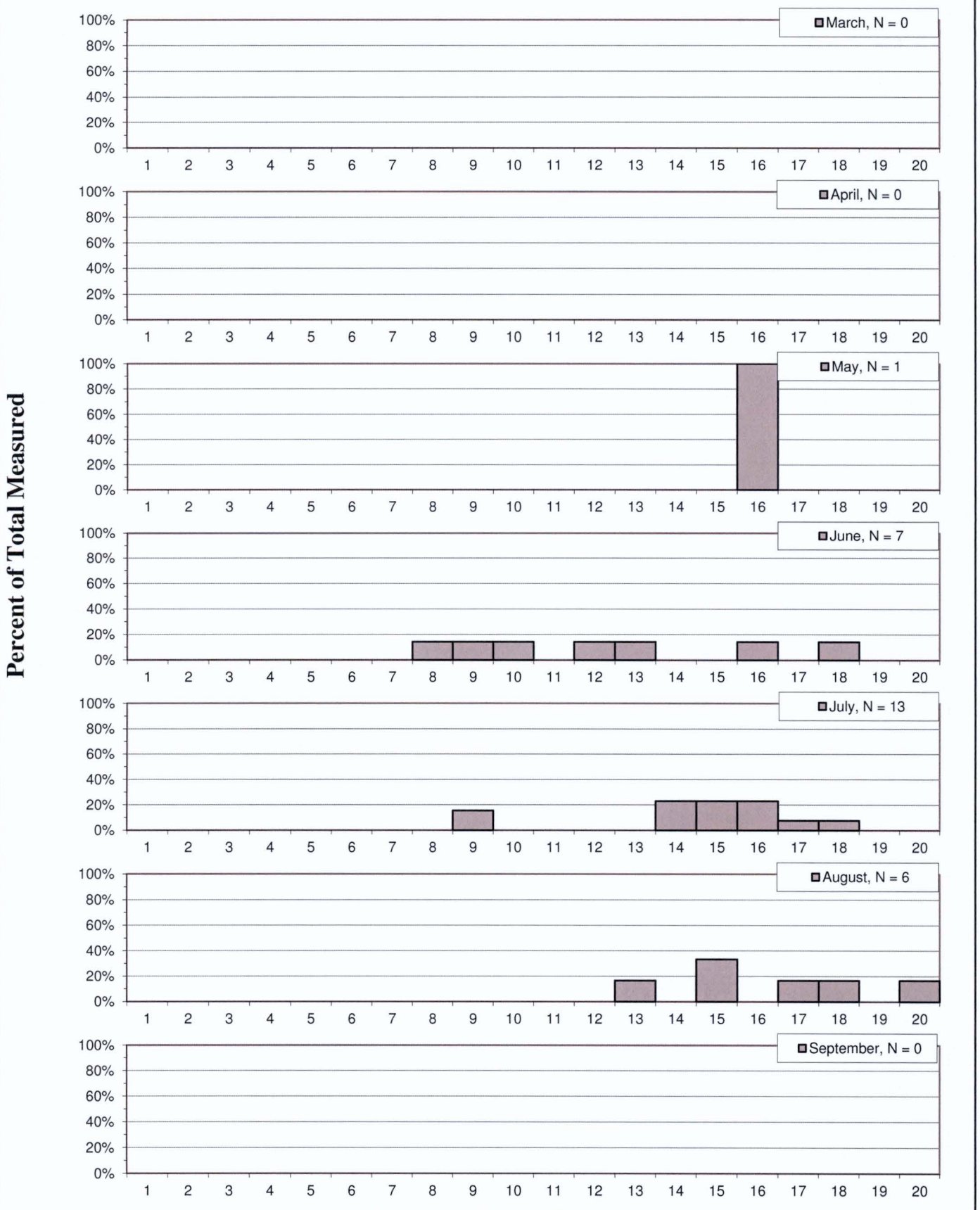
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Threadfin_Gizzard Shad_PYS_Head Capsule Width_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin/ Gizzard Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

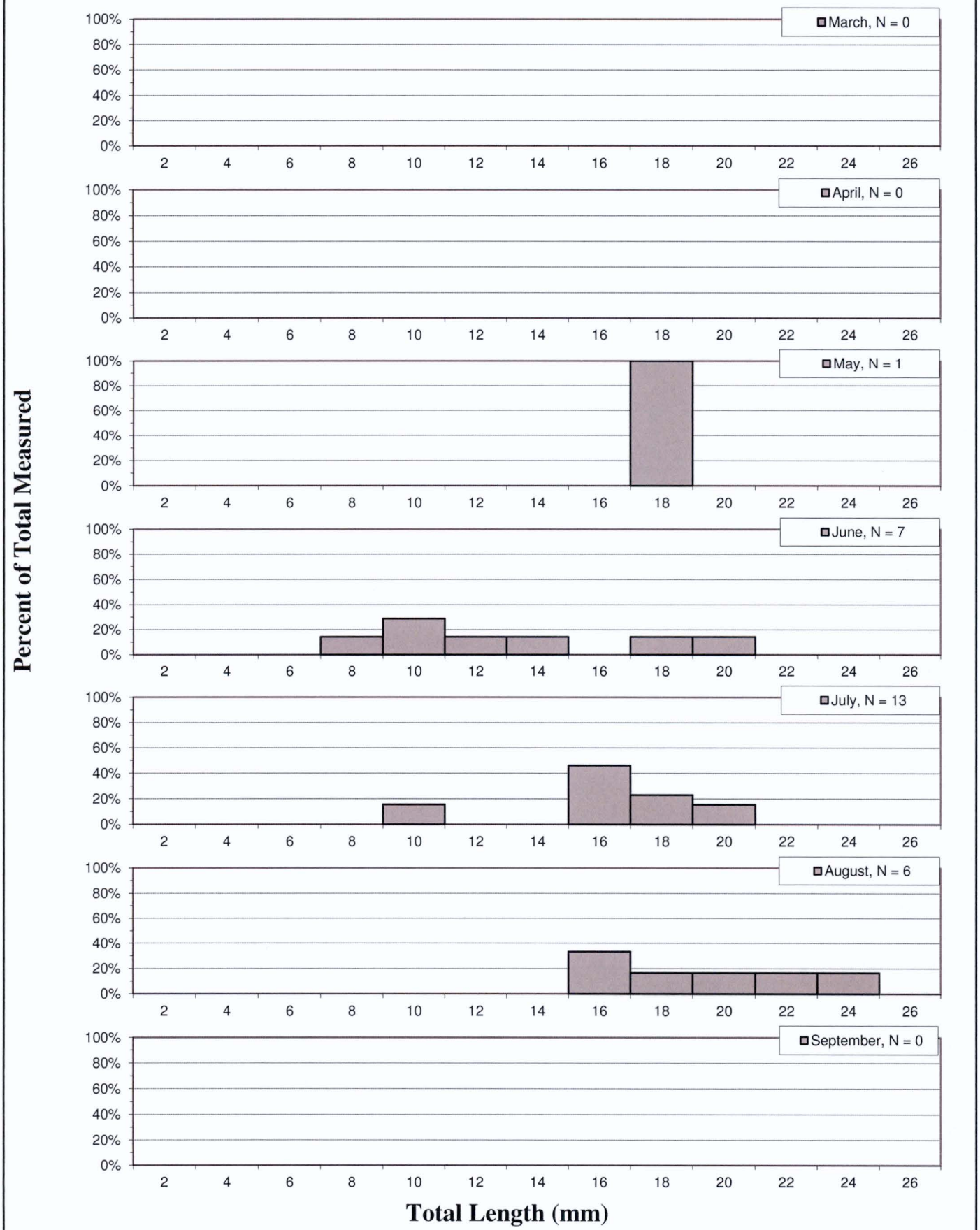
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Threadfin_Gizzard Shad_PYS_Max Body Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin/ Gizzard Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

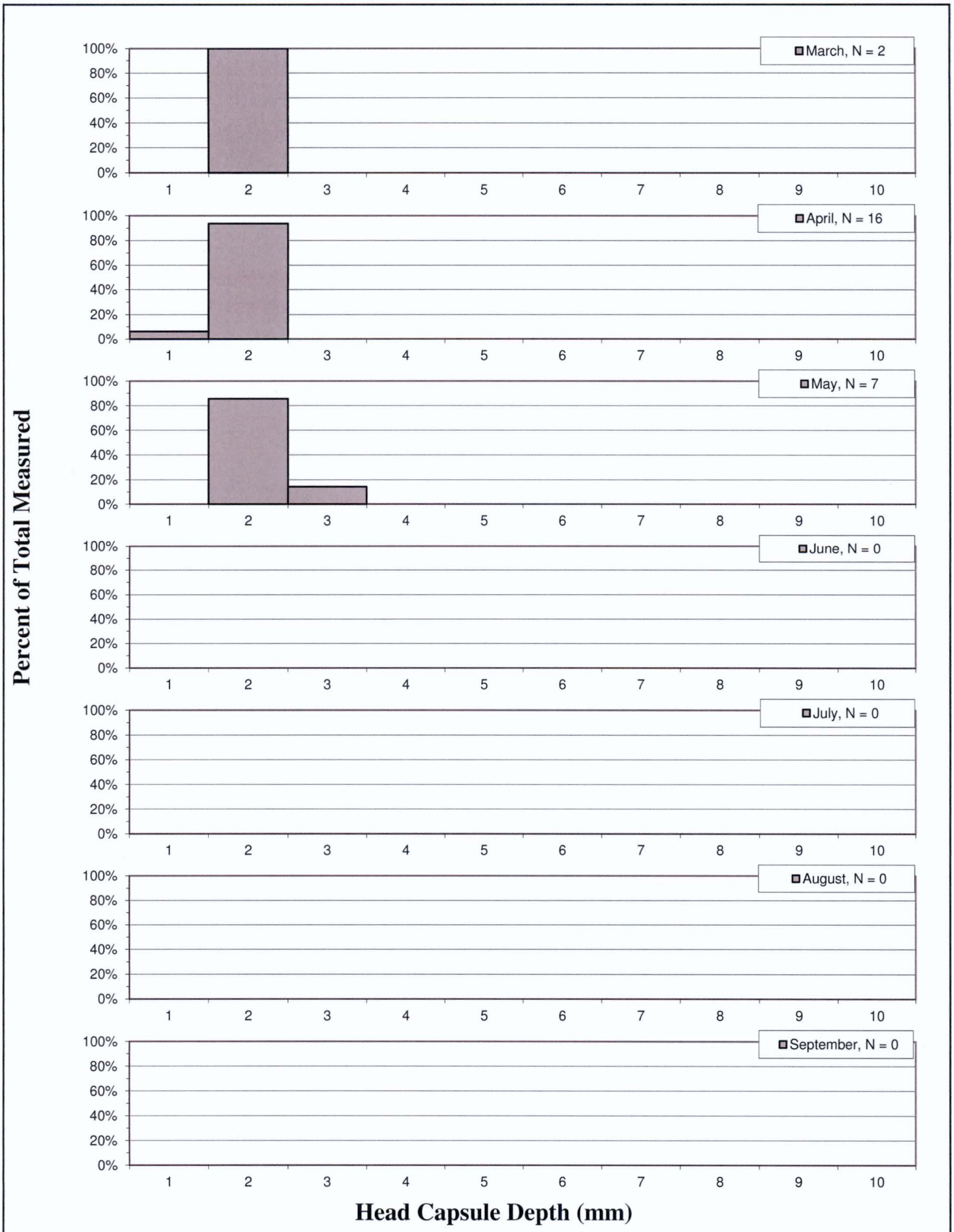
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_Threadfin_Gizzard Shad_PYS_Notochord Length_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**Threadfin/ Gizzard Shad**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

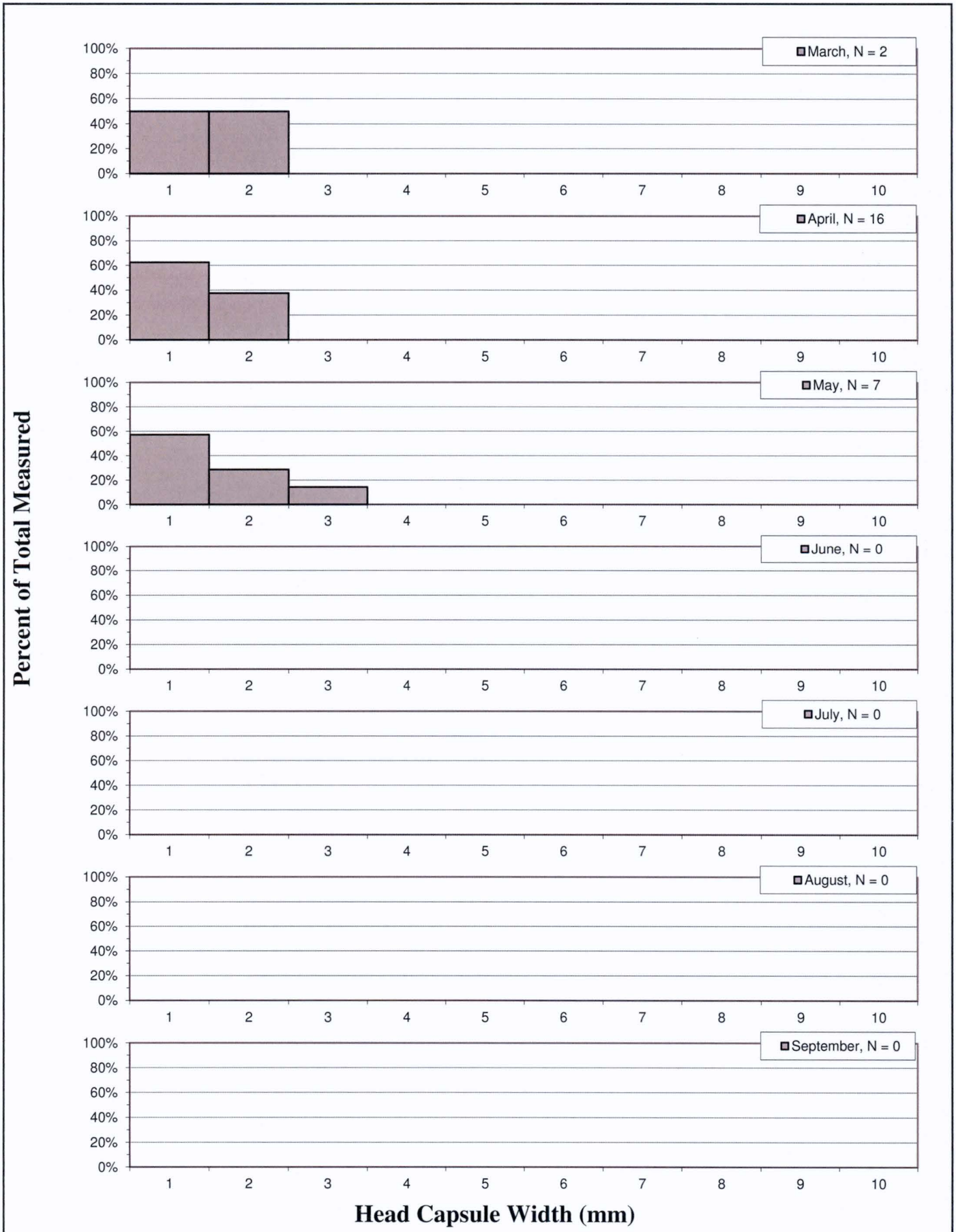
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_Threadfin_Gizzard Shad_PYS_Total Length_2mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**White Perch**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

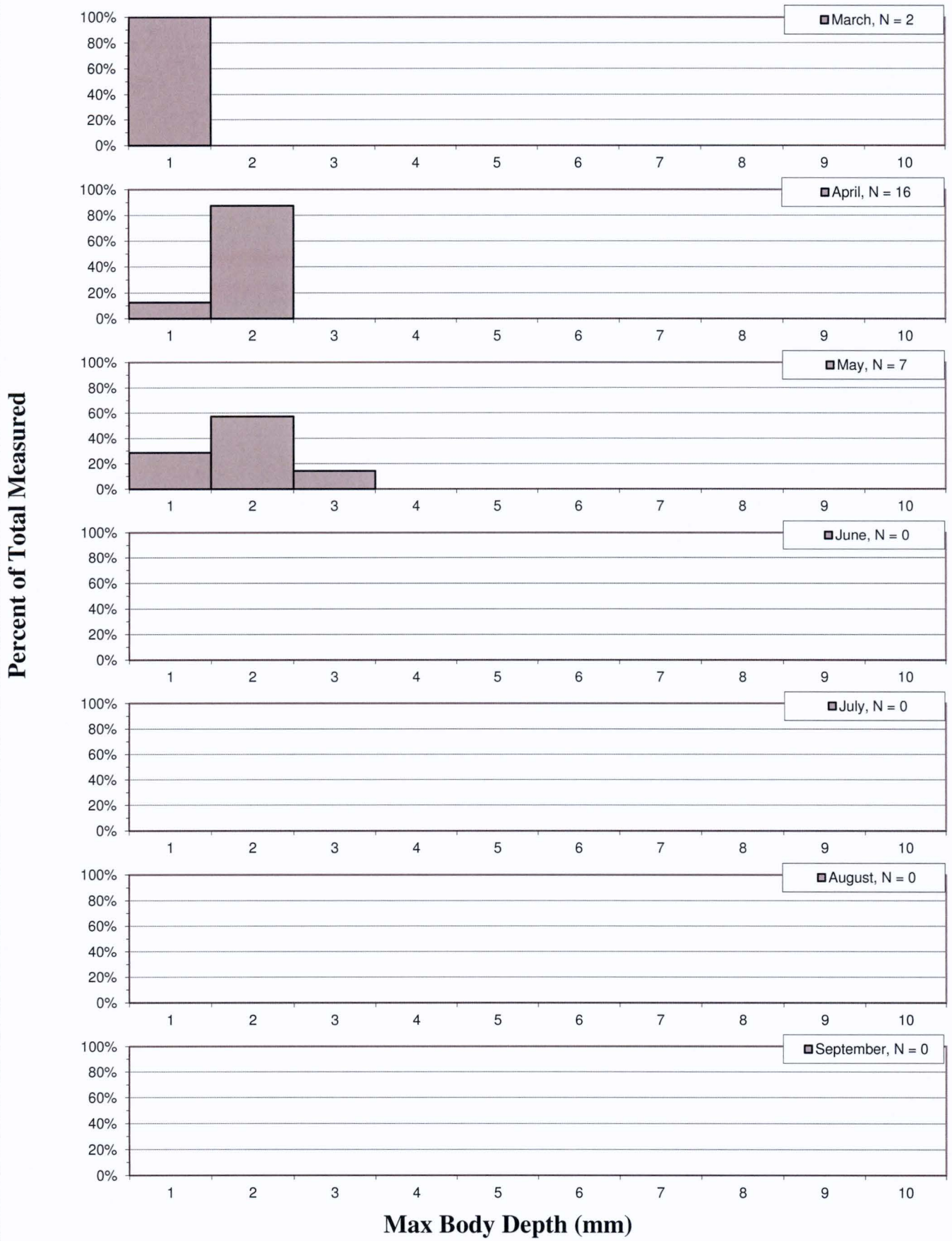
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_White Perch_PYS_Head Capsule Depth_1mm



North Anna Power Station	Length-Frequency Distribution of Species Entrained	Common Name	Life Stage
Entrainment Characterization Study	Apr. - Sep. 2016 and Mar. - Sep. 2017	White Perch	PYS

NOTE: PYS = Post Yolk Sac Larvae

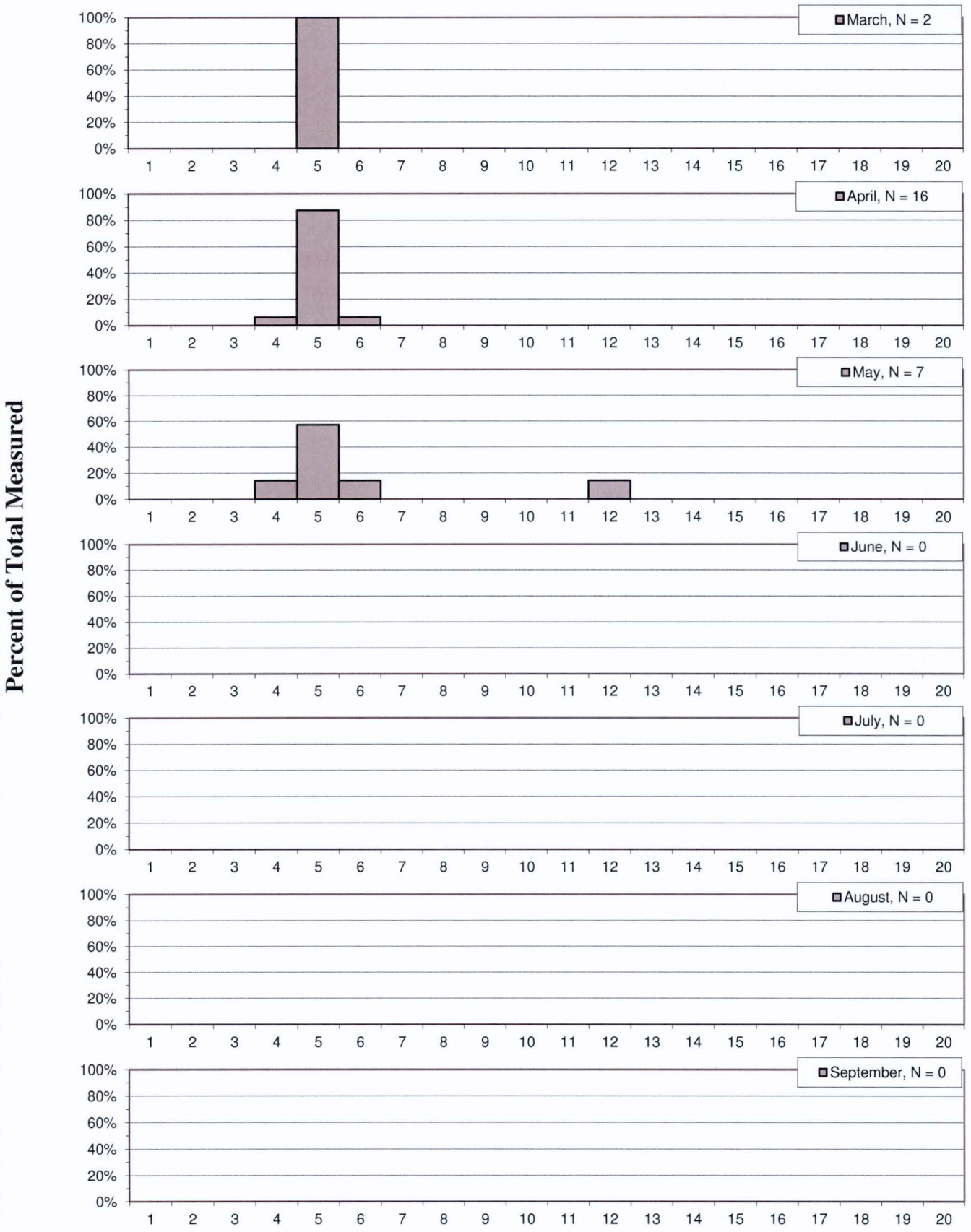
C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_White Perch_PYS_Head Capsule Width_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**White Perch**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

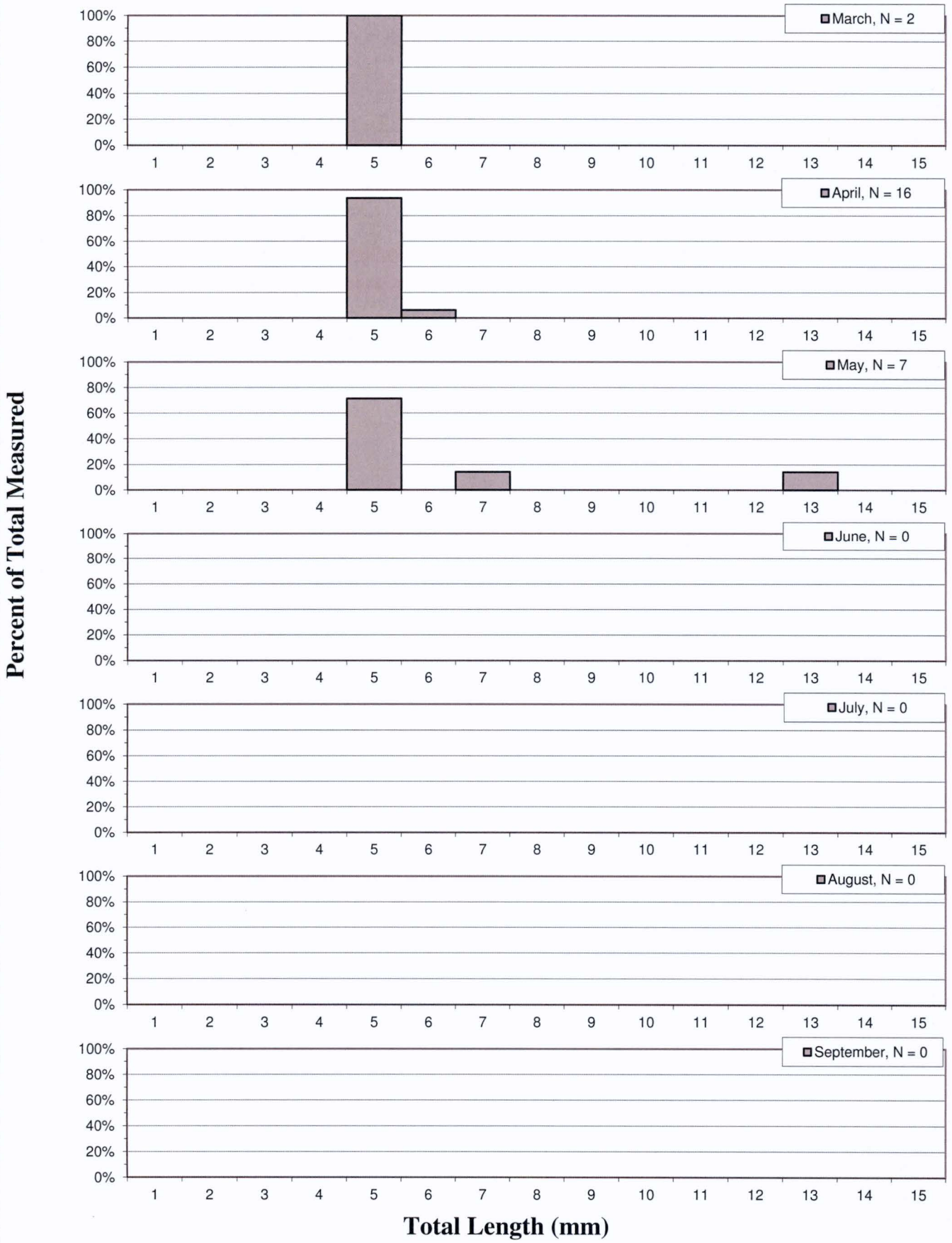
C:\Users\kmatatt\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\ESTZ5JCQ\L-F_NAPS_White Perch_PYS_Max Body Depth_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**White Perch**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_White Perch_PYS_Notochord Length_1mm



North Anna Power Station	**Length-Frequency Distribution of Species Entrained**	**Common Name**	**Life Stage**
Entrainment Characterization Study	**Apr. - Sep. 2016 and Mar. - Sep. 2017**	**White Perch**	**PYS**

NOTE: PYS = Post Yolk Sac Larvae

C:\Users\kmatatt\Desktop\L-F Plots\North Anna\L-F_NAPS_White Perch_PYS_Total Length_1mm

Appendix D

Water Quality Data

Table D. Water Quality Data by Sample

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
4/20/2016	NAPS_2_20160420_15	Start	Near-surface	9.2	7.3	0.0	75.0	18.5
			Mid-depth	9.3	7.6	0.0	75.0	17.8
			Near-bottom	9.6	7.8	0.0	75.0	16.4
		End	Near-surface	9.8	7.7	0.0	75.0	18.1
			Mid-depth	10.1	7.5	0.0	75.0	15.9
			Near-bottom	9.3	7.4	0.0	74.0	15.1
	NAPS_2_20160420_21	Start	Near-surface	9.5	8.3	0.0	72.0	18.4
			Mid-depth	9.0	8.1	0.0	73.0	17.6
			Near-bottom	9.6	7.9	0.0	72.0	15.1
		End	Near-surface	9.2	8.0	0.0	72.0	18.1
			Mid-depth	9.2	7.8	0.0	72.0	17.3
			Near-bottom	9.3	7.7	0.0	72.0	14.6
4/21/2016	NAPS_2_20160421_09	Start	Near-surface	8.6	7.7	0.0	76.0	17.3
			Mid-depth	9.1	7.4	0.0	75.0	17.3
			Near-bottom	8.9	7.3	0.0	75.0	17.2
		End	Near-surface	8.8	7.6	0.0	76.0	17.6
			Mid-depth	9.3	7.2	0.0	77.0	17.4
			Near-bottom	9.0	7.2	0.0	75.0	16.5
	NAPS_2_20160421_03	Start	Near-surface	9.4	7.9	0.0	74.0	17.7
			Mid-depth	9.4	7.9	0.0	73.0	17.5
			Near-bottom	9.7	7.8	0.0	73.0	15.5
		End	Near-surface	8.8	7.7	0.0	72.0	17.5
			Mid-depth	9.4	7.7	0.0	72.0	16.9
			Near-bottom	8.9	7.7	0.0	74.0	15.4
4/26/2016	NAPS_2_20160426_09	Start	Near-surface	8.5	7.5	0.0	74.0	18.8
			Mid-depth	8.8	7.2	0.0	74.0	18.6
			Near-bottom	8.4	7.3	0.0	74.0	18.3
			Near-surface - NAPS Intake	8.4	7.3	0.0	75.0	18.7
			Mid-depth - NAPS Intake	8.3	7.2	0.0	75.0	18.4
			Near-bottom - NAPS Intake	8.0	7.2	0.0	75.0	18.2
		End	Near-surface	6.6	7.5	0.0	74.0	19.3
			Mid-depth	5.8	7.4	0.0	74.0	19.0
			Near-bottom	6.1	7.4	0.0	74.0	18.7
			Near-surface - NAPS Intake	8.4	7.6	0.0	75.0	19.1
			Mid-depth - NAPS Intake	8.5	7.5	0.0	74.0	18.4
			Near-bottom - NAPS Intake	7.8	7.4	0.0	75.0	18.0
	NAPS_2_20160426_14	Start	Near-surface	8.8	7.5	0.0	74.0	19.5
			Mid-depth	8.7	7.4	0.0	74.0	19.3
			Near-bottom	8.1	7.5	0.0	74.0	18.2
			Near-surface - NAPS Intake	8.3	7.4	0.0	75.0	18.6
			Mid-depth - NAPS Intake	8.3	7.4	0.0	75.0	18.8
			Near-bottom - NAPS Intake	8.1	7.3	0.0	75.0	18.4
		End	Near-surface	8.5	7.5	0.0	74.0	19.6
			Mid-depth	8.3	7.4	0.0	74.0	19.2
			Near-bottom	8.1	7.5	0.0	74.0	18.2
			Near-surface - NAPS Intake	8.4	7.6	0.0	73.0	19.2
			Mid-depth - NAPS Intake	8.5	7.4	0.0	73.0	18.7
			Near-bottom - NAPS Intake	8.3	7.4	0.0	73.0	18.4
	NAPS_2_20160426_21	Start	Near-surface	8.4	7.2	0.0	70.0	19.8
			Mid-depth	8.7	7.0	0.0	70.0	19.7
			Near-bottom	8.8	7.3	0.0	70.0	17.6
			Near-surface - NAPS Intake	9.0	7.8	0.0	69.0	19.5
			Mid-depth - NAPS Intake	8.7	7.4	0.0	69.0	18.6
			Near-bottom - NAPS Intake	8.7	7.2	0.0	69.0	18.1
		End	Near-surface	8.8	7.5	0.0	71.0	19.9
			Mid-depth	8.6	7.0	0.0	69.0	19.3
			Near-bottom	8.7	7.3	0.0	71.0	18.2
			Near-surface - NAPS Intake	8.8	7.3	0.0	69.0	19.7
			Mid-depth - NAPS Intake	8.7	7.3	0.0	70.0	19.4
			Near-bottom - NAPS Intake	8.6	7.3	0.0	70.0	17.9
4/27/2016	NAPS_2_20160427_03	Start	Near-surface	8.6	7.1	0.0	70.0	19.7
			Mid-depth	8.7	7.2	0.0	70.0	19.3
			Near-bottom	8.9	7.4	0.0	70.0	18.4
			Near-surface - NAPS Intake	8.3	7.5	0.0	70.0	19.7
			Mid-depth - NAPS Intake	8.8	7.5	0.0	70.0	19.3
			Near-bottom - NAPS Intake	8.6	7.5	0.0	70.0	18.4
		End	Near-surface	8.9	7.2	0.0	70.0	19.7
			Mid-depth	8.4	7.2	0.0	70.0	19.5
			Near-bottom	8.7	7.4	0.0	70.0	18.1
			Near-surface - NAPS Intake	8.4	7.3	0.0	70.0	19.6
			Mid-depth - NAPS Intake	8.7	7.3	0.0	70.0	19.2
			Near-bottom - NAPS Intake	8.7	7.3	0.0	70.0	18.0
5/10/2016	NAPS_2_20160510_09	Start	Near-surface	8.4	8.2	0.0	74.0	19.3
			Mid-depth	8.0	8.0	0.0	76.0	19.3
			Near-bottom	7.8	8.0	0.0	76.0	18.8
			Near-surface - NAPS Intake	8.5	8.8	0.0	75.0	19.2
			Mid-depth - NAPS Intake	8.3	8.6	0.0	77.0	19.2
			Near-bottom - NAPS Intake	8.2	8.3	0.0	75.0	19.0
		End	Near-surface	8.1	7.8	0.0	78.0	19.4
			Mid-depth	7.9	7.7	0.0	73.0	19.4
			Near-bottom	8.1	7.7	0.0	73.0	18.9
			Near-surface - NAPS Intake	8.6	8.1	0.0	75.0	19.3
			Mid-depth - NAPS Intake	8.3	7.8	0.0	75.0	19.3
			Near-bottom - NAPS Intake	8.4	7.7	0.0	74.0	19.1

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
	NAPS_2_20160510_15	Start	Near-surface	9.3	7.3	0.0	74.0	19.6
			Mid-depth	9.0	7.2	0.0	73.0	19.4
			Near-bottom	8.8	7.0	0.0	72.0	18.6
			Near-surface - NAPS Intake	8.9	7.1	0.0	73.0	19.5
			Mid-depth - NAPS Intake	8.9	7.1	0.0	73.0	19.5
			Near-bottom - NAPS Intake	8.8	7.0	0.0	72.0	18.9
		End	Near-surface	9.3	7.2	0.0	73.0	19.6
			Mid-depth	9.1	7.2	0.0	73.0	19.6
			Near-bottom	8.9	7.1	0.0	72.0	18.7
			Near-surface - NAPS Intake	8.9	7.2	0.0	73.0	19.5
			Mid-depth - NAPS Intake	8.9	7.2	0.0	73.0	19.5
			Near-bottom - NAPS Intake	8.7	7.0	0.0	73.0	19.0
	NAPS_2_20160510_21	Start	Near-surface	9.1	7.2	0.0	73.0	19.6
			Mid-depth	9.0	7.1	0.0	73.0	19.3
			Near-bottom	8.8	7.2	0.0	73.0	18.7
			Near-surface - NAPS Intake	8.8	7.4	0.0	72.0	19.5
			Mid-depth - NAPS Intake	8.7	7.2	0.0	73.0	19.5
			Near-bottom - NAPS Intake	8.8	7.1	0.0	73.0	19.4
		End	Near-surface	9.1	7.2	0.0	68.0	19.5
			Mid-depth	9.0	7.1	0.0	73.0	19.4
			Near-bottom	8.9	7.1	0.0	72.0	18.7
			Near-surface - NAPS Intake	8.8	7.2	0.0	73.0	19.4
			Mid-depth - NAPS Intake	8.7	7.1	0.0	73.0	19.4
			Near-bottom - NAPS Intake	8.7	7.1	0.0	73.0	19.4
5/11/2016	NAPS_2_20160511_03	Start	Near-surface	9.1	7.3	0.0	73.0	19.4
			Mid-depth	8.8	7.2	0.0	73.0	19.4
			Near-bottom	8.9	7.2	0.0	73.0	19.0
			Near-surface - NAPS Intake	8.6	7.4	0.0	73.0	19.3
			Mid-depth - NAPS Intake	8.6	7.2	0.0	73.0	19.4
			Near-bottom - NAPS Intake	8.7	7.1	0.0	73.0	19.2
		End	Near-surface	9.1	7.2	0.0	73.0	19.4
			Mid-depth	8.9	7.1	0.0	73.0	19.0
			Near-bottom	8.9	7.2	0.0	73.0	19.0
			Near-surface - NAPS Intake	8.6	7.3	0.0	73.0	19.4
			Mid-depth - NAPS Intake	8.6	7.1	0.0	73.0	19.4
			Near-bottom - NAPS Intake	8.6	7.1	0.0	73.0	19.3
5/24/2016	NAPS_2_20160524_09	Start	Near-surface	8.9	6.7	0.0	72.0	20.4
			Mid-depth	8.4	6.6	0.0	72.0	19.6
			Near-bottom	8.2	6.5	0.0	72.0	18.9
		End	Near-surface	8.7	6.5	0.0	71.0	20.7
			Mid-depth	7.7	6.5	0.0	71.0	19.7
			Near-bottom	7.6	6.4	0.0	71.0	19.0
	NAPS_2_20160524_15	Start	Near-surface	8.4	6.3	0.0	72.0	22.1
			Mid-depth	8.8	6.5	0.0	71.0	20.6
			Near-bottom	8.5	6.4	0.0	71.0	19.2
		End	Near-surface	8.0	6.5	0.0	72.0	22.0
			Mid-depth	8.3	6.5	0.0	71.0	20.5
			Near-bottom	8.1	6.5	0.0	71.0	19.1
	NAPS_2_20160524_20	Start	Near-surface	7.5	7.6	0.0	71.0	21.8
			Mid-depth	7.0	7.4	0.0	71.0	20.9
			Near-bottom	6.8	7.5	0.0	72.0	18.9
		End	Near-surface	7.6	7.7	0.0	71.0	21.6
			Mid-depth	6.8	7.4	0.0	72.0	20.6
			Near-bottom	6.6	7.5	0.0	72.0	19.2
5/25/2016	NAPS_2_20160525_03	Start	Near-surface	7.6	7.6	0.0	72.0	20.9
			Mid-depth	7.3	7.5	0.0	72.0	20.5
			Near-bottom	7.2	7.5	0.0	72.0	19.7
		End	Near-surface	7.5	7.6	0.0	71.0	20.9
			Mid-depth	7.2	7.5	0.0	71.0	20.4
			Near-bottom	6.8	7.5	0.0	71.0	19.2
6/14/2016	NAPS_2_20160614_10	Start	Near-surface	7.6	7.6	0.0	72.0	26.2
			Mid-depth	7.9	7.5	0.0	72.0	26.2
			Near-bottom	7.4	7.5	0.0	73.0	26.2
			Near-surface - NAPS Intake	7.5	7.5	0.0	73.0	26.3
			Mid-depth - NAPS Intake	7.6	7.5	0.0	73.0	26.1
			Near-bottom - NAPS Intake	7.4	7.4	0.0	72.0	26.1
		End	Near-surface	7.5	7.6	0.0	72.0	26.6
			Mid-depth	7.1	7.6	0.0	73.0	26.4
			Near-bottom	7.2	7.5	0.0	73.0	26.2
	NAPS_2_20160614_15	Start	Near-surface	7.0	7.7	0.0	73.0	27.2
			Mid-depth	7.7	7.4	0.0	73.0	26.6
			Near-bottom	7.0	7.1	0.0	73.0	25.9
		End	Near-surface	7.5	7.7	0.0	73.0	27.6
			Mid-depth	7.4	7.6	0.0	73.0	27.2
			Near-bottom	6.6	7.2	0.0	72.0	26.1
	NAPS_2_20160614_21	Start	Near-surface	7.3	7.8	0.0	74.0	27.1
			Mid-depth	7.2	7.5	0.0	74.0	27.1
			Near-bottom	6.4	7.4	0.0	74.0	25.8
		End	Near-surface	7.3	7.7	0.0	74.0	27.0
			Mid-depth	7.2	7.6	0.0	74.0	27.0
			Near-bottom	6.3	7.4	0.0	74.0	25.8
6/15/2016	NAPS_2_20160615_03	Start	Near-surface	7.0	7.4	0.0	74.0	26.5
			Mid-depth	6.9	7.3	0.0	74.0	26.3
			Near-bottom	6.4	7.2	0.0	74.0	26.0
		End	Near-surface	7.1	7.4	0.0	74.0	26.3
			Mid-depth	6.8	7.3	0.0	74.0	26.2

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
			Near-bottom	6.2	7.3	0.0	74.0	25.9
6/28/2016	NAPS_2_20160628_09	Start	Near-surface	6.8	7.7	0.0	73.0	27.8
			Mid-depth	6.6	7.2	0.0	73.0	27.6
			Near-bottom	6.3	7.3	0.0	72.0	26.9
		End	Near-surface	7.1	7.4	0.0	73.0	28.0
			Mid-depth	6.7	6.4	0.0	73.0	27.6
			Near-bottom	6.5	6.4	0.0	73.0	27.0
	NAPS_2_20160628_15	Start	Near-surface	7.4	6.8	0.0	72.0	29.5
			Mid-depth	6.9	6.5	0.0	72.0	27.9
			Near-bottom	6.5	6.5	0.0	73.0	27.5
		End	Near-surface	7.2	6.8	0.0	73.0	28.4
			Mid-depth	6.8	6.6	0.0	73.0	28.0
			Near-bottom	6.5	6.6	0.0	73.0	27.7
	NAPS_2_20160628_21	Start	Near-surface	7.7	7.6	0.0	72.0	28.0
			Mid-depth	7.5	7.4	0.0	73.0	27.7
			Near-bottom	6.9	7.2	0.0	72.0	26.9
		End	Near-surface	8.5	7.7	0.0	72.0	28.1
			Mid-depth	7.1	7.5	0.0	72.0	27.8
			Near-bottom	7.1	7.3	0.0	72.0	27.3
6/29/2016	NAPS_2_20160629_02	Start	Near-surface	8.3	7.6	0.0	72.0	28.0
			Mid-depth	7.6	7.5	0.0	71.0	27.9
			Near-bottom	7.7	7.4	0.0	72.0	27.6
		End	Near-surface	7.8	7.6	0.0	72.0	27.8
			Mid-depth	6.7	7.5	0.0	72.0	27.9
			Near-bottom	6.7	7.2	0.0	72.0	26.9
7/12/2016	NAPS_2_20160712_09	Start	Near-surface	6.7	7.5	0.0	71.0	29.9
			Mid-depth	5.9	7.4	0.0	71.0	29.9
			Near-bottom	5.9	7.3	0.0	71.0	29.4
			Near-surface - NAPS Intake	6.7	7.5	0.0	69.0	29.9
			Mid-depth - NAPS Intake	6.0	7.3	0.0	70.0	29.8
			Near-bottom - NAPS Intake	5.9	7.1	0.0	70.0	29.1
		End	Near-surface	6.9	7.3	0.0	71.0	30.1
			Mid-depth	6.2	7.3	0.0	71.0	30.0
			Near-bottom	5.9	6.8	0.0	71.0	29.4
	NAPS_2_20160712_15	Start	Near-surface	7.0	7.9	0.0	71.0	30.7
			Mid-depth	6.3	7.2	0.0	71.0	29.8
			Near-bottom	5.6	7.2	0.0	70.0	29.3
		End	Near-surface	7.4	7.8	0.0	71.0	30.8
			Mid-depth	6.3	6.9	0.0	71.0	30.0
			Near-bottom	6.0	6.7	0.0	71.0	29.6
	NAPS_2_20160712_21	Start	Near-surface	6.8	7.6	0.0	71.0	30.2
			Mid-depth	6.8	7.4	0.0	71.0	30.0
			Near-bottom	6.4	7.2	0.0	70.0	29.7
		End	Near-surface	6.4	7.5	0.0	71.0	30.1
			Mid-depth	6.7	7.5	0.0	70.0	30.0
			Near-bottom	6.2	7.4	0.0	71.0	29.9
7/13/2016	NAPS_2_20160713_03	Start	Near-surface	5.9	7.5	0.0	71.0	29.8
			Mid-depth	6.3	7.3	0.0	71.0	29.9
			Near-bottom	6.2	7.3	0.0	71.0	29.8
		End	Near-surface	5.8	7.4	0.0	71.0	29.8
			Mid-depth	5.9	7.3	0.0	71.0	29.8
			Near-bottom	5.7	7.3	0.0	70.0	29.7
7/26/2016	NAPS_2_20160726_10	Start	Near-surface	6.4	7.7	0.0	71.0	32.7
			Mid-depth	6.0	7.4	0.0	71.0	32.1
			Near-bottom	5.2	7.1	0.0	70.0	30.7
		End	Near-surface	5.8	6.7	0.0	71.0	33.4
			Mid-depth	5.5	7.2	0.0	70.0	32.5
			Near-bottom	4.2	6.0	0.0	69.0	30.1
	NAPS_2_20160726_14	Start	Near-surface	6.6	7.1	0.0	71.0	34.3
			Mid-depth	6.8	7.2	0.0	71.0	32.4
			Near-bottom	5.8	6.2	0.0	71.0	30.7
		End	Near-surface	7.0	7.9	0.0	71.0	34.6
			Mid-depth	5.7	7.2	0.0	71.0	32.3
			Near-bottom	5.3	7.0	0.0	71.0	31.0
	NAPS_2_20160726_21	Start	Near-surface	6.3	7.8	0.0	70.0	32.8
			Mid-depth	6.0	7.7	0.0	70.0	32.5
			Near-bottom	5.9	7.7	0.0	70.0	32.3
		End	Near-surface	6.4	7.8	0.0	70.0	32.6
			Mid-depth	5.9	7.6	0.0	71.0	32.4
			Near-bottom	5.7	7.6	0.0	71.0	32.3
7/27/2016	NAPS_2_20160727_03	Start	Near-surface	6.4	7.7	0.0	70.0	32.4
			Mid-depth	5.8	7.5	0.0	70.0	32.3
			Near-bottom	4.9	7.2	0.0	71.0	31.2
		End	Near-surface	6.3	7.7	0.0	70.0	32.2
			Mid-depth	5.7	7.6	0.0	70.0	32.2
			Near-bottom	5.0	7.2	0.0	70.0	31.3
8/9/2016	NAPS_2_20160809_09	Start	Near-surface	5.9	7.3	0.0	72.0	29.5
			Mid-depth	5.7	7.1	0.0	72.0	29.5
			Near-bottom	5.3	7.2	0.0	72.0	29.5
			Near-surface - NAPS Intake	4.6	7.1	0.0	72.0	29.5
			Mid-depth - NAPS Intake	5.0	6.9	0.0	72.0	29.5
			Near-bottom - NAPS Intake	5.2	6.8	0.0	72.0	29.5
		End	Near-surface	5.9	7.1	0.0	72.0	29.5
			Mid-depth	5.6	7.0	0.0	72.0	29.5
			Near-bottom	5.5	7.0	0.0	72.0	29.5
	NAPS_2_20160809_15	Start	Near-surface	6.1	7.3	0.0	72.0	29.5

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
			Mid-depth	6.0	7.0	0.0	72.0	29.5
			Near-bottom	5.6	7.1	0.0	77.0	29.5
			Near-surface - NAPS Intake	4.7	6.9	0.0	72.0	29.5
			Mid-depth - NAPS Intake	4.6	6.8	0.0	72.0	29.5
			Near-bottom - NAPS Intake	5.3	6.7	0.0	72.0	29.5
		End	Near-surface	5.9	7.1	0.0	72.0	29.6
			Mid-depth	5.6	7.0	0.0	72.0	29.5
			Near-bottom	5.1	7.0	0.0	72.0	29.6
	NAPS_2_20160809_20	Start	Near-surface	5.7	7.0	0.0	72.0	29.6
			Mid-depth	5.5	7.0	0.0	71.0	29.6
			Near-bottom	5.1	7.0	0.0	71.0	29.5
			Near-surface - NAPS Intake	5.3	7.0	0.0	72.0	29.5
			Mid-depth - NAPS Intake	5.2	6.9	0.0	72.0	29.5
			Near-bottom - NAPS Intake	5.3	6.8	0.0	72.0	29.4
		End	Near-surface	6.0	7.0	0.0	71.0	29.5
			Mid-depth	5.7	7.0	0.0	72.0	29.5
			Near-bottom	5.1	7.0	0.0	72.0	29.5
8/10/2016	NAPS_2_20160810_03	Start	Near-surface	6.2	7.1	0.0	71.0	29.4
			Mid-depth	5.7	7.1	0.0	72.0	29.4
			Near-bottom	5.3	7.0	0.0	71.0	29.4
		End	Near-surface	5.5	7.0	0.0	71.0	29.4
			Mid-depth	5.5	7.0	0.0	71.0	29.4
			Near-bottom	5.4	6.9	0.0	71.0	29.4
8/23/2016	NAPS_2_20160823_09	Start	Near-surface	6.3	7.3	0.0	73.0	30.6
			Mid-depth	5.7	7.2	0.0	73.0	30.6
			Near-bottom	5.8	7.3	0.0	73.0	30.6
		End	Near-surface	6.6	7.2	0.0	71.0	30.8
			Mid-depth	5.8	6.9	0.0	71.0	30.6
			Near-bottom	5.9	7.0	0.0	71.0	30.6
	NAPS_2_20160823_15	Start	Near-surface	6.3	7.5	0.0	71.0	30.9
			Mid-depth	6.1	7.3	0.0	72.0	30.7
			Near-bottom	4.8	7.2	0.0	71.0	30.4
		End	Near-surface	6.5	7.6	0.0	71.0	31.1
			Mid-depth	5.6	7.3	0.0	71.0	30.6
			Near-bottom	4.9	7.1	0.0	71.0	30.4
	NAPS_2_20160823_20	Start	Near-surface	6.9	7.6	0.1	73.0	30.8
			Mid-depth	6.4	7.3	0.1	74.0	30.7
			Near-bottom	5.8	7.2	0.1	73.0	30.3
		End	Near-surface	7.2	7.3	0.1	73.0	30.7
			Mid-depth	6.2	7.2	0.1	73.0	30.6
			Near-bottom	5.7	7.2	0.1	77.0	30.4
8/24/2016	NAPS_2_20160824_03	Start	Near-surface	6.6	7.3	0.1	73.0	30.4
			Mid-depth	6.1	7.1	0.1	73.0	30.4
			Near-bottom	5.4	7.1	0.1	73.0	30.3
		End	Near-surface	6.9	7.2	0.1	73.0	30.3
			Mid-depth	5.8	7.1	0.1	73.0	30.3
			Near-bottom	5.4	7.1	0.1	74.0	30.2
9/13/2016	NAPS_2_20160913_09	Start	Near-surface	6.8	7.6	0.0	70.0	28.8
			Mid-depth	6.5	7.4	0.0	70.0	28.7
			Near-bottom	6.0	7.4	0.0	71.0	28.7
			Near-surface - NAPS Intake	6.7	7.2	0.0	71.0	28.7
			Mid-depth - NAPS Intake	6.6	7.1	0.0	70.0	28.7
			Near-bottom - NAPS Intake	6.6	7.0	0.0	71.0	28.7
		End	Near-surface	7.1	7.1	0.0	71.0	28.9
			Mid-depth	6.3	7.0	0.0	71.0	28.8
			Near-bottom	6.2	7.0	0.0	71.0	28.7
	NAPS_2_20160913_15	Start	Near-surface	6.9	6.6	0.0	71.0	29.5
			Mid-depth	6.3	6.6	0.0	71.0	28.8
			Near-bottom	5.6	6.7	0.0	71.0	28.8
		End	Near-surface	7.3	6.8	0.0	72.0	29.4
			Mid-depth	6.3	6.6	0.0	71.0	28.7
			Near-bottom	5.9	6.7	0.0	71.0	28.7
	NAPS_2_20160913_21	Start	Near-surface	6.7	7.5	0.0	70.0	29.0
			Mid-depth	5.8	7.3	0.0	70.0	28.8
			Near-bottom	6.4	7.3	0.0	70.0	28.6
		End	Near-surface	7.0	7.4	0.0	70.0	28.9
			Mid-depth	6.3	7.3	0.0	70.0	28.8
			Near-bottom	5.7	7.3	0.0	70.0	28.7
9/14/2016	NAPS_2_20160914_03	Start	Near-surface	6.6	7.4	0.0	70.0	28.7
			Mid-depth	6.0	7.2	0.0	70.0	28.7
			Near-bottom	6.0	7.3	0.0	70.0	28.6
		End	Near-surface	6.6	7.3	0.0	70.0	28.6
			Mid-depth	6.1	7.2	0.0	70.0	28.6
			Near-bottom	6.0	7.2	0.0	70.0	28.6
3/16/2017	NAPS_2_20170316_10	Start	Near-surface	10.6	7.6	0.0	67.0	10.5
			Mid-depth	10.8	7.5	0.0	68.0	10.5
			Near-bottom	10.0	7.5	0.0	67.0	10.4
			Near-surface - NAPS Intake	10.5	7.6	0.0	67.0	10.5
			Mid-depth - NAPS Intake	10.5	7.5	0.0	69.0	10.5
			Near-bottom - NAPS Intake	10.4	7.5	0.0	67.0	10.4
		End	Near-surface	11.5	7.4	0.0	68.0	10.6
			Mid-depth	10.6	7.5	0.0	68.0	10.6
			Near-bottom	10.5	7.5	0.0	68.0	10.4
	NAPS_2_20170316_15	Start	Near-surface	11.0	7.6	0.0	67.0	10.8
			Mid-depth	11.0	7.4	0.0	67.0	10.8
			Near-bottom	10.5	7.5	0.0	67.0	10.5

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
		End	Near-surface	10.9	7.5	0.0	68.0	10.8
			Mid-depth	10.3	7.4	0.0	68.0	10.7
			Near-bottom	10.2	7.4	0.0	68.0	10.6
	NAPS_2_20170316_21	Start	Near-surface	11.0	7.6	0.0	67.0	10.4
			Mid-depth	10.5	7.5	0.0	67.0	10.5
			Near-bottom	10.1	7.5	0.0	67.0	10.5
		End	Near-surface	10.6	7.5	0.0	67.0	10.4
			Mid-depth	10.5	7.5	0.0	67.0	10.4
			Near-bottom	10.0	7.5	0.0	67.0	10.4
3/17/2017	NAPS_2_20170317_03	Start	Near-surface	10.8	7.4	0.0	67.0	10.3
			Mid-depth	10.5	7.3	0.0	67.0	10.3
			Near-bottom	10.5	7.4	0.0	68.0	10.3
		End	Near-surface	11.0	7.5	0.0	67.0	10.2
			Mid-depth	10.8	7.5	0.0	68.0	10.3
			Near-bottom	10.5	7.5	0.0	67.0	10.3
3/28/2017	NAPS_2_20170328_09	Start	Near-surface	10.0	7.2	0.0	69.0	14.4
			Mid-depth	9.6	7.2	0.0	68.0	14.3
			Near-bottom	10.0	7.1	0.0	66.0	11.3
		End	Near-surface	10.3	7.6	0.0	69.0	14.5
			Mid-depth	9.5	7.5	0.0	66.0	14.5
			Near-bottom	10.0	7.4	0.0	66.0	12.2
	NAPS_2_20170328_14	Start	Near-surface	10.3	7.6	0.0	69.0	15.1
			Mid-depth	10.2	7.5	0.0	69.0	14.7
			Near-bottom	9.5	7.4	0.0	69.0	13.0
		End	Near-surface	10.2	7.6	0.0	69.0	16.1
			Mid-depth	9.9	7.4	0.0	69.0	15.1
			Near-bottom	10.1	7.4	0.0	68.0	12.2
	NAPS_2_20170328_21	Start	Near-surface	9.5	7.7	0.0	69.0	15.5
			Mid-depth	9.7	7.5	0.0	71.0	15.2
			Near-bottom	9.7	7.6	0.0	70.0	13.5
		End	Near-surface	10.1	7.6	0.0	69.0	15.5
			Mid-depth	9.4	7.5	0.0	70.0	15.3
			Near-bottom	10.2	7.5	0.0	70.0	12.4
3/29/2017	NAPS_2_20170329_03	Start	Near-surface	9.9	7.5	0.0	68.0	15.4
			Mid-depth	9.7	7.5	0.0	69.0	15.2
			Near-bottom	10.0	7.4	0.0	70.0	12.5
		End	Near-surface	9.9	7.5	0.0	69.0	15.4
			Mid-depth	9.5	7.5	0.0	69.0	15.2
			Near-bottom	10.1	7.4	0.0	69.0	13.2
4/11/2017	NAPS_2_20170411_10	Start	Near-surface	9.0	7.2	0.0	65.0	16.6
			Mid-depth	8.9	7.1	0.0	65.0	16.4
			Near-bottom	8.8	7.2	0.0	65.0	15.8
			Near-surface - NAPS Intake	8.9	6.7	0.0	67.0	16.4
			Mid-depth - NAPS Intake	8.9	6.8	0.0	67.0	16.4
			Near-bottom - NAPS Intake	9.1	6.9	0.0	68.0	15.7
		End	Near-surface	9.2	6.9	0.0	65.0	16.8
			Mid-depth	8.9	7.2	0.0	65.0	16.3
			Near-bottom	8.9	7.0	0.0	65.0	16.2
	NAPS_2_20170411_14	Start	Near-surface	8.8	7.4	0.0	65.0	18.5
			Mid-depth	8.8	7.4	0.0	64.0	16.7
			Near-bottom	8.9	7.4	0.0	65.0	16.2
		End	Near-surface	9.1	7.2	0.0	65.0	17.6
			Mid-depth	8.8	7.4	0.0	65.0	16.8
			Near-bottom	8.7	7.2	0.0	65.0	15.7
	NAPS_2_20170411_21	Start	Near-surface	9.0	7.6	0.0	65.0	17.6
			Mid-depth	8.8	7.5	0.0	64.0	16.9
			Near-bottom	8.4	7.6	0.0	64.0	16.3
		End	Near-surface	9.1	7.5	0.0	64.0	17.7
			Mid-depth	8.8	7.5	0.0	65.0	16.7
			Near-bottom	9.1	7.5	0.0	63.0	16.0
4/12/2017	NAPS_2_20170412_03	Start	Near-surface	8.9	7.6	0.0	65.0	17.6
			Mid-depth	8.8	7.5	0.0	65.0	17.2
			Near-bottom	9.1	7.4	0.0	65.0	15.4
		End	Near-surface	8.8	7.5	0.0	65.0	17.6
			Mid-depth	8.8	7.6	0.0	65.0	17.4
			Near-bottom	8.9	7.5	0.0	65.0	16.1
4/25/2017	NAPS_2_20170425_10	Start	Near-surface	9.0	8.0	0.0	70.0	18.5
			Mid-depth	8.9	7.6	0.0	70.0	18.5
			Near-bottom	8.3	7.7	0.0	62.0	18.5
		End	Near-surface	9.3	7.3	0.0	70.0	18.5
			Mid-depth	8.7	7.3	0.0	70.0	18.5
			Near-bottom	8.2	7.3	0.0	70.0	18.5
	NAPS_2_20170425_15	Start	Near-surface	8.8	7.4	0.0	70.0	18.6
			Mid-depth	8.6	7.3	0.0	70.0	18.6
			Near-bottom	8.4	7.4	0.0	70.0	18.6
		End	Near-surface	8.7	7.3	0.0	70.0	18.6
			Mid-depth	8.4	7.3	0.0	70.0	18.6
			Near-bottom	8.5	7.3	0.0	70.0	18.6
	NAPS_2_20170425_21	Start	Near-surface	8.6	7.4	0.0	70.0	18.6
			Mid-depth	8.7	7.3	0.0	70.0	18.6
			Near-bottom	8.6	7.3	0.0	70.0	18.6
		End	Near-surface	8.7	7.3	0.0	70.0	18.6
			Mid-depth	8.6	7.3	0.0	70.0	18.6
			Near-bottom	8.5	7.3	0.0	70.0	18.5
4/26/2017	NAPS_2_20170426_03	Start	Near-surface	8.9	7.5	0.0	70.0	18.5
			Mid-depth	9.2	7.4	0.0	70.0	18.5

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
			Near-bottom	8.3	7.4	0.0	70.0	18.5
		End	Near-surface	8.6	7.4	0.0	70.0	18.5
			Mid-depth	8.7	7.3	0.0	70.0	18.5
			Near-bottom	8.7	7.3	0.0	70.0	18.5
5/16/2017	NAPS_2_20170516_09	Start	Near-surface	8.1	7.7	0.0	70.0	20.5
			Mid-depth	7.7	7.5	0.0	70.0	20.3
			Near-bottom	8.0	7.6	0.0	70.0	20.2
			Near-surface - NAPS Intake	7.8	7.4	0.0	70.0	20.5
			Mid-depth - NAPS Intake	7.8	7.3	0.0	70.0	20.1
			Near-bottom - NAPS Intake	7.5	7.1	0.0	70.0	19.8
		End	Near-surface	7.9	7.3	0.0	70.0	20.9
			Mid-depth	7.5	7.2	0.0	70.0	20.6
			Near-bottom	7.7	7.3	0.0	70.0	20.4
	NAPS_2_20170516_15	Start	Near-surface	8.5	7.2	0.0	70.0	21.3
			Mid-depth	8.0	6.9	0.0	70.0	20.4
			Near-bottom	8.0	6.9	0.0	70.0	20.2
		End	Near-surface	8.5	7.4	0.0	70.0	20.8
			Mid-depth	8.5	7.2	0.0	70.0	20.4
			Near-bottom	8.2	7.3	0.0	70.0	20.0
	NAPS_2_20170516_20	Start	Near-surface	8.7	7.6	0.0	70.0	21.8
			Mid-depth	8.4	7.3	0.0	70.0	20.4
			Near-bottom	7.8	7.4	0.0	70.0	20.0
		End	Near-surface	8.8	7.4	0.0	70.0	21.7
			Mid-depth	8.4	7.2	0.0	70.0	20.4
			Near-bottom	7.7	7.2	0.0	70.0	20.0
5/17/2017	NAPS_2_20170517_03	Start	Near-surface	8.4	7.5	0.0	70.0	21.5
			Mid-depth	8.0	7.3	0.0	70.0	20.7
			Near-bottom	8.1	7.4	0.0	70.0	20.3
		End	Near-surface	8.6	7.5	0.0	70.0	21.5
			Mid-depth	8.3	7.4	0.0	70.0	20.8
			Near-bottom	7.9	7.5	0.0	70.0	20.3
5/30/2017	NAPS_2_20170530_09	Start	Near-surface	8.0	7.7	0.0	71.0	23.6
			Mid-depth	7.8	7.4	0.0	71.0	23.6
			Near-bottom	7.6	7.4	0.0	71.0	23.3
		End	Near-surface	7.7	7.2	0.0	71.0	23.6
			Mid-depth	7.5	7.1	0.0	71.0	23.6
			Near-bottom	7.6	7.1	0.0	71.0	22.8
	NAPS_2_20170530_15	Start	Near-surface	8.2	6.7	0.0	71.0	24.2
			Mid-depth	7.7	6.7	0.0	71.0	23.9
			Near-bottom	7.6	6.7	0.0	71.0	22.9
		End	Near-surface	7.9	7.1	0.0	71.0	24.4
			Mid-depth	7.8	7.1	0.0	71.0	23.6
			Near-bottom	7.8	7.1	0.0	71.0	22.9
	NAPS_2_20170530_20	Start	Near-surface	7.2	6.6	0.0	72.0	24.2
			Mid-depth	6.8	6.7	0.0	72.0	23.9
			Near-bottom	7.0	6.6	0.0	71.0	23.1
		End	Near-surface	7.0	7.2	0.0	72.0	24.2
			Mid-depth	6.7	7.1	0.0	71.0	24.0
			Near-bottom	6.6	7.1	0.0	71.0	22.7
5/31/2017	NAPS_2_20170531_02	Start	Near-surface	7.6	7.4	0.0	72.0	23.9
			Mid-depth	7.0	7.3	0.0	72.0	24.0
			Near-bottom	7.2	7.3	0.0	71.0	23.2
		End	Near-surface	7.0	7.3	0.0	71.0	24.0
			Mid-depth	6.8	7.2	0.0	71.0	24.0
			Near-bottom	7.0	7.2	0.0	71.0	23.3
6/13/2017	NAPS_2_20170613_10	Start	Near-surface	7.3	7.5	0.0	70.0	28.7
			Mid-depth	6.6	7.4	0.0	71.0	27.5
			Near-bottom	6.4	7.3	0.0	70.0	25.1
			Near-surface - NAPS Intake	7.2	7.5	0.0	70.0	28.4
			Mid-depth - NAPS Intake	7.1	7.4	0.0	71.0	27.4
			Near-bottom - NAPS Intake	6.8	6.7	0.0	70.0	25.0
		End	Near-surface	6.4	7.1	0.0	70.0	29.7
			Mid-depth	6.5	7.2	0.0	70.0	27.6
			Near-bottom	6.6	6.6	0.0	70.0	25.6
	NAPS_2_20170613_15	Start	Near-surface	6.3	7.2	0.0	71.0	30.2
			Mid-depth	6.8	7.0	0.0	70.0	27.6
			Near-bottom	6.5	6.6	0.0	70.0	25.6
		End	Near-surface	6.3	7.3	0.0	70.0	29.4
			Mid-depth	6.5	7.1	0.0	70.0	27.6
			Near-bottom	6.3	6.7	0.0	70.0	25.1
	NAPS_2_20170613_20	Start	Near-surface	6.3	7.2	0.0	70.0	29.0
			Mid-depth	6.4	7.7	0.0	70.0	27.7
			Near-bottom	6.0	6.6	0.0	70.0	24.9
		End	Near-surface	7.1	7.4	0.0	70.0	29.0
			Mid-depth	6.4	7.6	0.0	70.0	27.9
			Near-bottom	6.2	6.7	0.0	70.0	25.4
6/14/2017	NAPS_2_20170614_02	Start	Near-surface	6.8	7.2	0.0	70.0	28.6
			Mid-depth	6.6	7.6	0.0	69.9	28.3
			Near-bottom	6.6	6.9	0.0	69.3	25.0
		End	Near-surface	6.7	7.6	0.0	69.8	28.4
			Mid-depth	6.7	7.5	0.0	69.0	28.0
			Near-bottom	6.0	7.2	0.0	71.0	25.1
6/27/2017	NAPS_2_20170627_09	Start	Near-surface	7.9	7.4	0.0	73.0	28.1
			Mid-depth	7.7	7.3	0.0	73.0	28.0
			Near-bottom	7.7	7.3	0.0	73.0	28.1
		End	Near-surface	8.0	7.4	0.0	73.1	28.3

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
			Mid-depth	7.7	7.3	0.0	73.0	28.2
			Near-bottom	7.7	7.3	0.0	73.0	28.1
	NAPS_2_20170627_14	Start	Near-surface	8.5	7.6	0.0	73.0	28.5
			Mid-depth	8.2	7.5	0.0	73.0	28.5
			Near-bottom	8.0	7.4	0.0	73.0	28.2
		End	Near-surface	8.5	7.5	0.0	73.0	28.6
			Mid-depth	7.9	7.5	0.0	73.0	28.4
			Near-bottom	7.9	7.4	0.0	73.0	28.1
	NAPS_2_20170627_20	Start	Near-surface	8.1	7.6	0.0	73.0	28.4
			Mid-depth	8.3	7.3	0.0	73.0	28.2
			Near-bottom	7.8	7.2	0.0	73.0	27.9
		End	Near-surface	8.2	7.5	0.0	73.0	28.3
			Mid-depth	8.3	7.4	0.0	73.0	28.2
			Near-bottom	7.6	7.3	0.0	73.0	28.0
6/28/2017	NAPS_2_20170628_03	Start	Near-surface	7.6	7.4	0.0	73.0	28.0
			Mid-depth	8.5	7.3	0.0	74.0	28.1
			Near-bottom	7.7	7.4	0.0	73.0	28.0
		End	Near-surface	8.2	7.3	0.0	73.0	27.9
			Mid-depth	7.7	7.3	0.0	73.0	28.0
			Near-bottom	7.8	7.3	0.0	73.0	28.0
7/11/2017	NAPS_2_20170711_09	Start	Near-surface	7.1	7.7	0.0	73.0	29.8
			Mid-depth	7.7	7.5	0.0	73.0	29.7
			Near-bottom	6.7	7.4	0.0	73.0	29.4
		End	Near-surface	8.2	7.7	0.0	73.0	29.9
			Mid-depth	9.2	7.5	0.0	73.0	29.7
			Near-bottom	7.9	7.5	0.0	73.0	29.5
			Near-surface - NAPS Intake	8.6	7.7	0.0	73.0	29.8
			Mid-depth - NAPS Intake	8.7	7.5	0.0	73.0	29.6
			Near-bottom - NAPS Intake	8.7	7.5	0.0	73.0	29.6
	NAPS_2_20170711_15	Start	Near-surface	8.8	7.8	0.0	73.0	30.1
			Mid-depth	9.6	7.6	0.0	73.0	29.8
			Near-bottom	7.4	7.6	0.0	73.0	29.6
		End	Near-surface	8.4	7.8	0.0	73.0	30.0
			Mid-depth	8.1	7.5	0.0	73.0	29.7
			Near-bottom	7.7	7.3	0.0	73.0	29.3
	NAPS_2_20170711_20	Start	Near-surface	8.5	8.0	0.0	73.0	30.1
			Mid-depth	8.6	7.7	0.0	74.0	30.0
			Near-bottom	8.9	7.4	0.0	73.0	29.4
		End	Near-surface	8.5	7.9	0.0	74.0	30.0
			Mid-depth	8.7	7.7	0.0	74.0	30.0
			Near-bottom	7.7	7.5	0.0	73.0	29.5
7/12/2017	NAPS_2_20170712_03	Start	Near-surface	7.9	7.8	0.0	73.0	29.9
			Mid-depth	8.4	7.7	0.0	73.0	29.9
			Near-bottom	7.6	7.6	0.0	73.0	29.6
		End	Near-surface	7.7	7.8	0.0	73.0	29.8
			Mid-depth	7.9	7.6	0.0	73.0	29.8
			Near-bottom	7.9	7.6	0.0	73.0	29.7
7/25/2017	NAPS_2_20170725_09	Start	Near-surface	6.0	7.7	0.0	71.3	30.9
			Mid-depth	5.5	7.4	0.0	72.0	30.9
			Near-bottom	5.7	7.4	0.0	72.2	30.9
		End	Near-surface	5.4	7.6	0.0	72.0	31.0
			Mid-depth	5.1	7.4	0.0	72.2	30.9
			Near-bottom	5.7	7.4	0.0	72.2	30.8
	NAPS_2_20170725_14	Start	Near-surface	6.6	7.9	0.0	72.0	31.6
			Mid-depth	6.2	7.7	0.0	72.0	31.4
			Near-bottom	5.5	7.5	0.0	72.0	31.2
		End	Near-surface	6.5	8.0	0.0	72.0	31.6
			Mid-depth	6.0	7.9	0.0	72.0	31.5
			Near-bottom	5.8	7.6	0.0	72.0	31.3
	NAPS_2_20170725_21	Start	Near-surface	7.2	7.9	0.0	72.0	31.1
			Mid-depth	6.0	7.8	0.0	72.0	31.1
			Near-bottom	6.6	7.9	0.0	72.0	31.1
		End	Near-surface	6.4	7.9	0.0	71.0	30.9
			Mid-depth	6.0	7.8	0.0	72.0	31.0
			Near-bottom	6.6	7.7	0.0	72.0	30.9
7/26/2017	NAPS_2_20170726_03	Start	Near-surface	6.6	7.7	0.0	72.0	30.6
			Mid-depth	5.0	7.6	0.0	72.0	30.7
			Near-bottom	6.3	7.5	0.0	72.0	30.7
		End	Near-surface	6.1	7.6	0.0	72.0	30.6
			Mid-depth	5.4	7.4	0.0	72.0	30.6
			Near-bottom	6.1	7.5	0.0	72.0	30.6
8/8/2017	NAPS_2_20170808_09	Start	Near-surface	5.5	7.3	0.0	72.0	28.7
			Mid-depth	5.7	7.3	0.0	72.0	28.7
			Near-bottom	5.8	7.3	0.0	71.0	28.8
			Near-surface - NAPS Intake	5.7	7.3	0.0	72.0	28.7
			Mid-depth - NAPS Intake	5.6	7.2	0.0	70.0	29.4
			Near-bottom - NAPS Intake	5.6	7.2	0.0	70.0	29.2
		End	Near-surface	6.1	7.3	0.0	72.0	28.8
			Mid-depth	6.0	7.3	0.0	72.0	28.8
			Near-bottom	6.0	7.3	0.0	72.0	28.8
	NAPS_2_20170808_15	Start	Near-surface	6.1	7.5	0.0	72.0	29.0
			Mid-depth	6.7	7.3	0.0	72.0	28.9
			Near-bottom	6.7	7.4	0.0	72.0	29.0
		End	Near-surface	6.0	7.5	0.0	72.0	29.1
			Mid-depth	6.5	7.4	0.0	72.0	29.0
			Near-bottom	5.8	7.4	0.0	72.0	29.0

SampleDate	Sample ID	Period	Stratum	DO (mg/L)	pH	Salinity (ppt)	Specific Conductivity (uS/cm)	Water Temperature (°C)
	NAPS_2_20170808_21	Start	Near-surface	6.1	7.4	0.0	72.0	28.9
			Mid-depth	6.2	7.4	0.0	72.0	28.9
			Near-bottom	6.3	7.3	0.0	72.0	28.7
		End	Near-surface	6.9	7.4	0.0	72.0	28.8
			Mid-depth	6.1	7.4	0.0	72.0	28.8
			Near-bottom	5.7	7.2	0.0	72.0	28.6
8/9/2017	NAPS_2_20170809_03	Start	Near-surface	7.0	7.3	0.0	72.0	28.6
			Mid-depth	6.4	7.3	0.0	72.0	28.6
			Near-bottom	6.4	7.4	0.0	72.0	28.6
		End	Near-surface	7.0	7.3	0.0	72.0	28.6
			Mid-depth	6.2	7.3	0.0	72.0	28.6
			Near-bottom	6.1	7.3	0.0	72.0	28.6
8/22/2017	NAPS_2_20170822_10	Start	Near-surface	6.5	6.7	0.0	69.0	30.4
			Mid-depth	6.7	6.8	0.0	70.0	30.3
			Near-bottom	6.5	6.8	0.0	70.0	30.0
		End	Near-surface	6.3	7.2	0.0	70.0	30.5
			Mid-depth	6.2	7.1	0.0	70.0	30.3
			Near-bottom	6.3	7.1	0.0	70.0	30.0
	NAPS_2_20170822_15	Start	Near-surface	6.9	7.2	0.0	69.0	30.5
			Mid-depth	6.4	7.1	0.0	69.0	30.2
			Near-bottom	6.7	7.2	0.0	69.0	30.2
		End	Near-surface	7.0	7.1	0.0	69.0	30.4
			Mid-depth	6.5	7.2	0.0	69.0	30.4
			Near-bottom	6.4	7.1	0.0	69.0	30.0
	NAPS_2_20170822_21	Start	Near-surface	6.9	7.6	0.0	69.0	30.6
			Mid-depth	7.0	7.4	0.0	69.0	30.6
			Near-bottom	5.8	7.3	0.0	69.0	30.0
		End	Near-surface	6.7	7.4	0.0	69.0	30.6
			Mid-depth	6.2	7.3	0.0	69.0	30.5
			Near-bottom	6.0	7.3	0.0	69.0	30.2
8/23/2017	NAPS_2_20170823_03	Start	Near-surface	6.1	7.3	0.0	69.0	30.3
			Mid-depth	6.6	7.2	0.0	69.0	30.4
			Near-bottom	6.2	7.3	0.0	69.0	30.3
		End	Near-surface	6.1	7.3	0.0	70.0	30.2
			Mid-depth	6.2	7.2	0.0	70.0	30.3
			Near-bottom	5.7	7.2	0.0	70.0	30.1
9/5/2017	NAPS_2_20170905_09	Start	Near-surface	6.5	7.5	0.0	71.4	26.5
			Mid-depth	6.5	7.2	0.0	71.7	26.4
			Near-bottom	6.6	7.3	0.0	72.4	26.4
			Near-surface - NAPS Intake	6.7	7.1	0.0	71.3	26.4
			Mid-depth - NAPS Intake	6.9	6.9	0.0	72.3	26.3
			Near-bottom - NAPS Intake	6.5	6.9	0.0	72.2	26.2
		End	Near-surface	7.5	7.1	0.0	68.8	26.6
			Mid-depth	6.7	6.8	0.0	68.7	26.6
			Near-bottom	6.5	7.0	0.0	69.1	26.4
	NAPS_2_20170905_14	Start	Near-surface	7.7	6.9	0.0	69.0	26.7
			Mid-depth	7.3	6.4	0.0	68.0	26.4
			Near-bottom	7.0	6.2	0.0	68.0	26.3
		End	Near-surface	7.6	6.9	0.0	69.0	26.6
			Mid-depth	7.4	6.6	0.0	68.0	26.5
			Near-bottom	6.5	6.5	0.0	68.0	26.3
	NAPS_2_20170905_21	Start	Near-surface	8.1	7.4	0.0	68.0	26.8
			Mid-depth	7.5	7.3	0.0	68.0	26.8
			Near-bottom	7.2	7.3	0.0	68.0	26.3
		End	Near-surface	7.8	7.5	0.0	68.0	26.8
			Mid-depth	6.9	7.3	0.0	68.0	26.8
			Near-bottom	6.8	7.4	0.0	68.0	26.3
9/6/2017	NAPS_2_20170906_03	Start	Near-surface	7.8	7.4	0.0	68.0	26.8
			Mid-depth	7.5	7.3	0.0	68.0	26.8
			Near-bottom	6.9	7.2	0.0	68.0	26.3
		End	Near-surface	7.8	7.4	0.0	68.0	26.7
			Mid-depth	7.4	7.3	0.0	68.0	26.7
			Near-bottom	6.7	7.3	0.0	68.0	26.4

Enclosure 4
Attachment 2

LETTER FROM J. WILLIAMS TO S. MACKERT, DATED MARCH 12, 2019, RE: VPDES PERMIT NO. VA0052451: APPLICATION FOR PERMIT REISSUANCE – 316(B) 40 CFR §122.21 (R)(10)-(13)
[without Appendices and Attachment]

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Dominion Energy Services, Inc.
5000 Dominion Boulevard, Glen Allen, VA 23060
DominionEnergy.com

Dominion Energy®

BY U.S. MAIL
RETURN RECEIPT REQUESTED

March 12, 2019

Ms. Susan Mackert
Department of Environmental Quality
Northern Regional Office
13901 Crown Court
Woodbridge, VA 22193

RE: Dominion Energy North Anna Power Station VPDES Permit No. VA0052451: Application for Permit Reissuance – 316(b) 40 CFR §122.21(r)(10)-(13)

Dear Ms. Mackert:

Enclosed are reports that have been generated for the North Anna Power Station's water intake structure to satisfy the requirements of 40 CFR §122.21 (r)(10)-(13). By letter dated October 5, 2018, DEQ granted an extension of the deadline for submittal of this information to March 15, 2019. This submittal completes Dominion Energy's application for reissuance of North Anna Power Station's VPDES permit.

Please feel to contact Ken Roller at Kenneth.roller@dominionenergy.com or at (804) 273-3494 should you have any questions about this information.

Sincerely,

Jason E. Williams, P.G.
Director, Environmental Services

Enclosure:
North Anna Power Station 40 CFR §122.21(r)(10)-(13) Submittal

cc:

Regional Administrator
U.S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE, Suite 1200
Atlanta, Georgia 30303-1257
RE: North Anna Units 1 and 2
Docket Nos. 50-338/50-339
License Nos. NPF-4NPF-7

U.S. Nuclear Regulatory Commission
Attention Document Control Desk
Washington, DC 20555
RE: North Ann Units 1 and 2
Docket Nos. 50-338/50-339
License Nos. NPF-4NPF-7

NRC Resident Inspector
North Anna Power Station

ebc link to Documentum:

Amanda Tornabene
Daniel Stoddard
Larry Lane
Jason Williams
Bill Standley
Donald Taylor
Randy Markey
Karen Canody
Oula Shehab-Dandan
Cathie Tiernan
Bob Graham
Tony Banks
Brian Conte
Ken Roller

Documentum:
North Anna Units 1 and 2/Water-NPDES/Permit-Application
NA VA0052451 316(b) 122.21(r)(19)-(13) Submittal March 2019

North Anna Power Station
40 CFR §122.21(r)(10-(13)Submittal
March 2019
Certification Statement

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.

Larry Lane, Site Vice President

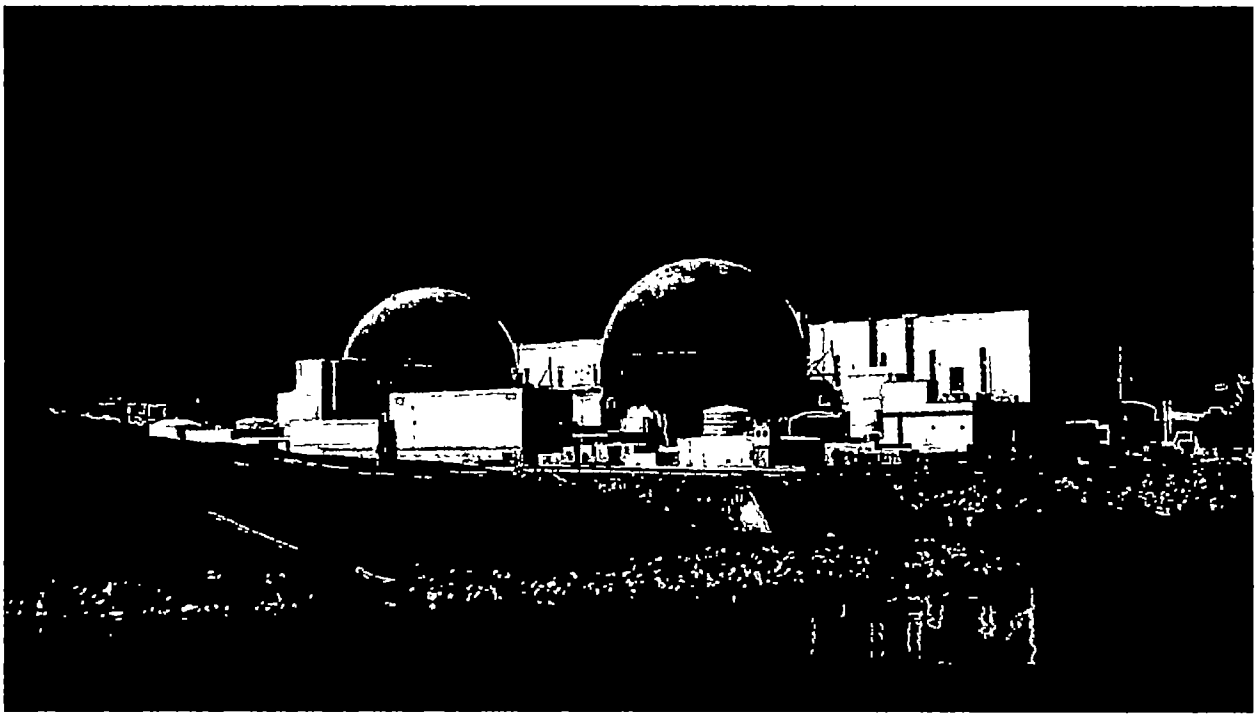
3-7-19
Date

Dominion North Anna Power Station

National Pollutant Discharge Elimination System (NPDES) Permit No. VA0052451

DRAFT Updated Final §316(b) Rule Information

40 CFR 122.21(r)(10)-(r)(12) Submittals



Prepared for:
Dominion Energy

January 2019

Prepared by:
Enercon Services, Inc.
Normandeau Associates, Inc.
and
NERA Economic Consulting

NERA
Economic Consulting
200 Clarendon Street
Boston, MA 02116

ENERCON
Excellence—Every project. Every day
500 TownPark Lane
Kennesaw, GA 30144

NORMANDEAU ASSOCIATES
Environmental Consultants
25 Nashua Road
Bedford, NH 03110

Table of Contents

1 Introduction and Regulatory Framework 10
1.1 North Anna Power Station Background 10
2 Comprehensive Technical Feasibility And Cost Evaluation Study (40 CFR § 122.21 (r)(10)) 12
2.1 40 CFR §1221.21 (r)(10) Requirements: 12
2.2 Technologies and/or Operational Measures Screening Process 13
2.3 Flow Reductions via Flow Modifications 14
2.3.1 Overview of Flow Modifications Technologies and Operational Measures 14
2.3.2 Conceptual Implementation of Flow Modification TOMs 17
2.3.3 Impacts of Flow Modifications 18
2.3.4 Implementation Schedule 33
2.3.5 Cost Estimates 33
2.3.6 References 34
2.4 2 mm Fine-Mesh Screens 35
2.4.1 Existing Cooling Water Intake System 35
2.4.2 Conceptual Design of 2 mm Fine-Mesh Screens 35
2.4.3 Impacts of 2 mm Fine-Mesh Screens 57
2.4.4 Implementation Schedule 76
2.4.5 Cost Estimates 79
2.4.6 References 82
2.5 Social and Compliance Cost Estimates 85
2.5.1 Social Cost Estimates 85
2.5.2 Compliance Cost Estimates 98
2.5.3 Summary 104
2.5.4 References 104
2.5.5 Figures 106
3 Benefits Valuation Study (40 CFR § 122.21 (r)(11)) 110
3.1 §122.21(r)(11) Requirements 110
3.2 Introduction 110
3.3 Impingement and Entrainment Information 111
3.3.1 Impingement Mortality Data 111
3.3.2 Entrainment Abundance Data 111
3.3.3 Entrainment Abundance Estimates for the Existing CWIS 112
3.3.4 Entrainment Reductions from Seasonal Flow Reductions 114
3.3.5 Entrainment Reductions from 2 mm Fine-Mesh Screens 115
3.3.6 Tables and Figures 117
3.4 Biological Benefits of Entrainment Reduction Technologies 149
3.4.1 Technical Approach 149
3.4.2 Biological Benefits Estimation Methods 149
3.4.3 Biological Benefits 156
3.4.4 Tables and Figures 159
3.5 Biological Basis of Non-Use Benefits 176
3.5.1 Threatened and Endangered Species 176

3.5.2 Long-lasting or Irreversible Effects on Species Populations 177
3.5.3 Tables and Figures 179
3.6 Social Benefits Valuation 182
3.6.1 Overview of Benefits Methodology 182
3.6.2 Biological Fish Benefits 184
3.6.3 Monetized Use Benefits 187
3.6.4 Evaluation of Non-Use Benefits 189
3.6.5 Total Monetized Benefits 196
3.7 Prior Mitigation Efforts 196
3.8 Other Benefits 197
3.9 Summary 198
3.10 References 198
4 Non-Water Quality Environmental And Other Impacts Study (40 CFR § 122.21 (r)(12)) 203
4.1 § 122.21 (r)(12) Requirements: 203
4.2 Flow Reductions via Flow Modifications 203
4.2.1 Construction-related Impacts 204
4.2.2 Operational-related Impacts 204
4.3 Fine-Mesh Screens 206
4.3.1 Construction-related Impacts 206
4.3.2 Operational-related Impacts 208
4.4 References 210

List of Appendices

Appendix A: Technologies and/or Operational Measures Screening Memo 36 Pages
Appendix B: Fine-Mesh Screen Conceptual Drawings 8 Pages
Appendix C: Fine-Mesh Screen Project Cost Estimate 2 Pages
Appendix D: Fine-Mesh Screen Construction Schedule 1 Page
Appendix E: Fine-Mesh Screen Structural Calculations Mathcad Printout 27 Pages
Appendix F: Life History Tables 12 Pages

List of Attachments

Attachment 1: Fine-Mesh Screen Vendor Quotations 55 Pages

Executive Summary – 40 CFR 122.21(r)(10)-(r)(12) Reports

Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion) owns and operates the North Anna Power Station (NAPS), located on Lake Anna, a reservoir in Louisa County, Virginia. With two nuclear units (Units 1 and 2) designed to generate collectively 1,892 megawatts of electric power and withdraw 2,749 million gallons per day (MGD) for non-contact cooling purposes, NAPS is subject to compliance with the U.S. Environmental Protection Agency's (EPA) Final §316(b) Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities (Final §316(b) Rule). NAPS withdraws and discharges non-contact cooling water from Lake Anna in accordance with Virginia Pollutant Discharge Elimination System (VPDES) Permit Number VA0052451 (VPDES Permit). In accordance with the Final §316(b) Rule, Dominion has prepared this document which contains a series of reports to address the Final §316(b) Rule information requirements specified in Sections §122.21 (r)(10)-r(12).

To assist with the development of the §122.21(r) submittals, Dominion enlisted the services of several engineering, biological, and economic consulting firms. The §122.21(r)(10) – (r)(12) submittals contained in this report were developed by Enercon Services, Inc. (ENERCON), Normandeau Associates, Inc. (Normandeau), and NERA Economic Consulting (NERA). For these submittals ENERCON authored Sections 2.1 – 2.4 and Section 4, Normandeau authored Sections 3.1, 3.3 – 3.5, and Section 3.7, and NERA authored Sections 0, 3.2, 3.6, 3.6.4, and 3.8.

The purpose of Dominion's §122.21(r)(10)-(r)(12) submittals is to provide the information necessary to make a best technology available (BTA) determination after consideration of all factors relevant to such a determination under the Final §316(b) Rule for NAPS. A summary of each §122.21(r) requirement follows:

§122.21(r)(10) - Comprehensive Technical Feasibility and Cost Evaluation Study

This section provides a description of the comprehensive, two-step technologies and/or operational measures (TOMs) screening process that was used to evaluate potential TOMs for implementation at NAPS (details of this process are provided in Appendix A). Based on the screening process, two TOMs were selected for detailed and comprehensive evaluation; (1) flow reductions via circulating water pump curtailments and (2) 2 mm fine-mesh screens. Conceptual designs, cost estimates, and implementation schedules are presented for each selected technology along with a preliminary evaluation of potential operational, construction, and regulatory impacts. Social costs and compliance costs are calculated for the two technology options.

§122.21(r)(11) - Benefits Valuation Study

This section provides an evaluation of potential benefits for the two potential entrainment reduction technologies and operational measures evaluated pursuant to §122.21(r)(10). The potential benefits were developed using data generated by the Entrainment Characterization Study completed pursuant to §122.21(r)(9) and long-term ecological monitoring study results. Each category of benefits is described narratively, and when possible, benefits are quantified in physical or biological units and monetized using appropriate economic valuation methods.

§122.21(r)(12) - Non-Water Quality Environmental and Other Impacts Study

This section includes a detailed, NAPS-specific discussion of the changes in non-water quality environmental and other impacts attributed to each technology and operational measure selected for detailed and comprehensive evaluation pursuant to §122.21(r)(10), including both impacts increased and impacts decreased. The study includes estimates of changes to energy consumption, estimates of air pollutant emissions and estimates of the human health and environmental impacts associated with such emissions, estimates of changes in noise, impacts to safety, discussion of facility reliability, significant changes in consumption of water, and a discussion of reasonable efforts to mitigate each of these factors.

Summary of the Report

This report includes detailed information developed in response to §122.21(r)(10) – (12) of the Final §316(b) Rule. The Executive Summary provides a summary of the existing controls at NAPS as well as identified potential additional technologies and/or operational measures selected for a detailed and comprehensive review.

Existing Controls

Closed-Cycle Recirculating System

As defined in 40 CFR §125.92(c), a closed-cycle recirculating system (CCRS) is a system that passes cooling water through the condenser and other components of the cooling system and reuses the water for cooling multiple times. A CCRS can include a system with impoundments of waters of the U.S. where the impoundment was constructed prior to October 14, 2014 and created for the purpose of serving as part of the cooling water system. As described in further detail in the sections below, Lake Anna was created by impounding the North Anna River to use as a cooling water source for surface condensers and other heat exchanger equipment at NAPS. Dominion Energy has received confirmation from the Virginia Department of Environmental Quality (VDEQ) that Lake Anna and the Waste Heat Treatment Facility (WHTF) meet the definition of a CCRS as provided in 40 CFR §125.92(c). Therefore, through its construction and use of Lake Anna and the WHTF as part of the cooling water system, NAPS is currently operating a CCRS year-round as an existing technology.

Planned Spring Refueling Outages

NAPS operates on an 18-month fuel cycle, with the refueling outages occurring in either the spring (typically between mid-March and early April) or the fall (typically between mid-September and early October), depending on where each unit is in the refueling cycle. Planned outage schedules for each unit are aligned with a portion of the entrainment season every other outage, resulting in the shutdown of the circulating water pumps for that unit, reducing the amount of water withdrawn during these periods. The reduction in impingement and entrainment is proportional to the reduction in cooling water volume withdrawn. Because the spring outages occur during a portion of the spring entrainment season, the reduction in intake flows at that time already provides an incremental reduction in entrainment at NAPS.

Potential Additional Technologies and/or Measures

Flow Reductions

Implementation of flow reductions via flow modifications would require only operational modifications at NAPS, and therefore no design changes are necessary. Likewise, no capital costs are incurred. The following is a high-level summary of the findings and conclusions contained within this report.

- A flow reduction of approximately 21.8% was evaluated, achieved by removing one CW pump from service for one unit (operating the remaining three pumps unthrottled) and operating all four of CW pumps for the second unit, with three of the four pumps throttled. This flow reduction scenario was evaluated assuming implementation during the months of May and June.
- At a recommended flow reduction of 21.8% during May and June, it was estimated that a total entrainment reduction of approximately 10% could be achieved.
- The total lost generating capacity due to flow reductions is estimated to be an average of 13.7 MWe for the month of May and 23.6 MWe for the month of June. This would result in a loss of electricity supplied to the grid of 24,929 MWhr per year[1].
- Implementing flow reductions would require the plant to operate at a higher condenser backpressure during May and June, increasing the risk for a plant trip.

Fine-Mesh Screens

The conceptual design to implement fine-mesh screens at NAPS includes retrofitting the existing through-flow traveling water screens with a 2 mm fine-mesh, construction of two new intake structures located to the east and west of the existing intake structure to house new dual-flow 2 mm fine-mesh screens, and the installation of a fish handling return system. The following provides a high-level summary of the findings and conclusions contained within this report.

- The total estimated construction cost for retrofitting NAPS to 2 mm fine-mesh screens is $33,400,000 based upon 2018 dollars.
- Operation and maintenance costs for the new intake structures and supporting equipment are estimated to be $179,900 annually.
- Retrofitting NAPS with fine-mesh screens would result in parasitic power losses due to the power requirements of the new equipment and pumps. The total lost generating capacity due to this is estimated to be 316 kW. This would result in a loss of electricity supplied to the grid of 2,768 MWhr per year.
- The total project schedule for retrofitting NAPS to fine-mesh screens is estimated to be approximately 44 months. This estimate is "best case" and includes 12 months to complete the detailed engineering design, 12 months for permitting, 5 months for initial procurement activities, and 15 months for construction, tie-in, and startup testing.

[1] Assuming a 91.7% utilization factor (average five-year capacity factor from the values presented in the §122.21(r)(8) Operational Status report)

- At a gross output of 1,002 MWe and a 91.7% utilization factor, construction related outage time would result in 617,456 MWhr in lost power generation. Only the lost generation from one unit is considered because the construction activities requiring a plant shutdown would be performed during the other unit's normally scheduled refueling outage.
- Federal, state, and local reviews, permits, and authorizations would be required for the proposed fine-mesh modifications, including USACE, NEPA, NRC, DEQ, and Louisa County. It is recommended that any detailed design efforts include a permitting evaluation for the project, as significant regulatory reviews are anticipated in order to implement this alternative. Implementation could face delays due to the potential for lengthy federal, state, and local permit processes.

Summary of the Results

Results regarding the potential two additional technologies and/or operational measures is summarized in two tables in this section. Table ES-1 highlights results related to biological effectiveness, engineering costs related to construction and operation, power costs, administrative costs and other impacts/challenges. Table ES-2 summarizes the monetized estimates of social benefits and social costs for these various technologies using well-established economic methodologies.

Table ES- 1: Summary of Comparisons of Entrainment Reduction Technologies

Technology	Estimated Effectiveness	Project Costs[2]				Power Costs[2]		Administrative Costs[2]		Impacts and Challenges
	Entrainment Reduction	Capital Cost (millions)		O&M Costs (millions)		Cost of Power Loss (millions)		Administrative Costs (millions)		
Discount Rate		3%	7%	3%	7%	3%	7%	3%	7%	
Flow Reductions via Flow Modifications	4.8 – 21.9% (species dependent) 9.9% (all species)	N/A	N/A	N/A	N/A	$23.72	$16 75	$0.01	$0.01	• Reduction in electricity provided to the grid • Increased risk of plant trip due to high condenser backpressure
2 mm Fine-Mesh Screens	0.3 – 88.0% (species dependent) 8.7% (all species)	$33.08	$29.90	$2.46	$1.54	$36.04	$30.86	$0.07	$0.06	• Permanent and temporary construction-related environmental impacts • Operational impacts with fine-mesh screens • Significant permitting requirements

[2] Costs are presented as net present values. All dollar values are in real 2018 dollars. Present values are calculated as of January 1, 2020 for costs that are assumed to begin on January 1, 2020 and end on December 31, 2043. The analysis end date reflects the 20-year useful life of the 2 mm fine-mesh screens, which are predicted to become operational at the end of 2023. See Table 2-32.

Table ES- 2: Summary of Social Benefits and Social Costs (millions, 2018$)[3]

Technology	Social Costs	Social Benefits	Net Social Costs	Cost-Benefit Ratio
3% Discount Rate				
Flow Reductions via Flow Modifications	$23.72	$0.27	$23.45	**88**
2 mm Fine-Mesh Screens	$71.65	$0.96	$70.68	**75**
7% Discount Rate				
Flow Reductions via Flow Modifications	$16.75	$0.19	$16.57	**90**
2 mm Fine-Mesh Screens	$62.36	$0.60	$61.75	**103**

[3] Social costs and benefits are presented as net present values. All dollar values are in real 2018 dollars. Present values are calculated as of January 1, 2020 for costs that are assumed to begin on January 1, 2020 and end on December 31, 2043. The analysis end date reflects the 20-year useful life of the 2 mm fine-mesh screens, which are predicted to become operational at the end of 2023. See Table 2-32 and Table 3-53.

Overall Conclusions

EPA's Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities (40 CFR Parts 122 and 125) establishes a process for a site-specific determination of entrainment control requirements at existing facilities with cooling water intake structures. The selection of any such site-specific entrainment controls must be based on a determination of the permitting agency of the maximum reduction in entrainment warranted after consideration of the information provided by the applicant's §122.21(r) submissions and the consideration of the factors relevant to a BTA determination pursuant to 40 CFR §125.94 and §125.98, including, but not limited to, air emission impacts, energy impacts and whether the cost of additional entrainment controls are justified or not by their potential benefits.

NAPS's §122.21(r)(10)-(12) submittals include evaluation of engineering, ecological, biological, regulatory, and economic assessments consistent with the Final §316(b) Rule. This evaluation includes investigation of the plant operational factors, implementation costs, and the monetized value of the resources potentially protected under each of the potential entrainment control technologies that were determined to be most appropriate potential additions to the current controls. The results developed in this document indicate that the social costs exceed the social benefits for these two potential entrainment technologies, leading to substantial net social costs. The present values of net social costs (i.e., social costs minus social benefits) range from $16.57 million to $23.45 million for the flow reduction alternative and from $61.75 million to $70.68 million for the 2 mm fine mesh screens, with the range based upon differences in the discount rate. Put another way, the social costs for both options are more than 75 times as great as the social benefits.

Based on the information provided, it is concluded that neither of the two potential entrainment control technologies evaluated should be implemented as BTA. Instead, the actions taken to date at NAPS–including the existing CCRS utilized by the station (consisting of Lake Anna and the WHTF, which were created by the station to use as a cooling water source) and the planned spring refueling outages that are aligned with a portion of the entrainment season–constitute BTA and should be continued.

1 Introduction and Regulatory Framework

EPA's Final §316(b) Rule established requirements under the Clean Water Act (CWA) for existing power generating facilities that withdraw more than 2 million gallons per day (MGD) of water from waters of the United States and use at least 25 percent of that water for cooling purposes. Those requirements, implemented through National Pollutant Discharge Elimination System (NPDES) permits, apply to the location, design, construction, and capacity of cooling water intake structures (CWIS) that reflect the Best Technology Available (BTA) for minimizing adverse environmental impact (AEI). There are two main components of the Final §316(b) Rule for existing facilities such as NAPS. The first requires the owner or operator of the facility to choose one of seven options for meeting BTA requirements for reducing impingement. The second component requires the facility to conduct studies to help their permitting authority determine whether and what site-specific controls, if any, would be required to reduce entrainment.

To address these two components, the Final §316(b) Rule establishes additional permit application requirements for existing power plants that include twelve distinct submittals (40 CFR 122.21(r)(2) through (13)) as follows:

- §122.21(r)(2) - -Source Water Physical Data
- §122.21(r)(3) - -Cooling Water Intake Structure Data
- §122.21(r)(4) - -Source Water Baseline Biological Characterization Data
- §122.21(r)(5) - -Cooling Water System Data
- §122.21(r)(6) - -Chosen Method of Compliance with Impingement Mortality Standard
- §122.21(r)(7) - -Entrainment Performance Studies
- §122.21(r)(8) - -Operational Status
- §122.21(r)(9) - -Entrainment Characterization Study
- §122.21(r)(10) - -Comprehensive Technical Feasibility and Cost Evaluation Study
- §122.21(r)(11) - -Benefits Evaluation Study
- §122.21(r)(12) - -Non-Water Quality Environmental and Other Impacts Study
- §122.21(r)(13) - -Peer Reviews

1.1 North Anna Power Station Background

NAPS is a two-unit, pressurized water reactor (PWR) nuclear power plant that is owned and operated by Dominion Energy and Old Dominion Electric Cooperative. NAPS is located on the southern shore of Lake Anna in Louisa County. Lake Anna was created by impounding the North Anna River, and was developed by Virginia Electric and Power Company (VEPCO) to use as a cooling water source and for other processes at NAPS. Lake Anna was constructed to serve the needs of the NAPS and was designed to provide adequate cooling water for an ultimate nuclear station capacity of approximately 4000 MWe. While Lake Anna was constructed for power station purposes, it also provides the additional multipurpose benefits of low stream flow augmentation,

flood control, and recreation. Lake Anna State Park provides recreational facilities for picnicking, fishing, boat launching, swimming, and biking.

Each of the two existing units (Units 1 and 2) are three-loop Westinghouse PWR designs, and became operational in 1978 and 1980, respectively. The units were originally designed with a licensed core power rating of 2775 MWt. However, in 1986, both units were uprated to a core power output of 2893 MWt. The latest uprate occurred in 2010 and 2012 for Unit 2 and Unit 1, respectively, where the core power output increased to 2940 MWt.

The original 40-year operating licenses for NAPS Units 1 and 2 were issued by the Nuclear Regulatory Commission (NRC) in 1978 and 1980, respectively. In 2003, the NRC approved a license renewal for NAPS, extending each of the operating licenses for both units an additional 20 years. In November of 2017, Dominion declared its intent to pursue a subsequent license renewal (SLR) for NAPS, which would extend the operating licenses an additional 20 years. The subsequent license renewal application (SLRA) is scheduled to be submitted to the NRC in 2020.

2 Comprehensive Technical Feasibility And Cost Evaluation Study (40 CFR § 122.21 (r)(10))

2.1 40 CFR §1221.21 (r)(10) Requirements:

§122.21(r)(10) of the Final §316(b) Rule requires submittal of a Comprehensive Technical Feasibility and Cost Evaluation Study consistent with the following requirements:

> *"For an existing facility that withdraws greater than 125 MGD actual intake flow (AIF), submit an engineering study of the technical feasibility and incremental costs of candidate entrainment control technologies. In addition, the study must include the following:*
>
> *(i) Technical feasibility. An evaluation of the technical feasibility of closed-cycle recirculating systems as defined at 40 CFR 125.92(c), fine-mesh screens with a mesh size of 2 millimeters or smaller, and water reuse or alternate sources of cooling water. In addition, this study must include:*
>
> *a. A description of all technologies and operational measures considered (including alternative designs of closed-cycle recirculating systems such as natural draft cooling towers, mechanical draft cooling towers, hybrid designs, and compact or multi-cell arrangements);*
>
> *b. A discussion of land availability, including an evaluation of adjacent land and acres potentially available due to generating unit retirements, production unit retirements, other buildings and equipment retirements, and potential for repurposing of areas devoted to ponds, coal piles, rail yards, transmission yards, and parking lots;*
>
> *c. A discussion of available sources of process water, grey water, waste water, reclaimed water, or other waters of appropriate quantity and quality for use as some or all of the cooling water needs of the facility; and*
>
> *d. Documentation of factors other than cost that may make a candidate technology impractical or infeasible for further evaluation.*
>
> *(ii) Other entrainment control technologies. An evaluation of additional technologies for reducing entrainment may be required.*
>
> *(iii) Cost evaluations. The study must include engineering cost estimates of all technologies considered in paragraphs (i) and (ii) above. Facility costs must also be adjusted to estimate social costs. All costs must be presented as the net present value (NPV) and the corresponding annual value. Costs must be clearly labeled as compliance costs or social costs. The applicant must separately discuss facility level compliance costs and social costs, and provide documentation as follows:*
>
> *a. Compliance costs are calculated as after-tax, while social costs*

are calculated as pre-tax. Compliance costs include the facility's administrative costs, including costs of permit application, while the social cost adjustment includes the Director's administrative costs. Any outages, downtime, or other impacts to facility net revenue, are included in compliance costs, while only that portion of lost net revenue that does not accrue to other producers can be included in social costs. Social costs must also be discounted using social discount rates of 3 percent and 7 percent. Assumptions regarding depreciation schedules, tax rates, interest rates, discount rates and related assumptions must be identified;

b. Costs and explanation of any additional facility modifications necessary to support construction and operation of technologies considered in (i) and (ii) above, including but not limited to relocation of existing buildings or equipment, reinforcement or upgrading of existing equipment, and additional construction and operating permits. Assumptions regarding depreciation schedules, interest rates, discount rates, useful life of the technology considered, and any related assumptions must be identified; and

c. Costs and explanation for addressing any non-water quality environmental and other impacts identified in paragraph 122.21 (r)(12). The cost evaluation must include a discussion of all reasonable attempts to mitigate each of these impacts."

2.2 Technologies and/or Operational Measures Screening Process

Prior to conducting the full comprehensive technical feasibility and cost evaluation study for NAPS, a two-step technologies and operational measures (TOMs) screening process was performed. This screening process is documented in the July 13, 2018 memorandum, provided in Appendix A.

For the initial screening, a comprehensive list of potential options available at NAPS for Final §316(b) Rule compliance was assembled using a list of TOMs developed from input by Dominion, EPA Technical Development Documents, vendor documentation, and previous ENERCON project experience. Dominion Energy received confirmation from VDEQ that Lake Anna and the WHTF meet the definition of a CCRS as provided in 40 CFR §125.92(c)(2), which is a pre-approved technology for impingement mortality purposes in 40 CFR§125.94(c)(1) and is Dominion's chosen impingement compliance method in accordance with 40 CFR §122.21(r)(6); therefore, the initial screening process did not retain any TOM that could not provide incremental entrainment reduction benefits. Additionally, because the existing technology at NAPS (Lake Anna and the WHTF) is CCRS, the screening process focused on fine-mesh screens, water reuse, and a number of other non-CCRS TOMs.

The initial screening was performed for each TOM based on criteria that generally included: whether the TOM is commercially available and/or proven in the nuclear industry; whether the TOM would be generally consistent with the Nuclear Regulatory Commission (NRC) General

Design Criteria (GDC) and other safety, licensing, or design requirements; whether NAPS would be able to obtain approval from permitting agencies; whether there is available real estate in which to implement or install the TOM; and whether the TOM may provide entrainment benefit beyond that available from equivalent/existing technologies and/or measures.

Following the initial screening, a secondary screening was performed on the remaining TOMs. Screening criteria for the secondary screening included, but were not limited to, the following:

1. Effectiveness at reducing entrainment impacts;
2. Environmental impacts;
3. Surrounding land use impacts;
4. Impact on reliability, operation, and efficiency;
5. Interference with existing structures and equipment; and,
6. Permitting feasibility.

The main objective of this initial and then further screening process was to identify the TOMs most viable and compatible for use at NAPS to be considered during the comprehensive evaluation. Following the secondary screen, the TOMs that were selected for a full technical feasibility and cost evaluation study were; (i) flow reductions via flow modifications (through a combination of the existing planned spring refueling outages and potential new seasonal flow reductions); and (ii) the permanent installation of 2 mm fine-mesh panels on existing and new traveling water screens. These technologies are evaluated in detail in sections 2.3 and 2.4, below.

Note that water reuse and alternate sources of cooling water were evaluated during the initial screening processes, consistent with the requirements of §122.21(r)(10)(i),but were ultimately not retained for the comprehensive evaluation due to the minimal amount of alternative water sources available. As described above, because the existing technology at NAPS (Lake Anna and the WHTF) is CCRS, the screening process focused on fine-mesh screens, water reuse, and a number of other non-CCRS TOMs.

2.3 Flow Reductions via Flow Modifications

2.3.1 Overview of Flow Modifications Technologies and Operational Measures

In the TOM screening process (Appendix A), several flow modification TOMs were evaluated, including planned seasonal refueling outages, seasonal flow reductions, and variable speed pumps (achieved either by installing variable frequency drives on the existing circulating water (CW) pumps or via the installation of new variable speed CW pumps). Although each of these technologies would operate differently, they all work to reduce the amount of water withdrawn for plant operation and thereby reduce the amount of entrainment.

2.3.1.1 Planned Seasonal Refueling Outages

NAPS operates on an 18-month fuel cycle, with the refueling outages occurring in either the spring (typically between mid-March and early April) or the fall (typically between mid-September and

early October), depending on where each unit is in the refueling cycle. Planned outage schedules for each unit occur during a portion of the entrainment season every other outage, reducing the amount of water withdrawn during these periods. The reduction in impingement and entrainment during these periods is proportional to the reduction in cooling water volume withdrawn.

Because the spring outages occur during a portion of the spring entrainment season, the reduction in intake flows at that time already provides an incremental reduction in entrainment at NAPS. This flow reduction is captured in the actual intake flow values presented in Section 5.1.3 of the §122.21(r)(5) Cooling Water System Data report. As a result, the planned seasonal refueling outages operational measure was screened in for further evaluation in tandem with other TOMs, because it is low-cost (already in place at NAPS) and provides incremental benefits.

It should be noted, however, that movement of the outage to another part of the year is not proposed, since it would be challenging and would not significantly increase the entrainment reduction potential of the operational measure. For example, a spring outage shift to April could be considered. This is the most promising application of an outage shift, since it is the only month for which entrainment percentages were significant (8% of annual entrainment), and the schedule shift is minimal. However, considering a frequency of two outages every three years, where intake flow is cut in half during an outage, the effective entrainment reduction percentage is reduced to approximately 2.7%. The challenges required to shift the outage schedules include detailed safety analyses related to increasing the fuel cycle duration during the transition as well as managing impacts to the grid during a period of higher electricity demand. Such challenges are not considered warranted for such a small entrainment benefit.

2.3.1.2 Seasonal Flow Reductions

Seasonal flow reductions at NAPS could be implemented by throttling and/or securing individual CW pumps during portions of the entrainment season, thus reducing the total volume of water withdrawn from Lake Anna. The resulting reduction in entrainment would be proportional to the reduction in cooling water withdrawn. Entrainment density is highest from May to July with a peak in July; therefore, entrainment reduction may be beneficial if intake flow can be reduced during this time. The percentages of flow reduction that are allowable during these months depend upon Lake Anna water temperature and the design and operating margin of the condensers at NAPS.

Among the three months of peak entrainment (May – July), flow reductions are most likely to be a viable option in May and June, since Lake Anna water temperature begins rising substantially in June and peaks in July. The amount of cooling water flow reductions would be constrained by condenser operating limits such as backpressure and hot well temperature limits. Typically, flow reductions are most readily achievable in the winter and spring, when water temperatures tend to be cooler.

It should be noted that both condenser modifications and a fish handling return system were considered for implementation in conjunction with seasonal flow reductions. Condenser modifications were determined to be impractical due to the small incremental performance improvement and the substantial increase they would bring to the capital cost of seasonal flow reductions. Installation of a fish handling return system was determined to be unnecessary, since North Anna is considered closed-cycle for impingement compliance, and a fish handling return

system is not necessary for an entrainment reduction technology which does not increase impingement.

In order to achieve various degrees of flow reductions, individual CW pumps could be secured and/or throttled in various combinations. A 50% closure of the valve downstream of a CW pump results in an approximately 25% reduction in flow through that pump and a 3.13% reduction in total CW flow. Table 2-1 shows some of the possible degrees of flow reductions that may be achieved for the plant with different combinations of throttling and securing of pumps. In each case, throttling is considered to be a 50% valve closure resulting in a 25% flow reduction for each throttled pump.

Table 2-1: CW Pump Flow Reduction Options

Unit 1		Unit 2		Percent Intake Flow Reduction
Number of Pumps Secured	Number of Pumps Throttled	Number of Pumps Secured	Number of Pumps Throttled	
0	0	0	0	0.00%
0	1	0	0	3.13%
0	2	0	0	6.25%
0	3	0	0	9.38%
1	0	0	0	12.50%
1	0	0	1	15.63%
1	0	0	2	18.75%
1	0	0	3	21.88%
1	0	1	0	25.00%

The operational measure of seasonally securing or throttling individual CW pumps could provide an incremental reduction in flow and would not require physical changes to the plant; therefore, it was screened in for further evaluation in tandem with other flow reduction TOMs.

2.3.1.3 Variable Speed Pumps

Variable speed pumps (VSPs), obtained either by installing variable frequency drives on the existing CW pumps or through the installation of new variable speed CW pumps, could be used to reduce intake flows by operating at flow rates less than the design flow rates of the existing CW pumps (238,200 gpm, Reference 2.3.6.1, Page 10.4-3). Similar to seasonal flow reductions described above, the amount of cooling water flow reduction using variable speed pumps would be constrained by condenser operating limits and would be most readily achievable in the winter and early spring, when water temperatures tend to be cooler.

As described above, variable speed pumps could achieve a reduction in entrainment abundance by reducing the amount of flow withdrawn from Lake Anna. The greatest potential for reduction in intake flow, as allowable by operational limits and cost of energy production changes, would occur during the winter to early spring- a timeframe in which there is little entrainment. However, the window from May to June represents a time in which water temperatures may allow for incremental flow reductions as approximately 45% of entrainment occurred in these months during sampling conducted from April 2016 to September 2017 (Reference 2.3.6.8).

In the initial two-step technology screening process (Appendix A), the use of variable speed pumps was screened out based on the current configuration of NAPS's CW pumps. Because NAPS has a dedicated intake tunnel for each unit, each supplied by four intake pumps, a desired intake flow reduction can be achieved by either removing individual CW pumps from service or throttling the discharge of one or more CW pumps, as shown in Table 2-1. Such operational measures are less costly than performing modifications to implement variable speed pumps. Therefore, variable speed pumps were considered comparable to reductions achievable by removing individual CW pumps from service and/or throttling the discharge of one or more CW pumps are were not considered further in this evaluation.

2.3.2 Conceptual Implementation of Flow Modification TOMs

As described in the preceding sections, planned seasonal refueling outages and seasonal flow reductions were selected for further evaluation of the various types of flow reduction TOMs considered.

Because spring refueling outages already occur during a portion of the entrainment season, the planned refueling outages TOM is already implemented at NAPS and no additional construction, modifications, or documentation revisions are required. Since each unit at NAPS operates on an 18-month fuel cycle, planned refueling outages align with a portion of the spring entrainment season occurring every other outage. A schedule of the recent and upcoming spring refueling outages for NAPS Units 1 and 2 is provided in Table 2-2 below. Note that only the spring outages are listed, as fall outages are not expected to have significant entrainment reduction benefit.

Table 2-2: Recent and Planned Spring Refueling Outages

Unit	Outage Start Date	Duration
1	3/11/2012	37 days
2	3/10/2013	26 days
1	3/11/2015	20 days
2	3/6/2016	20 days
1	3/11/2018	20 days
2	3/10/2019	28 days
1	3/7/2021	28 days
2	3/13/2022	20 days

As with planned refueling outages, the implementation of seasonal flow reductions by throttling and/or securing individual CW pumps could also be achieved with no new construction or modifications. Individual CW pumps could be throttled or removed from service during portions of the entrainment season in the same way that pumps are currently secured for routine maintenance. Operating procedure OP-48.2 provides guidance on starting and stopping any

NAPS circulating water pump,and would be used to secure and restart CW pumps to achieve seasonal flow reductions (Reference 2.3.6.2).

To successfully implement the seasonal flow reductions TOM, a guidance document or operating procedure would be required to be developed governing the timing and allowable parameters under which individual CW pumps could be throttled or secured to achieve entrainment reduction benefits.

As described in Section 2.3.1.2, entrainment reduction from flow reductions would be proportional to the reductions in cooling water withdrawn; entrainment density is highest from May to July, with a peak in July. Therefore, flow reductions will have the most significant effect on entrainment during these months. Of these three months, May and June are the most feasible months to implement flow reductions due to their lower water temperatures relative to July. The temperature of the lake water has a large impact on the power generation losses incurred by the plant and the increase in condenser backpressure when one or more CW pump is removed from service (see 2.3.3.1 for additional detail).

2.3.3 Impacts of Flow Modifications

The purpose of this section is to discuss the various impacts associated with implementing flow reductions through planned spring refueling outages and seasonally throttling or removing individual CW pumps from service during May and June of each year. Since NAPS's spring refueling outages already align with a portion of the entrainment season and no changes to the planned refueling outages are being proposed, there are no incremental impacts to entrainment associated with that TOM that must be considered. However, the implementation of seasonal flow reductions by throttling or securing CW pumps during the months of May and June would have incremental impacts to that should be considered, including impacts to power generation as well as potential impacts to various plant programs.

2.3.3.1 Power Generation Impacts

Implementing seasonal flow reductions at NAPS via securing or throttling CW pumps during the months of May and June would decrease generating capacity of the plant. Decreased thermal efficiency (i.e. operational losses) would result due to reduced gross generating capacity caused by reduced circulating water flow through the condensers. Although securing CW pumps could also reduce the total electricity demand and parasitic losses, the operational losses would be significantly larger than the reduction in parasitic losses, resulting in a net generation loss. These impacts and the consideration of the long-term recurring costs are discussed in more detail in subsequent sections.

2.3.3.1.1 Reductions in Gross Generating Capacity

NAPS currently operates using a cooling system that draws from Lake Anna, providing water year-round for use in the plant's main condensers. The cooling water intake structure (CWIS), which houses a total of eight CW pumps (four pumps per unit), provides the cooling water needed for both units. Each of the CW pumps has a design flow of 238,200 gpm, though, based on discussions with plant personnel, the actual flow rate for each pump is approximately 210,000

gpm when unthrottled. Additionally, the plant's condensers were sized to handle 940,300 gpm (Reference 2.3.6.1, page 10.4-18).

The amount of heat transfer in the plant's condenser is a function of both the CW temperature as well as the CW flowrate; in general[4], a lower CW flowrate results in a lower thermal efficiency for the condenser. The condenser backpressure increases as a result of the increased saturation pressure of the condensate. This increases the turbine backpressure, which results in a lower pressure differential across the turbine and, ultimately, lower power output. These losses are referred to as operational power losses

Water Temperature Data

Daily average Lake Anna water temperature data for a six-year period from January 2011 through December 2016 was obtained from Dominion from monitoring station NALINT, located approximately at the NAPS CW intake (see Figure 2-1). This data was used to calculate the predicted power that would have been generated by the plant based on the CW temperature, which was assumed to have been the same as the reported lake water temperature.

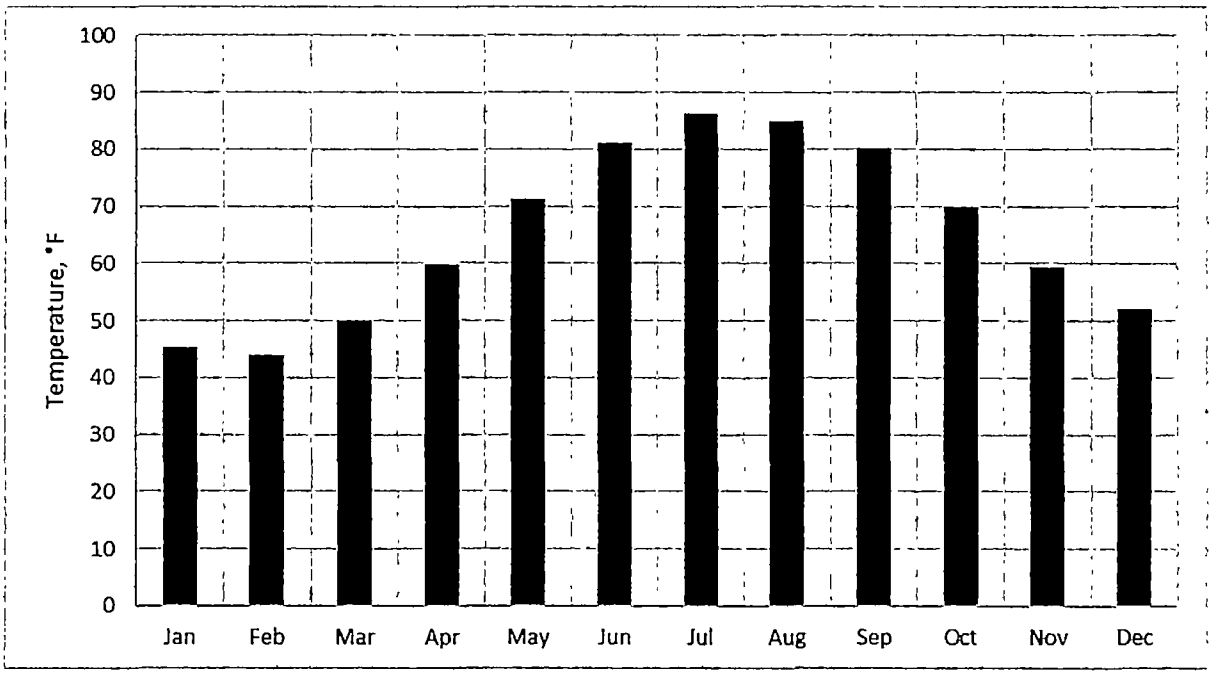


Figure 2-1: Average Monthly Intake Temperature, 2011 to 2016

[4] The only exception to this is when the CW temperature is low enough that an increased flow would create sub-cooling of the condensed turbine exhaust, resulting in less power generated (see Figure 2-2 and Figure 2-4). However, Lake Anna temperatures for May to June are high enough that this is not expected to occur for either of the months in which seasonal flow reductions would be implemented.

Data Recovery

In order to compare the predicted power generation if seasonal flow reductions were to be implemented to the predicted power generation from the existing cooling system, the water temperature data described above is required. The overall average data recovery rate for this data set was 100%. Therefore, the available data is sufficient for this evaluation.

Analysis

The hourly predicted power generation per unit was calculated for both the current CWIS operational flow rates as well as the different flow reduction scenarios shown in Table 2-1. The results of these calculations were used to quantify the difference in power generating capacity for the plant during each month under the different flow reduction scenarios.

This difference represents the estimated power generation capacity that would be lost if seasonal flow reductions were to be implemented at a given flow reduction percentage.

To estimate the hourly predicted loss in gross generating capacity, PEPSE models for the NAPS Units 1 and 2 were used. PEPSE is an industry-recognized software for power generation analysis that creates a balance of plant model and solves for critical plant parameters through iteration. Inlet water temperature was varied from 35°F to 95°F in increments of 5°F within the model to create a relationship between inlet water temperature, condenser backpressure, and electric power production for Units 1 and 2. The figures below show the relationships of power production (both total power production and lost power production) and condenser backpressure with inlet water temperature.

Although these relationships were analyzed for each flow reduction percentage from Table 2-1, only the plots for 100%, 81.25%, and 75% flow operation are shown. These figures illustrate that, above approximately 60°F (the expected water temperature range for May and June), power generation decreases and condenser backpressure increases as cooling water temperature increases; the trends illustrated in these figures for power output and condenser backpressure as a function of CW flow rate hold true for each flow reduction condition (100% flow, 81.25% flow, and 75% flow). It should be noted that NAPS currently uses flow reductions during the winter months, when the lake temperature is cool enough that flow reductions improve power generation.

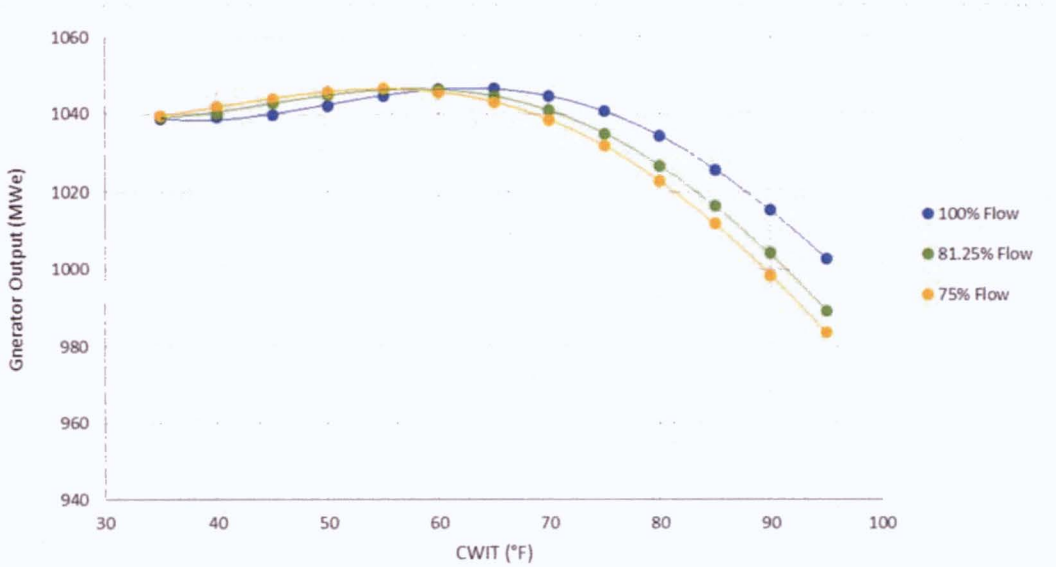


Figure 2-2: Unit 1 Generator Output vs. Inlet Water Temperature

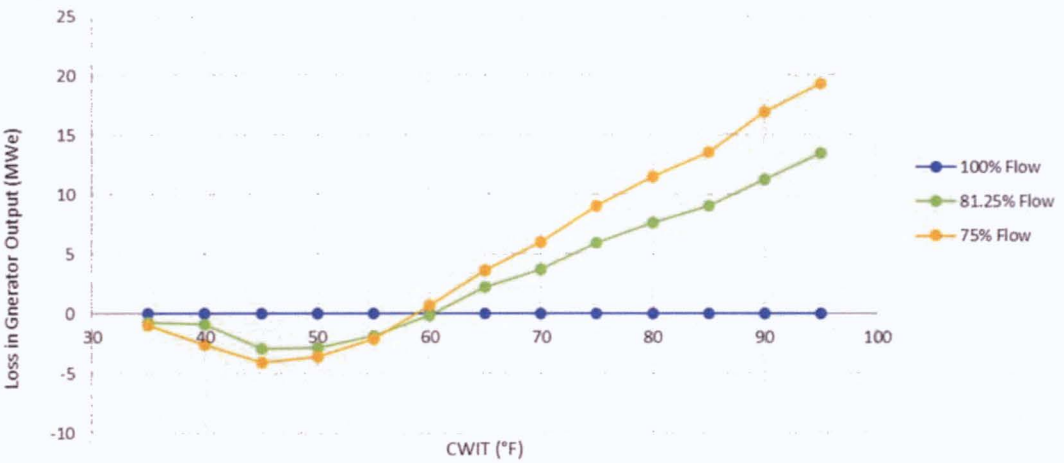


Figure 2-3: Unit 1 Loss in Generator Output vs. Inlet Water Temperature

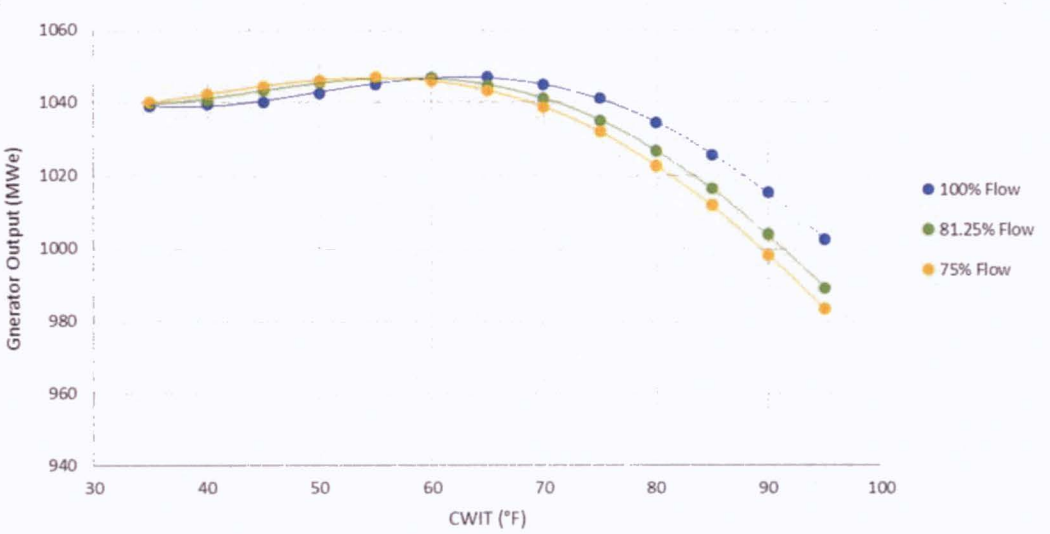


Figure 2-4: Unit 2 Generator Output vs. Inlet Water Temperature

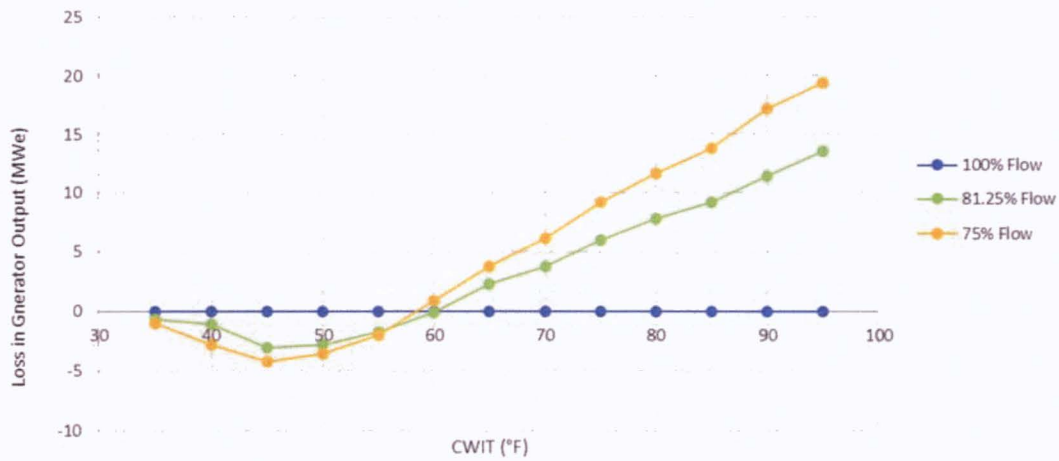


Figure 2-5: Unit 2 Loss in Generator Output vs. Inlet Water Temperature

For calculation of the predicted power generation, Lake Anna water temperature data was used for the six-year period of January 1st, 2011 – December 31st, 2016, as discussed above. This temperature data was used in combination with power generation curves for the appropriate flow level (similar to those presented above) to calculate the predicted hourly power generation for each of the CW pump operational scenarios presented in Table 2-1 for both units. For each flow reduction level, the difference between power generation resulting from the reduced-flow condition and the current flow condition represents the rate of power generation loss for the units during the time that flow reductions would be implemented.

The current flow condition was determined by examining historical CW pump flow data from 2014 to 2017 (see §122.21(r)(5) Cooling Water System Data report). These average monthly flow rates were compared to the maximum actual flow rate of 210,000 gpm per pump to determine the monthly percentage of full flow used. The average percent of flow in May and June is 92% and 95%, respectively. Therefore, the power generation for various flow reduction scenarios was compared to power generation at these flow conditions.

By evaluation of the entrainment sampling results and monthly intake flow data in conjunction with the flow throttling options from Table 2-1, it was estimated that entrainment reduction of approximately 10% could be achieved by throttling three pumps for Unit 1 (81.25% flow) and securing one pump for Unit 2 (75% flow) during the months of May and June, resulting in an estimated combined intake flow percentage of 78% (22% reduction). Since the cost due to decreased energy generation increases rapidly with higher flow reduction configurations, this flow reduction configuration was selected by Dominion for further evaluation. It should be noted that the flow reduction configuration could be swapped between units (i.e., one pump secured for Unit 1 and three pumps throttled for Unit 2) with minimal impact to the entrainment reduction and losses in power generation. Therefore, the configuration evaluated here could be swapped between units in implementation, if so desired. Additionally, operating at approximately 75% flow results in an average condenser tube flow velocity of approximately 4.8 fps, which exceeds the minimum condenser tube flow velocity of 3 fps recommended by the Heat Exchange Institute (Reference 2.3.6.9).

An alternative to scheduled flow reductions in May and June, when water temperatures are typically accommodating of such reductions, would be to implement flow reductions whenever water temperatures allow (e.g., for temperatures below 80°F) during periods in which flow reductions are not already implemented. However, such implementation would present operational challenges such as increased risk of operator error, increased wear and maintenance for associated components, and unplanned fluctuations in grid supply. Therefore, a fixed seasonal schedule was considered to be more favorable.

Based on the analysis, the estimated average losses in gross power generating capacity are shown in Table 2-3 below. As an illustration of the result impacts, if Unit 1 were to operate with three of its four operating pumps throttled (i.e., 81.25% flow) in May, the gross power generation would be 5.83 MWe lower than it would be with the existing condition of operation. If Unit 1 were to throttle three of its four pumps in June, the gross power generation would be 9.92 MWe lower than it would be with the existing condition of operation. The results displayed in Table 2-3 illustrate that the higher water temperatures in July lead to peak power generation losses, which supports the selection of May and June as the most feasible months for implementation of flow reductions.

Table 2-3: Monthly, Annual, and Daily Operational Power Results

	81.25% Flow		75% Flow	
Month	Unit 1 Average Power Loss (MWe)	Unit 1 Max Daily Loss in Month (MWe)	Unit 2 Average Power Loss (MWe)	Unit 2 Max Daily Loss in Month (MWe)
May	5.83	10.57	9.32	16.16
June	9.92	12.03	15.21	18.24
July	11.85	14.04	17.97	21.03

Based on the analysis performed above, the estimated combined losses for May and June, assuming Unit 1 operates with three pumps throttled (i.e., 81.25% flow) and Unit 2 operates with one pump secured (i.e., 75% flow), are 15.15 MWe (5.83 + 9.32) and 25.13 MWe (9.92 + 15.21), respectively.

2.3.3.1.2 Changes in Parasitic Power Losses

Although the reduction in cooling flow would reduce gross generating capacity due to operational losses, taking individual CW pumps offline would also result in a reduction of the electrical power consumed by the site. Each of the existing CW pumps is operated by a 2,000-horsepower motor (Reference 2.3.6.1, p. 10.4-3). Therefore, if one CW pump was secured during the months of May and June, the associated reduction in electrical load would be approximately 2,000 hp, or 1.49 MWe.

2.3.3.1.3 Total Reduction in Net Generating Capacity

The total reduction in net generating capacity is equal the operational losses due to increased condenser backpressure minus the decrease in electrical load due to removing two CW pumps from service. When the reduction in electrical load of 1.49 MWe per unit is considered in combination with the operational losses from Table 2-3, the total reduction in the combined net generating capacity for both units is 13.7 MWe for the month of May and 23.6 MWe for the month of June.

2.3.3.1.4 Plant Reliability

Seasonal flow reductions via CW pump discharge valve throttling could impact plant reliability. As stated in Section 2.3.3.1.1, a lower CW flowrate results in an increase in turbine backpressure, which could lead to a reactor trip. The desired reduction in total plant flow would be achieved by throttling each unit to different degrees and by different valve configurations, which increases the possibility of operator error. Additionally, the throttled position results in a harsher environment for the discharge valves and increases valve wear and risk of failure. Valve throttling also changes the pressure profile of the CW system, and, during valve positioning, causes transients which could potentially cause damage to the CW system. These items are discussed further in the following paragraphs.

Condenser Backpressure

If the condenser backpressure were to increase too much, it could cause the reactor to trip. As shown in figures below, the turbine backpressure at a circulating water temperature of 95°F (i.e., the UHS temperature limit; see Section 2.3.3.5) is higher for the 75% flow operational scenario

(one pump secured) than the 100% flow scenario and is approximately 4.5 in-Hg. However, this remains below the set point of 5.5 in-Hg at which the reactor is tripped (References 2.3.6.4 and 2.3.6.5) and below the pre-trip alarm setpoint of 5.0 in-Hg (Reference 2.3.6.10). Since flow reductions below 75% are not proposed for either unit (discussed below), a reactor trip caused by unacceptably high condenser backpressure due to the reduced CW flow is not expected. However, implementing seasonal flow reductions would cause the station to operate closer to the condenser backpressure limit than normal, increasing the risk that any incremental shock to the system (such as a tripped CW pump or other reduction in CW flow) would result in an unacceptably high backpressure and corresponding reactor trip.

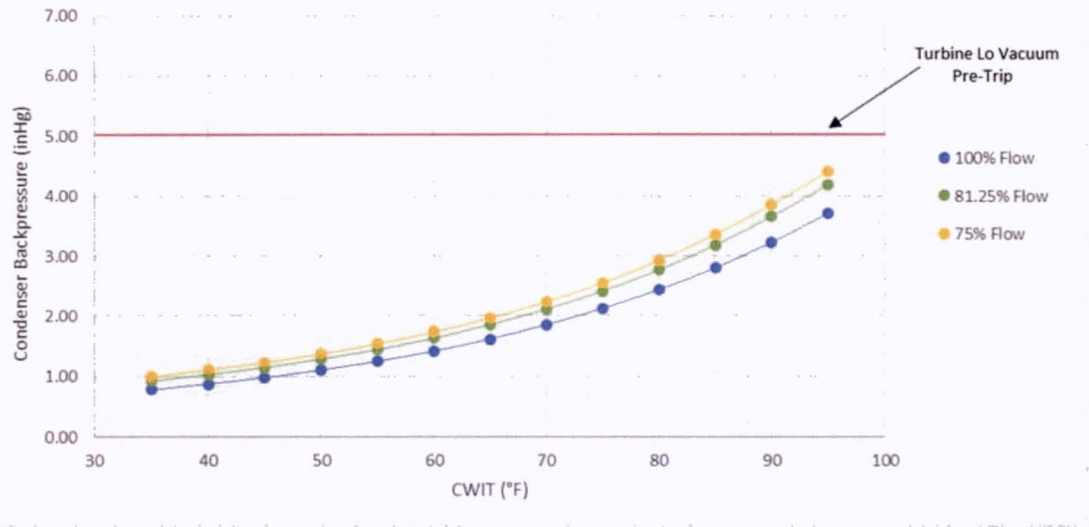


Figure 2-6: Unit 1 Condenser Backpressure vs. Inlet Water Temperature

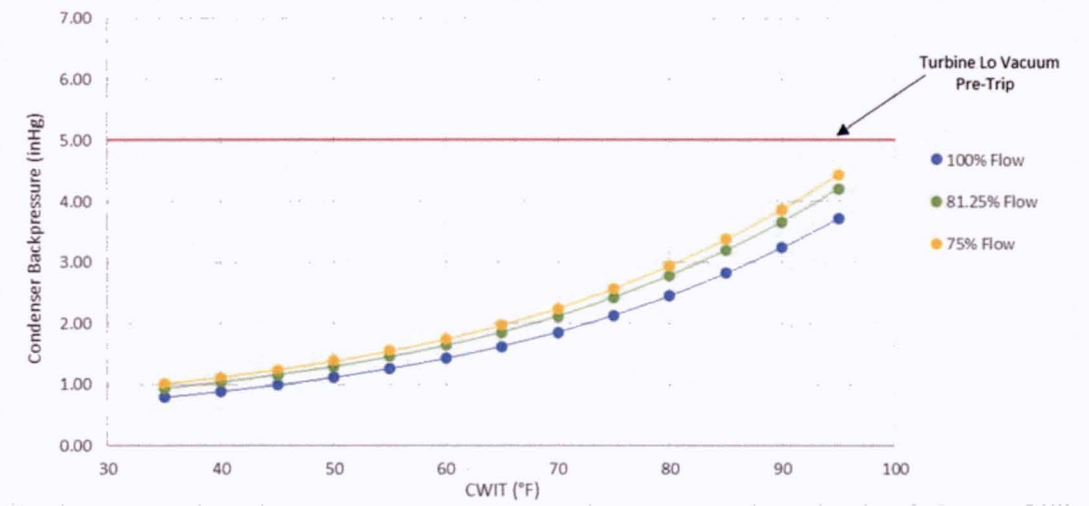


Figure 2-7: Unit 2 Condenser Backpressure vs. Inlet Water Temperature

At a reactor power of greater than 30% and backpressure of greater than 5.5 in-Hg, the reactor would be immediately tripped (References 2.3.6.4 and 2.3.6.5). As shown in Figure 2-6 and Figure

2-7 above, the condenser backpressure is approximately 4.5 in-Hg at the 75% flow condition with an inlet water temperature of 95°F, which is above any inlet water temperature predicted during the six-year period analyzed. Therefore, active power losses (i.e. power losses caused by a reactor trip) due to high condenser backpressure would not be expected.

Discharge Valve Positioning

A total flow reduction of 21.88% would be achieved with a 25% flow reduction for one unit and a 18.75% flow reduction for the other unit. The 25% flow reduction would be achieved by taking one CW pump offline, and the 18.75% flow reduction would be achieved by throttling three CW pump discharge valves. The increase in the number of valve manipulations and the unequal valve configurations between the two units would likely increase the risk of operator error. This is discussed further in Section 2.3 3.7.

Operation of the CW pump discharge valve at the 50% throttle position instead of the full open position increases the pressure differential across the valve. This increases the wear rate of the valve, thereby decreasing the useful life and increasing the need for maintenance. Additionally, the failure probability of the valve would likely increase.

Positioning the CW pump discharge valves changes the pressure profile of the CW system. While position adjustments are ongoing, the CW system is subject to transient conditions which could damage the CW system. Specifically, if valve positions are adjusted too quickly during CW pump operation, damaging pressure waves could be generated which could threaten the structural integrity of the CW system piping and tunnels A study of hydraulic transients in the CW system was conducted in 1979 which determined that opening and closing of the CW discharge valves had a much less significant impact if the valve stroke time was increased from 20 seconds to 60 seconds, and that the resulting hydraulic grade line loadings were acceptable.

Partial throttling of CW pump discharge valves while one CW pump is out of service is currently utilized at NAPS during cold weather months, and so the feasibility of seasonal flow reductions has been demonstrated. Therefore, impacts to plant reliability caused by seasonal flow reductions are expected to minimal.

2.3.3.2 Noise

Sound is energy transmitted through the atmosphere in the form of pressure waves. The measurement of these sound pressure levels is expressed in terms of decibels (dB). Being that sound is a wave form, it also has frequency characteristics which are expressed in hertz (cycles per second). Knowing sound pressure levels and frequencies, the character of a given sound may be analyzed. Sound pressure levels can be A-weighted to adjust for the hearing range of the human ear. The sound loudness as perceived by the human ear is measured in A-weighted decibels (dBA).

The practice of achieving flow reductions by securing a CW pump during the months of May and June would serve to reduce the existing level of noise at the intake during those months. Because no additional equipment or modifications are required for the implementation of this technology, the net impact to the existing noise level as a result of implementing the seasonal flow reductions technology would be a slight decrease during those months.

2.3.3.3 Visual Impacts

Because no additional equipment or site modifications are required for the implementation of the seasonal flow reductions technology, there are no associated visual impacts.

2.3.3.4 Water Consumption

The current cooling system at NAPS draws water from Lake Anna into the intake tunnels and discharges heated water into the WHTF via the discharge canal. Generally, the same amount of water is withdrawn from and discharged to the lake.

The implementation of the seasonal flow reductions technology would not alter the existing configuration of how NAPS draws water from Lake Anna and discharges it back to the lake via the discharge canal. Instead, the seasonal flow reductions technology would only serve to reduce the amount of water that is withdrawn and passed through the existing cooling system.

Since the NAPS cooling system discharges all of the water that is withdrawn, there are no water consumption impacts associated with the implementation of seasonal flow reductions. It should be noted that a decrease in cooling water flow would result in an incremental increase in the temperature of the water discharged to the WHTF in the immediate vicinity of the station. However, there would also be a reduction in total discharge flow, consistent with the reduction in cooling water flow. The results of the PEPSE model runs were evaluated to verify that the thermal discharge limit in the station's existing VPDES permit (a British thermal unit (Btu)/hour limit) is not anticipated to be exceeded.

2.3.3.5 Ultimate Heat Sink

Lake Anna, together with the Service Water (SW) reservoir, serves as the ultimate heat sink (UHS) for NAPS (Reference 2.3.6.6, Page 2-1). The UHS for NAPS provides a water source for the service water system, which is required to supply cooling water to safety-related heat exchangers.

If seasonal flow reductions were implemented, the temperature of the pumped water used as makeup for the SW reservoir would remain the same (equal to the temperature of Lake Anna). Therefore, it is not expected that maximum service water temperature of 95°F (Reference 2.3.6.3) would be challenged as a result of implementing seasonal flow reductions. Additionally, flow reductions will not impact the safety-related spray wash pumps or the auxiliary service water pumps.

Based on the above, no safety-related equipment or technical specification limitations will be impacted by flow reductions.

2.3.3.6 Regulatory, Licensing, Environmental, and Safety

2.3.3.6.1 Potentially Applicable Federal Permits

U.S. NRC Review

All plant modifications require implementation of the NAPS design change process, which includes assessments of all U.S. NRC licensing impacts. Plant modifications must follow the

process established in 10 CFR 50.59. The NRC will review this change, which is likely to require a detailed regulatory review

2.3.3.6.2 Potentially Applicable State Permits

Virginia VPDES Permit (VPDES) (Department of Environmental Quality [DEQ])

It is anticipated that the proposed flow modifications would be evaluated by DEQ as part of renewal process for VPDES Permit number VA0052451. If not evaluated as part of the renewal process, then a permit modification may be required. Part 28.s of the permit fact sheet addresses Final §316(b) Rule special conditions, stating that changes to the intake structures or conditions will be reevaluated at each reissuance to monitor continued compliance with the requirement.

2.3.3.7 FMEA and PRA Reviews

The implementation of seasonal flow reductions presents a limited potential for new failures within the CW System. The modification, as proposed, does not introduce any new structures, systems, or components and relies entirely on existing equipment. The process in which CW pumps are either throttled or taken out of service is already being used to reduce flow in the cooler months, thus the system operation would not differ significantly from how it is already being used.

What follows is a system-level analysis and is not intended to be an exhaustive evaluation of component-level failures. A more detailed FMEA and PRA analysis would need to be performed during the detailed design process.

The most likely increase in failure probability for existing plant equipment is due to the difference in flow reduction strategies used between the two units. Previous flow reductions have been performed such that if a pump is throttled or taken out of service in one unit, the same is done in the other unit. Now, by taking a pump out of service on one unit while throttling the three pumps on the other unit, the two CW Systems would be operating asymmetrically (flow capacities of 75% and 81.25%). Furthermore, if a pump were to trip in the unit operating at 81.25% capacity, there may be some initial uncertainty whether the tripped pump was operating at 100% capacity vs. 75% capacity. The unfamiliarity with this new operating scheme may increase the risk of operator error, though this risk is relatively small and could be mitigated with operator training.

Additionally, although the PEPSE modeling based on historical Lake Anna water temperatures demonstrated that a reactor trip caused by unacceptably high condenser backpressure due to the reduced CW flow is not expected, it should be noted that implementing seasonal flow reductions would cause the station to operate closer to the condenser backpressure limit than normal. This increases the risk that any incremental shock to the system (such as a tripped CW pump or other reduction in CW flow) would result in an unacceptably high backpressure and corresponding reactor trip. Further consequences of a loss of condenser vacuum during power operations may include condenser or turbine damage.

2.3.3.8 Plant Programs

Implementation of seasonal flow reductions would have minimal impact on the day-to-day operation of NAPS. A review of plant programs was conducted to inform the conceptual design and cost estimate during the preparation of this study, as well as to provide an assessment on the magnitude of the impact to the plant. These plant programs require consideration any time

NAPS performs site modifications, either physical modifications or operational modifications. The subsequent sections identify the plant programs and provide discussion to evaluate impacts of implement seasonal flow reductions.

2.3.3.8.1 10 CFR 50 Appendix J

10 CFR 50 Appendix J governs leakage testing for the primary containment buildings. Containment buildings are the final barrier between fission products and the public, and Appendix J requirements ensure that this barrier remains functional within the appropriate acceptance criteria. The implementation of seasonal flow reductions would not affect the containment integrity or the containment leakage rate. In addition, none of the containment isolation valves or containment penetrations would be impacted by reduced flow through the CW system.

2.3.3.8.2 ASME Code

The implementation of seasonal flow reductions would not require changes to ASME piping or to pressure vessels designed to the ASME Boiler and Pressure Vessel Code. The proposed change does not add new piping or components or physically modify existing piping or components.

2.3.3.8.3 Boric Acid

Boric acid is used to control reactivity and power level in the primary reactor coolant system. It is also stored in passive tank to provide reactor inventory and reactivity control in the case of an emergency. The implementation of seasonal flow reductions would not affect the Boric Acid programmatic controls at NAPS.

2.3.3.8.4 Buried Components

Although the proposed implementation of seasonal flow reductions does utilize a system with buried piping, there are no changes that would affect these components or how they are used. Therefore, there are no requirements for buried components that need to be considered for this change.

2.3.3.8.5 Coatings

The implementation of seasonal flow reductions would not require changes to coatings. The proposed change does not add new piping or components or physically modify existing piping or components that utilize coatings.

2.3.3.8.6 Environmental Qualification

10 CFR Part 50.49 defines rules and requirements for ensuring that electrical equipment that is important to safety can remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shutdown the reactor and maintain it in a safe condition, and to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines in 10 CFR Part 50.34(a)(1), 50.67(b)(2), or 100.11.

The implementation of seasonal flow reductions would not install any new components, thus would have no impact on Environmental Qualification.

2.3.3.8.7 Fire Protection, Appendix R, NFPA 805

10 CFR Part 50 Appendix R provides the fire protection program requirements for NAPS. The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing components are operated. Thus, there is no impact to Appendix R requirements.

2.3.3.8.8 FLEX

Following the Fukushima disaster in 2011, the industry responded by implementing compensatory measures for beyond-design basis external events, including measures for core cooling, spent fuel pool cooling, containment cooling, and upgraded spent fuel pool instrumentation. The implementation of Diverse and Flexible Coping Strategies (FLEX), an NRC standard, required the addition of tie-ins to use portable equipment to maintain steam generator cooling, reactor coolant system inventory, and multiple ways to keep spent fuel covered and cool in the spent fuel pool. Infrastructure was also developed to allow for multiple methods of powering equipment from external generators, etc.

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus would not impede or affect any of the above activities.

2.3.3.8.9 Flow Accelerated Corrosion

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus no impact is anticipated related to Flow accelerated corrosion (FAC). In addition, FAC tends to occur at water temperatures from 175°F – 450°F in the liquid phase, which is far above the expected temperatures in the circulating water system.

FAC is a form of material degradation that can affect metallic materials that are normally resistant to corrosion because they are protected by an oxide film that forms on the surface. Turbulent and fast-flowing water or wet steam can wear away the protective film and lead to continued dissolution of the underlying metal. Flow accelerated corrosion is not the same phenomenon as abrasion (caused by particles in the water), impingement (caused by water droplets in steam), or cavitation (caused by collapsing gas bubbles in a liquid flow). Heat Exchangers

The cooling water supplied by the CW system has a direct effect on the performance of the main condenser. Changes in the flow rate and temperature of the CW system water can affect condenser vacuum and plant efficiency and the system currently utilizes a flow reduction program for cooler months when thermal efficiency is higher. The potential impact resulting from the implementation of seasonal flow reduction in warmer months has been reviewed and quantified in the preceding sections. The proposed flow reductions are not expected to introduce any risk or adverse effects to the main condenser or other heat exchangers in the system.

2.3.3.8.10 License Renewal and Aging Management

In 2003, the NRC approved a license renewal to extend Unit 1 and 2 operating licenses an additional 20 years. In 2017, Dominion declared its intent to pursue SLR to extend both operating licenses another 20 years. The SLRA is scheduled to be submitted in 2020. Modifications to

incorporate any changes to the existing intake design would be considered by NRC during the relicensing process.

Regarding aging management, the NRC published NUREG-1801 to document the technical basis for determining where existing programs are adequate and where existing programs should be augmented for extended periods of operation with regard to license renewal. The implementation of seasonal flow reduction does not add any new piping or components or change the way in which existing equipment is operated, thus would not impede or affect the plant's licensing basis. Likewise, the implementation of seasonal flow reductions would not require new components subject to the NRC's aging management program.

2.3.3.8.11 Maintenance Rule

The scope of the Maintenance Rule (Regulatory Guide 1.160 and NUMARC 93-01) covers all safety-related structures, systems, and components (SSCs) as well as non-safety-related SSCs that are i) relied upon to mitigate accidents or transients or are used in plant emergency operating procedures, ii) whose failure could prevent SSCs from fulfilling their safety-related function, or iii) whose failure could cause a reactor scram or actuation of a safety-related system. To determine what equipment is within the scope of the Maintenance Rule, the function of the SSC is determined and the above screening criteria is applied.

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus would not affect the scope of the maintenance rule.

2.3.3.8.12 Material Compatibility

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus there are no significant material compatibility affects anticipated.

2.3.3.8.13 MOVs, AOVs, Relief Valves, and Check Valves

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus there is no impact to valves.

2.3.3.8.14 North American Electric Reliability Corporation

The North American Electric Reliability Corporation (NERC) was formed by the electric utility industry to promote the reliability and adequacy of bulk power transmission in North America. The Energy Policy Act of 2005 authorized the Federal Energy Regulatory Commission (FERC) to designate a national Electric Reliability Organization. NERC acts as this organization in the United States, and has the authority to enforce standards on power system utilities in the United Station and Canada to ensure electric system reliability.

The implementation of seasonal flow reductions would result in the plant generating less power, depending on the temperature of the water supplied by the CW system. This technically does not alter the generating capacity of the station (i.e. the plant could be returned to full power by returning the CW system to full flow), but if a commitment to meet Final §316(b) Rule requirements prevents the plant from returning to full power, then the potential for conflicts with NERC requirements should be explored. Similar conflicts between Final §316(b) Rule commitments and

PJM Interconnection requirements may also occur, and would need to be evaluated in detail prior to implementation.

2.3.3.8.15 Nuclear Energy Insurers Limited

Nuclear Energy Insurers Limited (NEIL) provides insurance to all operating nuclear power plants in the United States. The NEIL loss control manual provides standards for complying with NEIL requirements. The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated, thus there is no expected impact related to NEIL.

2.3.3.8.16 Obsolescence

The implementation of seasonal flow reductions does not add any new piping or components or change the way in which existing equipment is operated. The proposed flow reduction involves taking one CW pump out of service only temporarily. There is no equipment in the scope of this proposal affected by obsolescence.

2.3.3.8.17 Station Blackout

The Alternate AC (AAC) system was installed at NAPS to provide AC power to one emergency bus during a Station Blackout (SBO) event. The AAC system consists of a single, non-safety related 4160 VAC diesel generator. The AAC system is independent of the emergency diesel generators. The implementation of seasonal flow reductions would not affect this system, its operation, or its operating requirements.

2.3.3.8.18 Steam Generators

No impact is expected to the operation, maintenance, function, and design margins for the steam generators.

2.3.3.8.19 Thermal Fatigue

No impact is expected to the number of expected thermal cycles for the spent fuel pool lining, reactor, and associated piping

2.3.3.8.20 Vessel Internals

No impact is expected is expected to the design, maintenance, function operation, or safety margins for the reactor vessel internals.

2.3.3.8.21 Welding

No impacts are expected to the welding program.

2.3.3.9 Impact to Virginia's Electrical Grid Supply

The implementation of seasonal flow reductions at NAPS would impact the Virginia electrical supply grid by resulting in electrical power production losses during the months of May and June due to the operational losses associated with reduced circulating water flow. These operational losses would have to be replaced in the electrical supply grid by alternative sources of power. As discussed in Section 2.3.3.1.3, when the reduction in electrical load of 1.49 MWe for Unit 2 is considered in combination with the operational losses, the total reduction in the combined net generating capacity for both units is 13.7 MWe for the month of May and 23.6 MWe for the month

of June. Assuming a 91.7% utilization factor (average five-year capacity factor from the values presented in the §122.21(r)(8) Operational Status report), these operational losses result in a total loss of electricity supplied to the grid of 9,347 MWhr during May and 15,582 MWhr during June.

2.3.4 Implementation Schedule

The implementation of seasonal flow reductions by throttling or securing individual CW pumps could be achieved with no new construction or facility modifications, and therefore a detailed construction and implementation schedule is not provided. Full implementation of seasonal flow reductions would require the development of a guidance document or operating procedure that governs the timing and allowable parameters under which individual CW pumps could be secured, as well as the retraining of plant operators on the new operating guidelines for the CW pumps during May and June.

Implementation is contingent upon an assumption that a new NPDES permit will be issued in 2019 addressing and incorporating the proposed flow modifications, which will allow the necessary time for the development of the new operating guidelines and training of plant personnel prior to the assumed implementation of flow reductions in May/June of 2020.

Due to the decreased temperature of Lake Anna during the winter months and corresponding decrease in required CW flow to achieve optimal power generation, the normal routine for NAPS is to have two of the eight CW pumps (one per unit) offline during the months of January – April. Therefore, to implement seasonal flow reductions by securing one and throttling three CW pumps during May and June, one of the CW pumps that is already offline could be left offline for the additional two months. This practice would be implemented annually.

2.3.5 Cost Estimates

2.3.5.1 Capital Costs

Because the implementation of seasonal flow reductions by taking individual CW pumps offline and throttling could be achieved with no new construction or modifications, there are no capital costs associated with the implementation of this technology.

2.3.5.2 O&M Costs

Implementation of seasonal flow reductions by throttling three Unit 1 CW pumps and securing one Unit 2 CW pump during the months of May and June would result in new operation and maintenance costs for NAPS. Operations costs would result from the lost net generating capacity caused by the reduced circulating water flow. Maintenance costs would result from the increased wear of throttling components, though these costs are considered negligible compared to operational costs.

The lost generating capacities are based on the analysis in Section 2.3.3.1. The lost generating capacity of the plant in May and June, assuming continuous operation, is shown in Table 2-4 below. Note that there would be no active power losses expected, as discussed in Section 2.3.3.1.

Table 2-4: Estimated Lost Generating Capacity

Cost Item[5]	Average Power Loss (MWe)
Operational Power Losses During May	13.7
Operational Power Losses During June	23.6

2.3.5.3 Electricity Costs

As described in Section 2.3.3.1.3, the total reduction in net generation at NAPS is the net effect of the operational losses due to increased condenser backpressure and the reduction in parasitic load due to throttling three Unit 1 CW pumps and securing one Unit 2 CW pump. The operational losses associated with implementing seasonal flow reductions at NAPS would result in 24,929 MWhr of losses annually (9,347 MWhr during May and 15,582 MWhr during June). Note that dollar value estimates of the social and compliance costs due to reduced electricity generation are developed in Section 2.5.1.4 and 2.5.2.4.

2.3.6 References

2.3.6.1 North Anna Power Station Updated Final Safety Analysis Report, Revision 53.03

2.3.6.2 1-OP-48.2, Revision 42, Operation of Circulating Water System

2.3.6.3 North Anna Units 1 and 2 Technical Specifications, Amendment No. 278/261

2.3.6.4 1-AP-14.00, Revision 36, Low Condenser Vacuum

2.3.6.5 2-AP-14.00, Revision 33, Low Condenser Vacuum

2.3.6.6 SDBD-NAPS-SW, Revision 21, System Design Basis Document for Service Water System

2.3.6.7 Electric Power Monthly with Data through December 2017, Table 5.6.B, U.S. Energy Information Administration

2.3.6.8 2016-2017 Entrainment Characterization Study, North Anna Power Station, Prepared by HDR Engineering, Inc.

2.3.6.9 Standards for Steam Surface Condensers, Tenth Edition, September 2006, Heat Exchange Institute

2.3.6.10 1-AR-G-F3, Turbine Low Vacuum Pre-Trip

[5] Note that operational power loss does not occur uniformly over the course of the month but varies according to water temperature conditions at the site. This item represents an average over the course of the month.

2.4 2 mm Fine-Mesh Screens

2.4.1 Existing Cooling Water Intake System

The current cooling water intake system at NAPS is a CCRS that draws circulating water from Lake Anna and passes it through the main condensers to condense the steam from the turbine exhaust. The cooling water system utilizes eight CW pumps, four for each unit, that each have a design flowrate of 238,200 gallons per minute (gpm) to draw water from Lake Anna and supply the CW system. The CW pumps draw lake water through eight traveling water screens and discharge into two intake tunnels, one tunnel for each unit. The traveling water screens consist of a 0.125" x 0.5" rectangular mesh that is constructed of 16-gauge wire (Reference 2.4.6.37). Each traveling screen is equipped with a screenwash spray to clean the screen and prevent excessive head loss due to debris build up. The screenwash spray discharge is collected in the concrete trash rake flume located at the top of the intake structure, in front of the traveling screens, where it then flows to a collection basket at the east end of the intake structure.

After being pumped into each unit's respective intake tunnel, the CW travels through four steel pipes directing it to the condensers, where heat from the turbine exhaust steam is transferred to the CW system. The CW then leaves the condensers and is directed into a common concrete discharge tunnel via four steel pipes, one from each condenser water box. The Unit 1 discharge tunnel combines with the Unit 2 discharge tunnel on the south side of the station, where it then enters the discharge canal and is directed to the WHTF, for eventual recirculation within Lake Anna.

2.4.2 Conceptual Design of 2 mm Fine-Mesh Screens

The purpose of this section is to assess the technical feasibility of fine-mesh traveling water screens as an alternative to the existing 0.125" x 0.5" mesh screen system at NAPS. Feasibility is evaluated from an engineering and constructability standpoint, and a total project cost estimate is developed that includes capital costs, operational and maintenance (O&M) costs, and costs due to operational losses. Various impacts of retrofitting NAPS with fine-mesh screens are also evaluated, including operational, environmental, regulatory, licensing, and safety impacts.

2.4.2.1 Background

Fine-mesh screens utilize very small mesh opening sizes (less than or equal to 2 mm) to reduce entrainment. Because the mesh opening size is smaller, a greater proportion of the total area is covered by the screening material and not available for flow. As a result, the percent open area (POA), or percentage of the total screen area that can pass flow, is low for these screens. Therefore, a larger screening surface area would be required to reduce the through-screen velocity to an acceptable velocity. A maximum through-screen velocity of 1.5 feet per second (fps) at Extreme Low Water (ELW) was selected. This maximum through-screen velocity is lower than the current through-screen velocity at the station (approximately 2.6 fps), and balances the competing factors of maintaining a low velocity to improve survivability, but not so low that it would require too many additional screens to be feasible.

Conventional through-flow traveling water screens can be altered to incorporate modifications that improve survival of impinged fish and other organisms, thus reducing the impingement

mortality rate. These modifications are meant to minimize fish mortality associated with screen impingement and screenwash removal. There are four features of traveling water screen systems that improve the survivability of fish and other organisms:

- Continuous operation of traveling screens to minimize impingement time;
- Alternative bucket configurations that include provisions to minimize damage to the fish upon entering the fish bucket, while they are in the bucket, and during transport to the fish handling and return system (FHRS);
- Low pressure fish screenwash systems to gently remove the impinged fish before the high-pressure debris spray is used to clean debris off the screens;
- A FHRS that ensures that the fish can be returned to the water body with a minimum of stress.

Dual-flow traveling water screens are mechanically like through-flow screens but are rotated ninety degrees in the intake bay channel. A nose cone is mounted perpendicular to the flow to force the flow to the sides of the intake screens. The flow passes through both sides of the intake screen, exiting through the center of the screen on the back side. Flow diverters on the back side of the dual-flow screen prevent unfiltered water from bypassing the screens. A simplified illustration of a dual-flow screen is shown below.

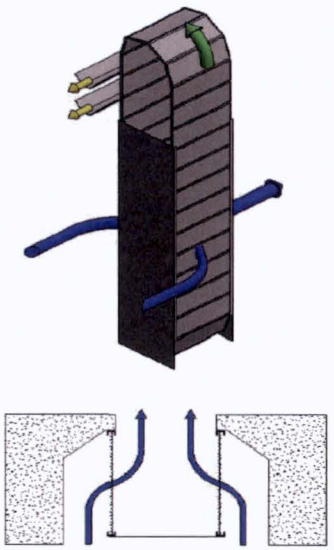


Figure 2-8: Dual-Flow Traveling Screen (Image Courtesy of WTR Engineering, Inc.)

Because dual-flow screens have incoming flow through both the ascending and descending sides of the screen, they provide the following benefits:

- Potential to decrease the velocity through the screens. The flow pattern of the dual-flow screen allows the entire submerged screen surface to be an active screen area. This means that a dual-flow screen of a given width would pass approximately twice as much water at the same velocity as a through-flow screen of the same width. Conversely, the

same amount of flow can pass through a dual-flow screen at about half the velocity as a through-flow screen of the same width.

- Elimination of debris and organism carryover. Since all flow going through a channel installed with a dual-flow screen must pass through the screen before entering the screen well, the potential for debris carryover is eliminated.

WTR Engineering is a leading designer and manufacturer of traveling water screens and was consulted on the project for the traveling water screen designs.

2.4.2.2 Overview of Design

To install fine-mesh screens at NAPS, it is proposed that the existing through-flow traveling water screens mesh of 1/8" x 1/2" would be retrofitted with a fine-mesh screen of 2 mm square. The existing screenwash system consists of four screenwash pumps each rated for approximately 910 gpm of flow at 225 feet of head (References 2.4.6.33, 2.4.6.34, 2.4.6.35, and 2.4.6.36), which is comparable to the screenwash requirements provided by WTR Engineering for the new dual-flow screens, and therefore is assumed to be sufficient to remove impinged species as well as debris. In order to achieve the required open area for flow, eight new dual-flow traveling water screens are needed. These eight new screens would be installed in two new intake structures (four screens per intake structure). The new intake structures would be located in the immediate vicinity of the existing intake structure, to the east and to the west, respectively.

Four of the eight CW pumps would need to be removed from the existing intake structure, allowing the removed CW pump's intake bay to be combined with a neighboring bay of a CW pump that was not removed. Intake bays would be combined such that two through-flow screens would filter water for each remaining CW pump. By doubling the inlet surface area for each pump while maintaining the pump's flow rate of 238,200 gpm, the through-screen velocity would be reduced to less than 1.5 fps. The four CW pumps removed from the existing intake structure would be placed into two new intake structures; one to the east (for Unit 1) and the other to the west (for Unit 2) of the existing structure.

As proposed, each new intake structure would feature four dual-flow traveling screens. Selection of these screens would allow for the design of a longer but narrower intake structure (as compared to the existing intake structure), approximately 109 feet in length and 78 feet in width, which would be beneficial given the limited shoreline around the existing intake structure. The new intake structures would include trash bars, trash rakes, stop gates for dewatering, screen-wash pumps, a FHRS, and supporting electrical equipment. Similar to the retrofitted through-flow traveling screens, the new dual-flow traveling screens would be outfitted with 2 mm square fine-mesh. The new intake structures would contain four intake bays each (i.e., two bays for each CW pump). Each bay would be designed such that water flows through dual-flow traveling screens, aligned in parallel prior to reaching the CW suction piping at the end of the intake bay. The relocated CW pumps would be placed similarly to those in the existing intake structure and new CW tunnels would be constructed to reconnect with the existing CW tunnels. The vacuum priming pump house is located at the CW discharge, and therefore, would not require relocation or modification.

A new FHRS is proposed to be constructed to safely return collected organisms to Lake Anna. This would require retrofitting a FHRS to the existing intake structure and adapting it to the FHRS

designed on each of the new intake structures. A system of troughs would be constructed to collect the FHRS output from all three intake structures. The debris and fish would be handled separately. The fish would be returned to Lake Anna beyond the hydraulic area of influence (AOI) of the intake structure. This reduces the possibility of immediate re-impingement of the fish and fish larvae at the intake structures. The fish trough would be constructed of an 18" wide fiber reinforced polymer (FRP) U-shaped channel with grating on the open end. The debris would be filtered by debris baskets and the water would be returned to the intake cove.

The conceptual design has an estimated technology service life of 20 years (Reference 2.4.6.31, Exhibit 8-19) for both the retrofit of fine-mesh screens on the existing intake structure and the construction of the new intake structures.

2.4.2.3 Proposed Modifications to the Existing Intake Structure Building

The existing intake structure is approximately 70 feet in length and 190 feet in width and houses eight through-flow traveling screens, eight CW pumps, two Auxiliary Service Water (ASW) pumps, four screenwash pumps, two auxiliary flash evaporator pumps, one supply pump for the reverse osmosis (RO) system, and a fire pump. The four screens and CW pumps on the east half of the structure provide the CW flow for Unit 1 and the four screens and CW pumps on the west half of the structure provide the CW flow for Unit 2. The structure consists of eight parallel bays, with one screen located near the mouth of the bay and a single CW pump at the end of the bay. Trash bars provide the first layer of debris defense for the structure, which is cleared as needed with a trash rake that traverses the width of the structure.

The ASW pumps are safety-related pumps and unaffected by the design proposed herein. These pumps are housed in a concrete structure, and the pumps' suction are located in the bays for CW pumps 1-CW-P-1D and 2-CW-P-1A (Reference 2.4.6.28). Similarly, there are two safety-related screenwash pumps, which are located adjacent to the ASW pumps. In addition to performing screenwash functions, these pumps also serve as the primary source for make-up flow into the station's closed-loop SW system (Reference 2.4.6.1, Section 9.2.1.2.2). These pumps and their operation would not be negatively affected by the modifications to the existing intake structure. The proposed hydraulic study would further reinforce the negligible impacts of the fine-mesh screen retrofit on the operation of the safety-related equipment.

There are also non-safety related pumps located on the existing intake structure: two screenwash pumps, two auxiliary flash evaporator pumps, a supply pump for the RO system, and a fire pump. The modifications required to the existing intake structure would not inhibit the operation of these pumps. All of these pumps are located in the bays where the new walls are proposed but their suctions are located well into the bays and will not be impacted by the new curved walls (see details below).

The CW pump discharge exits the back of the existing intake structure into a CW discharge tunnel. Each unit has its own tunnel that the flow from the four CW pumps associated with that unit flow into. There are motor-operated valves (MOVs) located at the discharge of each CW pump, which are used to throttle pump flow during the fall and spring seasons (Reference 2.4.6.18, Attachment 1). The tunnels are constructed of reinforced concrete below grade and have a 13-foot by 14-foot

(approximate) rectangular cross section (Reference 2.4.6.29). The vacuum priming pumps for the CW system reside near the discharge of the CW, and therefore, are not impacted by this design.

As proposed, modification to the existing intake structure building would remove four of the CW pumps and associated support equipment from the structure, two from each unit. The intake bay of a removed pump would be modified to be combined with the intake bay of a retained pump. The wall between the two intake bays and CW pumps and behind the traveling screens would be removed and two W10 x 112 steel beams would be inserted to provide the necessary support for the top deck. The intake bay walls that would be removed as part of the design are shown in red on Figure 2-9 below.

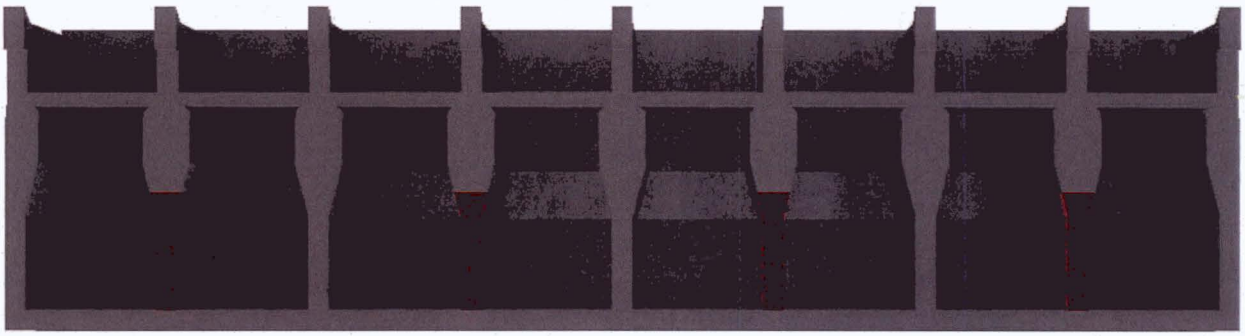


Figure 2-9: Illustration of Intake Bay Wall Modifications

Once the necessary intake bay walls are modified, a 2-foot-thick curved wall with a radius of 17'-4" would be constructed to seal off the abandoned CW pump area and guide the flow towards the retained CW pump. Similarly, the opening between the CW tunnel and the abandoned piping from the relocated CW pump would be sealed off. Drawing DMNNA00034-M-003 in Appendix B provides the full details of the modified intake structure. See Appendix E for the structural evaluation that validates the proposed modifications. Analysis of the proposed changes is in accordance with ACI 318-14 (Reference 2.4.6.13), AISC 360-16 (Reference 2.4.6.14), & IBC 2015 (Reference 2.4.6.10).

Since the retained pumps will not be relocated within the existing intake structure, they will remain slightly offset from the center of the two through-flow screens servicing each bay. As described above, curved walls would be added to help smoothly re-direct the flow towards the pumps and limit the amount of turbulence created. Since this is not a standard position for ideal intake flow conditions, a hydraulic study is included in the cost assessment to validate the approach taken in this conceptual design. There is risk the study will determine the pumps will need to be relocated within the existing intake structure, which would significantly increase implementation costs, lengthen the schedule and likely increase outage time (and therefore electricity costs).

The final modification to the existing intake structure would be to add retaining walls in front of the structure to extend the length of each intake bay. The placement and relation to the existing intake structure of the retaining walls are shown in Figure 2-10 below.

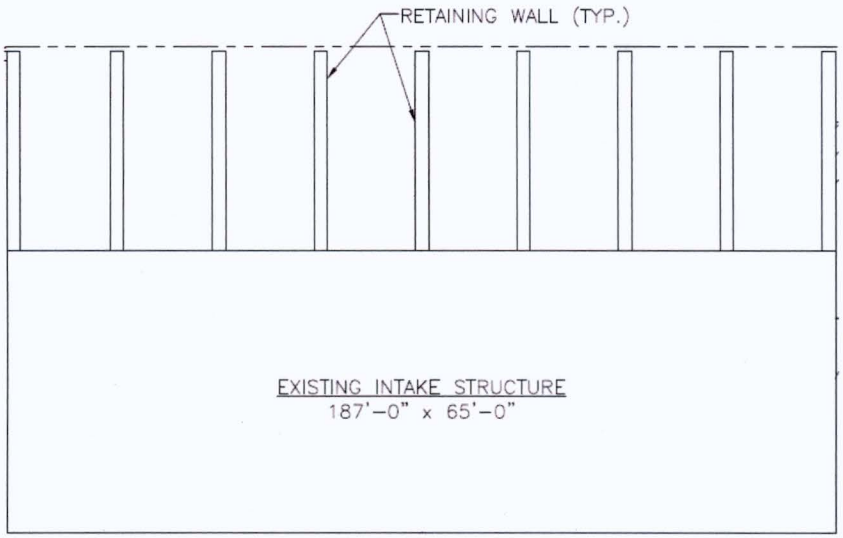


Figure 2-10: Retaining Wall Modification to the Existing Intake Structure

The overall length of these walls would align the intake bays between the existing intake structure and the new intake structure to the east. This is done to retain a nearly uniform flow distribution and eliminate unwanted eddies caused by offset intake structures. The overall dimensions of these walls are 45.2 feet long, 3 feet thick, and 47 feet tall. These walls would be reinforced with two mats of #9 rebar @ 6" on center. The face-to-face spacing between the walls would be 20 feet, which is the existing bay width. Note that the walls would be collinear with the existing walls (i.e., the retaining walls are in line with the current intake structure bay walls). A reinforced concrete slab, with two mats of #9 rebar @ 6" on center, would be poured to provide a common base for the retaining walls. The concrete slab would be 3 feet thick with a top elevation of El. 221'. This is the same elevation as the bottom of bay (in the existing intake structure).

2.4.2.4 New Intake Structure Buildings

As proposed, two new intake structures would be built to supplement the existing intake structure. The new intake structure to the east would provide CW flow to Unit 1 while the one to the west would service Unit 2. The new intakes are identical designs and would be reinforced concrete structures primarily utilizing shear walls for lateral load resistance. The intake structures would be designed in accordance with International Building Code (IBC) IBC-2015 (Reference 2.4.6.10), American Society of Civil Engineers (ASCE) ASCE 7-14 (Reference 2.4.6.15), American Concrete Institute (ACI) ACI 318-14 (Reference 2.4.6.13), and American Institute of Steel Construction (AISC) AISC 360-16 (Reference 2.4.6.14). Furthermore, the guidelines for environmental structures and seismic design of water retaining structures in ACI 350 (Reference 2.4.6.11) and ACI 350.3 (Reference 2.4.6.12), respectively, would be followed as appropriate. For the preliminary design, select bounding conditions from the codes of record were used to provide a preliminary design that supports providing a construction cost estimate and schedule for the new intake structures.

Figure 2-11 presents the plan view of the existing intake structure and proposed placement of the new intake structures. Note that some of the details provided in DMNNA00034-M-001 from

Appendix B have been removed for clarity. The placement within the intake bay and orientation relative to the existing structure plays a significant role in the conceptual design. This is discussed for both the new intake structures in the following paragraphs.

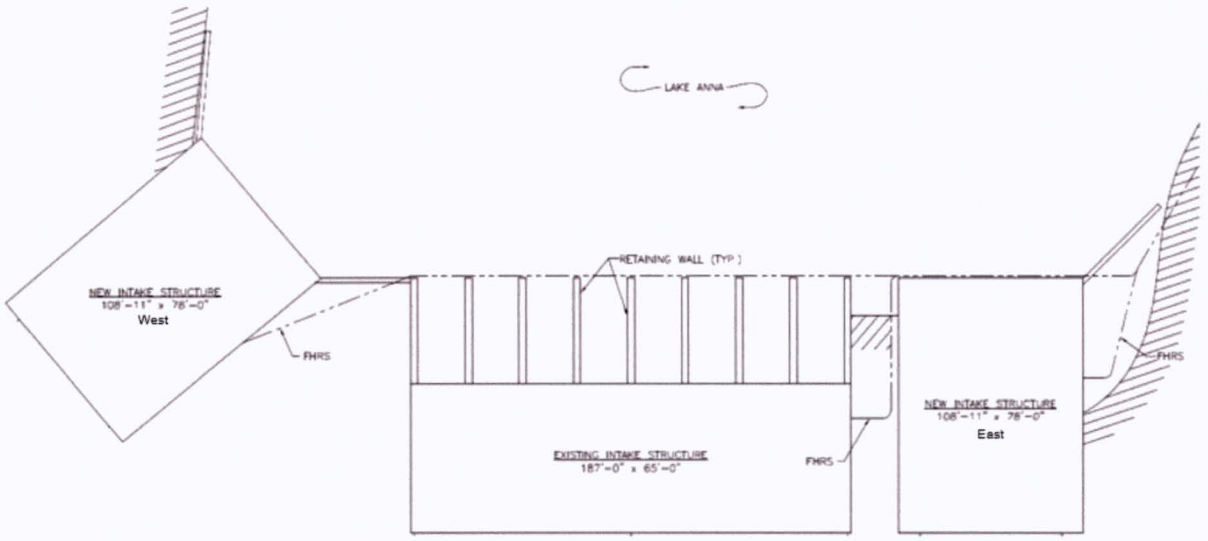


Figure 2-11: Layout of New and Existing Intake Structures

As proposed, the new intake structure to the east is 20' from the existing intake structure and parallel with it. The placement is preferential as it would create a uniform direction from which the intake structures draw their flow. Furthermore, the retaining walls (See Section 2.4.2.3) added to the existing structure would align the bays so that the overall bay length (from inlet to CW pump centerline) is identical for both structures. This placement of the new structure is advantageous for connecting the new CW tunnels to the existing ones.

The new intake structure to the west of the existing intake structure is proposed to be placed at a 50-degree angle to the existing intake. The front right corner is collinear with retaining walls and new intake structure to the east (as seen in Figure 2-11). Although not ideal to promote a uniform hydraulic flow pattern, the placement of this structure is beneficial for routing the corresponding CW tunnel to the existing one. Drawing DMNNA00034-M-001 shows the obstructions (transformers and intake structure control house) that the new circulating tunnel must circumvent.

The details of the preliminary design for the new intake structures are provided in drawings DMNNA00034-M-001 and DMNNA00034-M-002 in Appendix B and also shown in Figure 2-12 below. Each structure would be approximately 109 feet in length and 78 feet in width. The top deck elevation would be at El. 265' (same as the current intake structure) and a concrete flood wall would be provided around the perimeter of the top deck. The top deck would be reinforced concrete (two mats of #9 @ 9" on center) with a thickness of 2 feet.

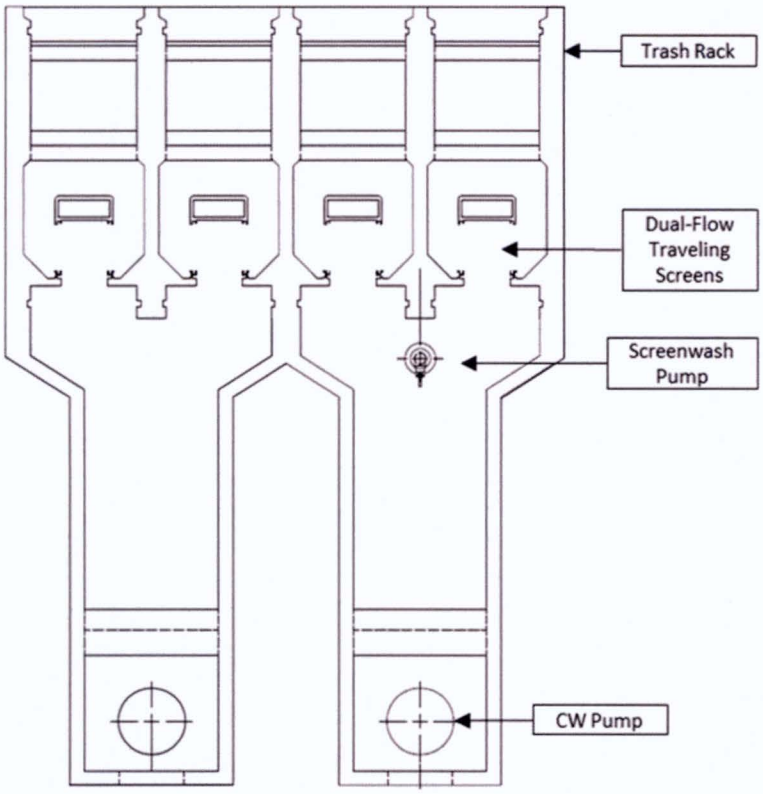


Figure 2-12: New Intake Structure Bay Configuration

Major components on the top deck of the new intake structures include a trash rake (shown in Figure 2-13 below), dual-flow traveling screen housings, screenwash pumps and the relocated CW pumps. The 4.16 kV, 480 V, and 125 V distribution equipment would be relocated from the existing intake structure in a separate electrical building also on top of the new intake structure. The additional electrical building would be a prefabricated structure secured to the top deck. See Appendix E for details of the structural evaluation that validates the proposed structure.

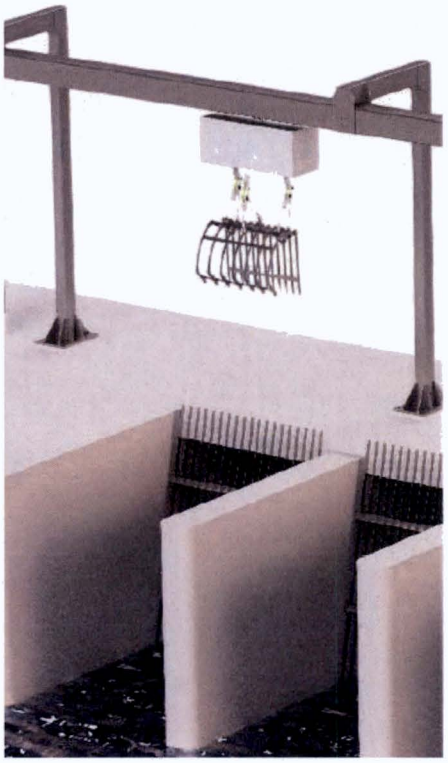


Figure 2-13: Trash Rake System (Image Courtesy of WTR Engineering, Inc.)

The bottom slab of the new intake structure would be 3 feet thick reinforced concrete with two mats of #10 @ 12" on center and a top of concrete elevation of El. 221' where the bottom of the traveling water screens, trash racks and stop logs would be located. No caissons would be required based on gravity loads in combination with seismic loads (including overturning effects). The seismic analysis credits the water in the structure.

Each new intake structure would consist of four identical openings. A single opening would house a set of front stop gate guides, a set of trash bars, a concrete "nose" to support proper approach flow to the traveling screen, a dual-flow traveling water screen and a set of rear stop gate guides. Each pair of openings would combine into a single bay to form two parallel bays. Each bay would end at the CW pump suction piping. The perimeter walls would be two feet thick with two mats of #11 rebar @ 12" on center embedded for concrete reinforcement. The interior vertical walls would also be two feet thick, but the embedded concrete would be two mats of #10 rebar @ 12" on center.

2.4.2.4.1 Hydraulic Design for the New Intake Structures

As proposed, the new intake structures would use the four CW pumps relocated from the existing intake structure. Similar to the existing intake structure, the pumps would be located at the rear of the new intake structures. The relocated pumps in the new east intake structure would be collinear to the line of retained CW pumps in the existing intake structure. This is not the case with the new west intake structure because of its angled placement, which results in the line of relocated pumps in the west intake structure being angled approximately 45 degrees from the line of retained CW pumps in the existing intake structure. It should be noted that, although the size

of the NAPS's intake structure would be expanded as part of this conceptual design, the capacity of the intake to withdraw cooling water would not be increased. The larger intake structure is required to maintain an acceptable through-screen velocity and head loss across the fine-mesh screens.

The pump bays are designed based on guidance from the Hydraulic Institute Standards (HIS) for pump pit design (Reference 2.4.6.3). For each new intake structure, the flow would be split between two 25 percent capacity pumps. The other 50 percent would be supplied by the CW pumps in the existing intake structure. Therefore, the required flow rate for each CW pump would be 238,200 gpm (Reference 2.4.6.1, Section 10.4.2.1). The pump bay and channel are designed to maintain adequate approach velocity and submergence for effective pump operation.

Based on the HIS design guidance, the sump dimensions for a pump with a design flow rate of 238,200 gpm are shown below. Because each CW pump would have its own individual pump bay, the dimensions shown in Table 2-5 are for each individual CW pump bay. See design drawing DMNNA00034-M-002 in Appendix B for layout and dimensions of the pump bays.

Table 2-5 - Circulating Water Pump Pit Design Dimensions

Parameter	Dimension
Pump Intake Bell Diameter (D)	9'
Length of Pump Bay to pump bell centerline (>5D)	45'
Vertical clearance between bottom of pump bell and bottom of pump pit (>0.3D and < 0.5D)	2'-9"
Horizontal distance between pump bell centerline and back wall of pump pit (0.75D)	7'
Horizontal distance between pump bell centerline and side wall of pump pit (D)	9'-4"
Width of pump pit (2D)	18'-8"

Each screen bay would have a channel width of 16'-9" to meet the requirements of the screen vendor. The two screen intake bays (for each pump) would combine into a wide common area before converging to a narrower pump bay suction pit that would travel towards the pump suction. HIS does not recommended having a pump suction located in an overly wide intake channel. Therefore, the width must be reduced prior to the long channel that leads to the pump. A general layout of the intake structure is provided in Figure 2-12 and a dimensioned drawing is provided in DMNNA00034-M-002 in Appendix B.

Additionally, due to the large flow through the CW pumps, it is recommended that a hydraulic model study be performed to determine if vortexing would be a potential concern. Based on the results of the hydraulic model study, vortex suppression devices such as flow straighteners may be required. This is considered standard practice for an intake of this size.

2.4.2.4.2 New Intake Structure Discharge Piping

As proposed, the discharge piping associated with the relocated CW pumps would be capped and abandoned in place. The discharge of the relocated CW pumps would exit the rear of the new intake structures below grade, which is similar to the current configuration. New CW tunnels would be constructed for each new intake structures. These tunnels would consist of a scaled version of the existing CW tunnel with external dimensions of 9 feet wide by 10 feet tall. For the west intake structure, the flow would travel in a tunnel around the transformer equipment and control house for the existing intake structure and reconnect to the exiting CW tunnel approximately 110 feet downstream of the existing intake structure. The new CW discharge tunnel for the west intake structure would reconnect with the existing Unit 2 CW discharge tunnel prior to the existing rail line, avoiding interference and the need to modify the rail line during construction. A similar tunnel would be installed for the east intake structure. The new CW tunnel would reconnect with the existing tunnel 30 feet downstream of the existing intake structure. For current operation, the RO supply pump is used to ensure that the CW discharge tunnel is filled prior to bringing the CW pumps online when coming out of an outage. A similar process would be used for the new CW discharge tunnels and the RO supply pump would be run longer prior to startup to ensure that all CW discharge tunnels are filled. As part of a detailed design, a hydraulic study would be performed to confirm whether this could be achieved using the current RO supply pump piping configuration (i.e. the new CW tunnels are backfilled from the RO supply flowing into the existing tunnel), or if additional pipe runs to the new CW tunnels would be necessary. See design drawing DMNNA003-M-001 in Appendix B for layout of the new CW tunnels.

2.4.2.5 Through-Flow Traveling Water Screens

The preliminary design for fine-mesh screens at NAPS proposes two modifications to the through-flow traveling water screens on the existing intake structure: 1) retrofitting fine-mesh screens on the screen and 2) retrofitting a FHRS.

2.4.2.5.1 Fine-Mesh Screen Retrofit

The through-flow traveling water screens are currently outfitted with a 0.125" x 0.500" x 0.06" (16 gauge) diameter mesh. The screens are operated manually, on an as-needed basis. Actual flow rate through each screen is approximately 530 cubic feet per second (cfs), which indicates a through-screen velocity of 2.57 fps based on a wetted screen area of 350 ft^2 at ELW level and a POA of 59%. POA is the percent of wetted screen area that is not wire mesh.

WTR Engineering was consulted on the project for alterations to the existing through-flow screens. The existing traveling water screens are proposed be retrofitted with a 0.08" (2 mm) x 0.08" (2 mm) fine-mesh screen. The retrofitted screens would be operated on a continual basis. The through velocity for each screen would be reduced to 1.40 fps, based on the same immersion requirements applied to the existing screens. Even though the opening size is smaller, the reduction in velocity is attributed to the doubling in screen area per pump since two screen bays will combine flow to a single CW pump. Table 2-6 below captures the comparison of critical parameters between the existing and retrofitted through-flow screens.

Table 2-6 - Design Parameters for Existing and Retrofitted Through-Flow Traveling Water Screens

Parameter	Existing Through-Flow Screen	Retrofitted Through-Flow Screen
Mesh Opening Width	0.125"	0.08"
Mesh Opening Height	0.500"	0.08"
Mesh Thickness	0.06"	0.03"
Chamber Width	15'-3"	15'-3"
Effective Width	14'-0"	14'-0"
Minimum Immersion*	25'	25'
Flow Per Screen	530 cfs	265 cfs
Wetted Screen Area	350 ft^2	350 ft^2
POA	59%	54%
Through Velocity	2.57 fps	1.40 fps

* Immersion height based on ELW level (El. 246').

This design assumes the retrofit requires the entire screen to be removed from the intake structure so that each screen/bucket section could be replaced. Additionally, the existing screenwash system (four pumps, two for each unit, each rated for approximately 910 gpm of flow at 225 feet of head) is comparable to the screenwash requirements provided by WTR Engineering for the new dual-flow screens, and therefore is assumed capable of removing debris from the smaller mesh. This includes the required spray for the retrofitted FHRS.

2.4.2.5.2 Fish Spray System Retrofit

In order to fully benefit from having a FHRS installed at NAPS, the existing intake structure and corresponding traveling water screens are proposed to be modified to handle debris and fish/fish larvae separately. The current screenwash system provides a spray that is not optimal for fish/fish larvae survival (i.e., too great of a pressure). Therefore, a new set of spray pipes would be installed adjacent to the existing ones to provide a lower pressure spray, ranging between 5 and 10 psi. Furthermore, a new trough would be added along the top deck of the existing intake structure to carry the debris and fish/fish larvae separately.

Two new troughs would be added to the existing intake structure: one inside the existing concrete debris trough and one directly above it. Both of these troughs are identical to the FRP trough (18"

wide and 27" tall) used for the FHRS installed on the new intake structures (described in detail in Section 2.4.2.7). The upper trough, servicing the debris spray system, would be installed above the existing concrete trough, which is located directly below the fiberglass splash housing of the through-flow traveling water screens. Therefore, modifications to the existing fiberglass housing would be required to allow for the new trough. A set of stairs would be installed to allow easy access to both sides of the trough. The lower trough, servicing the fish spray system, would be placed inside the existing concrete trough and would require minor modifications to the concrete to fit correctly.

In order to separate the debris and fish, a new 2" line would be added adjacent to the existing 4" debris spray piping. The placement would be such that the spray from the 2" line cleans the screens off with lower pressure flow to remove the fish/fish larvae while the debris remains. The pressure of the 2" line and eventual spray would be adjusted with a valve to a sufficiently low value (ranging between 5 and 10 psi). The larger 4" debris spray would continue to operate as originally designed. Note that the new 2" line is the first spray to contact the screens, reducing the potential for the fish/fish larvae to contact the higher pressure spray. As described above, the layout also changes the existing concrete debris trough into the trough for the FHRS.

Figure 2-14, which is a markup of Reference 2.4.6.30, presents the profile (a) and straight-on (b) views of the existing traveling water screens with the proposed fish spray system retrofit. The light blue is the low-pressure system for fish/fish larvae and the debris spray is shown in red. As discussed above, and piping for the debris spray already exists. The new components are the FRP troughs to carry the debris and fish/fish larvae and the piping for the low-pressure spray.

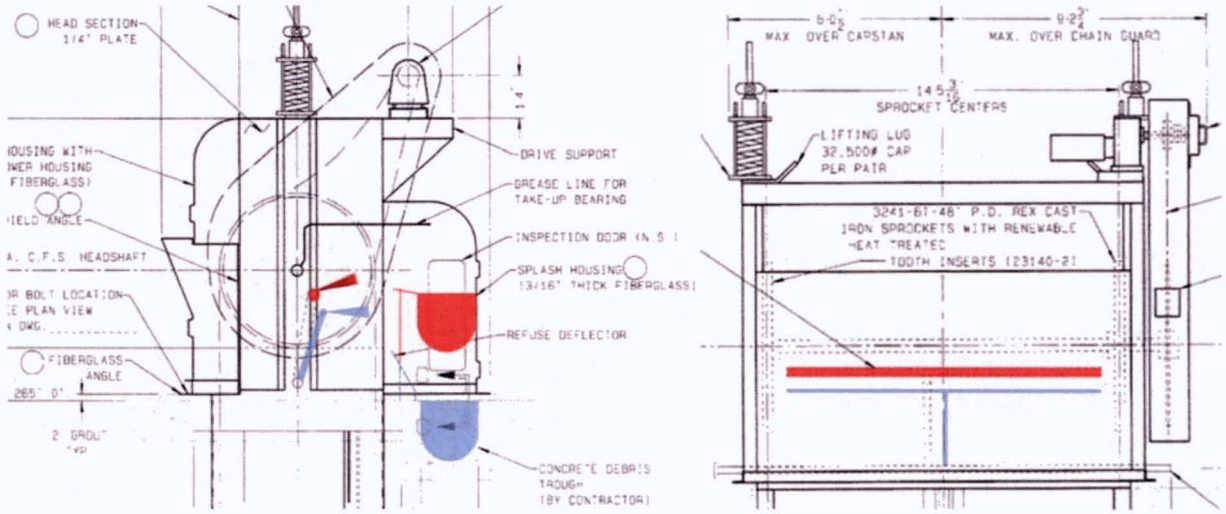


Figure 2-14: Retrofit of a FHRS on Existing Traveling Water Screens

2.4.2.6 Dual-Flow Traveling Water Screens

In order to limit the quantity of new screens required, WTR was asked to provide the largest dual-flow traveling water screens that can effectively and reliably operate for the design. Through

discussion with WTR, the largest screen width that could reliably operate for this application is a screen having a basket width of 6'-8" and an overall width of 10'-8.375". Based on achieving a through velocity of 1.5 fps or less, the submerged screening area was used in combination with the percent open area and channel dimensions to determine the number of dual-flow screens required. Eight dual-flow screens would be required to pass the CW intake flow at a through-screen velocity of 1.44 fps at ELW level. The elevation of the bottom of the new intake channel was matched to the existing intake structure so that the maintenance dredging requirements would be equivalent for both structures.

The primary design parameters for the new fine-mesh, dual-flow traveling water screens are summarized in Table 2-7 below. See design drawing DMNNA00034-M-002 in Appendix B for layout of the screens. The values provided by the screen vendor are based on the CW flow only. Note that the head loss across the new dual-flow screens ranges from 2.8 inches of water when 100% clean to 5.34 inches of water when 50% blocked. Although these head loss values are higher than the head loss across the existing screens, they are not expected to have a significant impact on the CW system or challenge the CW pumps' NPSH margin. This would be confirmed as part of the hydraulic study that would be performed during detailed design. Similar to the retrofitted existing screens, the new dual-flow screens would be operated on a continual basis. In each intake structure, one of the two bays contains a screenwash pump. The screenwash pump suction would add a negligible amount of additional flow through the screens.

Table 2-7 - Design Parameters for the Fine-mesh, Dual-flow Traveling Water Screens

Parameter	Dual-Flow Screen
Mesh Opening Width	0.08"
Mesh Opening Height	0.08"
Mesh Thickness	0.03"
Chamber Width	16'-9"
Effective Width	6'-8"
Minimum Immersion[1]	25'
Width of opening at back of screens	6'-1.25"
Flow capacity per screen	265 cfs
Wetted Screen Area	333 ft^2
POA	59%
Velocity approaching the screen	0.8 fps
Velocity along the sides	1.18 fps
Velocity through screens	1.44 fps
Velocity through outlet	1.91 fps
Total head loss across screen	2.80" (100% Clean) 3.46" (75% Clean) 5.34" (50% Clean)

[1] Immersion height based on ELW level (El. 246').
[2] Includes head loss across inlet openings, mesh panels, and exit outlet

The screens would use two sets of low-pressure fish spray nozzles, one on the inside of the screen and one on the outside (see WTR proposal in Attachment 1). This ensures that no fish remain attached to the screens (done by the inside nozzles spray out) and that all the fish are washed into the fish trough (done by the outside spray by spraying along the surface of the screen). The fish sprays would operate at a nominal pressure of 10 psi. The design of the screen is such that the fish would be gently removed from the screens by the low-pressure fish spray before the high-pressure debris spray is applied to remove debris. The debris sprays would operate at a nominal pressure of 40 psi. The screens would use two troughs, a fish return trough and a debris trough. The fish return trough would be located above the debris trough. The fish would empty into the main fish trough, discussed below. Each debris trough would empty into a main debris trough that would carry debris to the end of the intake structure for removal. This dual trough setup would be similar to the existing intake structure's configuration after the retrofit of the FHRS.

2.4.2.6.1 Screenwash System

The screenwash system of dual-flow traveling water screens removes debris and fish from the screen surface. The total required screenwash flow rate for each screen ranges from a recommended minimum of 681 gpm to a recommended maximum of 759 gpm. Using the maximum of these flow rates as a design point and multiplying by 4 for the number of screens, the total required screenwash flow rate for each new intake structure is 3,036 gpm. This required flow is rounded to 3,200 gpm for operational margin.

As discussed earlier, the dual-flow screens would require water at both high and low pressures to operate the debris and fish screenwash systems, respectively. The fish sprays would operate at 10 psi, while the debris sprays would operate at 40 psi. Pressure-reducing valves would be used to reduce the pressure for the low-pressure fish sprays.

As proposed, the screenwash pump would be located just behind the dual-flow screens. Suction piping would be 21.50" in diameter and would draw water starting at El. 241'. The screenwash pump would discharge to a 10" diameter pipe and tee into two 8" headers. The two 8" header pipes would be routed to reach behind each traveling screen. From the 8" header, 3" pipes would tee off to supply screenwash flow to each screen. These pipes would be routed directly to the sides or back of the screens as needed. The debris spray header would tee from the 3" pipe, and two 2" pipes would connect to the inside and outside fish spray headers. Pressure-reducing valves would drop the pressure to an acceptable level for the low-pressure fish spray nozzles. Isolation valves on each of the fish spray and debris spray headers would be installed. The specific routing of these pipes would be finalized during detailed design.

The screenwash pump would be required to deliver flow at a pressure of 40 psi (92 feet) to each high-pressure debris spray nozzle. Elevation change from pump suction (El. 241') to top spray header (assumed to be 10' above the top deck elevation of El. 265') is approximately 34 feet. Head losses are approximately 40 feet when accounting for the length of pipe and fittings.

The required total dynamic head (TDH) for the screenwash pump is approximately 166 feet. To provide operating margin, a pump that can supply 3,200 gpm at a design TDH of 180 feet is specified. One pump would be required for each new intake structure and the corresponding four dual-flow traveling screens (Attachment 1). Note the screenwash pumps would draw suction from the intake bays and not from the CW discharge piping.

2.4.2.7 Fish Handling and Return System

The design of the FHRS is driven by the description of a fish handling system in the definition of a modified traveling screen at 40 CFR 125.92(s), which requires that a FHRS have sufficient water flow to return the fish directly to the source water in a manner that does not promote predation or re-impingement of the fish or require a large vertical drop. Additionally, this design considered the best practices and guidelines provided in References 2.4.6.4 and 2.4.6.5. The best practices are summarized in the numbered list below.

1. All conveyance structures shall be smooth to prevent abrasion to the fish.
2. Water depth shall be a minimum of 6 in. and shall have a minimum width of 18 in.
3. Transport velocities should be greater than the sustained cruising speed of fish. The cruising speed is often 2 – 4 fps.

4. Materials used should minimize bio-fouling.
5. Long radius (r/d > 2.5) bends shall be used to prevent abrasion at the bends.
6. Pipe joints shall be constructed such that there is a smooth transition between pipe sections.
7. All transitions should be gradual and avoid flow separation.
8. Buried piping shall be below the frost depth.
9. The outlet shall be located well away from the intake to avoid re-impingement.
10. If a trough-style pipe is used (i.e., the flow is not fully circumscribed), screening material shall be used to prevent bird/animal predation.

The design of the FHRS has been evaluated to meet each of the above criteria as follows:

- To satisfy the 1st and 4th criteria, FRP material would be used for the new fish trough. FRP would provide a smooth conveyance surface and is resistant to bio-fouling.

- To ensure that the 2nd criterion is met, an 18" diameter trough would be used for the conveyance of fish, eggs, and larvae

- For the 3rd criterion, the flow was modeled using the Manning formula for uniform open-channel flow in a partially full, U-shaped channel. This was done for all segments of the FHRS as the flow rate varies in each section (see below). The cross-section of the trough is known, and a reasonable slope is established. The water would fill the curved area of the trough up to an unknown depth on the straight sides of the U. This depth is estimated, which results in a velocity of water. The velocity is converted to a flow rate using the assumed depth, and the calculated flow rate is checked against the known flow rate for the segment of interest. The estimated depth is iterated until the calculated flow rate is similar to the known flow rate. The Manning equation applied is shown below (Reference 2.4.6.6):

$$V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

  Where V is the velocity in fps, k is a unit conversation factor of 1.486, n is pipe roughness (0.011 for FRP, Reference 2.4.6.6, dimensionless), A is the flow area of fluid in the trough (ft^2), P is the wetted perimeter of the trough (ft) and S is the slope (ft/ft).
- To meet the 5th and 7th criteria, sharp bends are avoided in the design to reduce abrasion of fish around turns. All bends have a turn radius ratio (r/d) greater than or equal to 2.5.

- FRP sections would be flange connected to provide a smooth conveyance surface, meeting the 6th criterion.

- The 8th criterion is not applicable as the FHRS troughs are above grade until the troughs drop below the water level to return the organisms to Lake Anna. Icing along the FHRS is of a concern but may be able to be mitigated by running additional screenwash pumps to increase the flow rate through the trough/piping or by routing a portion of the heated discharge flow to the FHRS. Potential icing mitigation techniques would be proposed and evaluated as part of a detailed design.

- The 10th criterion is met by covering the trough portion of the FHRS with screening/grating.
- In order to avoid re-impingement, the FHRS would be routed beyond the intake's Impingement AOI. As presented in Section 2.2.3 of the §122.21(r)(2) Characterization of Source Water Body report, the required distance away from the intake structure to be beyond the Impingement AOI is 210 feet. The design of the FHRS for NAPS is over 1,500 feet from the intake structure, meeting the requirement of the 9th criterion.

The FHRS consists of five sections of varying length and slope as the flows converge from the various sources (i.e., the two new intake structures and existing intake structure). Figure 2-15, which is a cut from DMNNA00034-M-001, identifies all five sections of the FHRS.

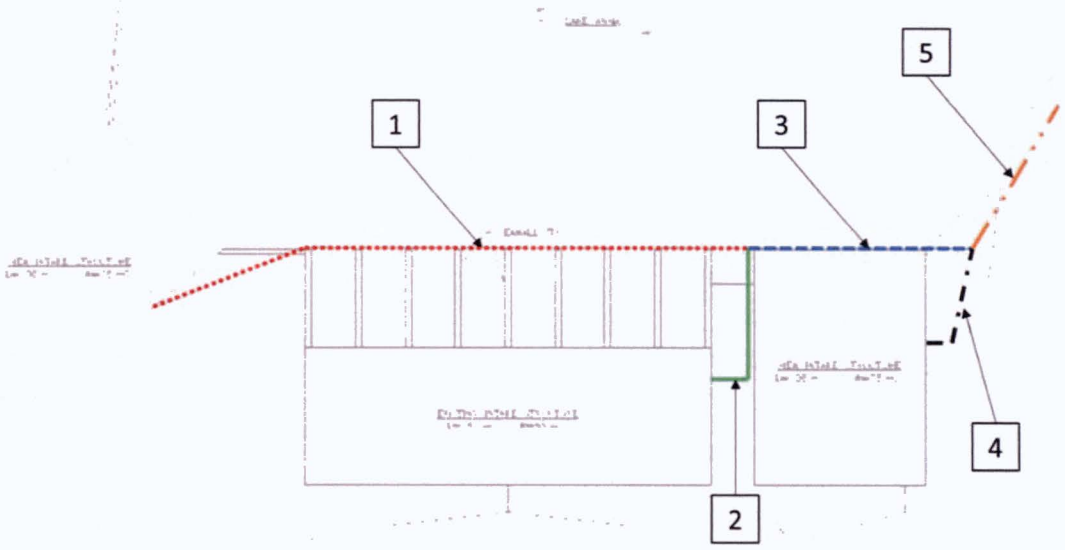


Figure 2-15: Sections of the FHRS

Section 1 connects the new intake structure to the west to the first wye connection. The second section joins the retrofitted FHRS from the existing intake structure to the first wye connection. At the first wye connection the flows of Section 1 and 2 converge and are carried through Section 3. Section 3 terminates at the second wye connection. The penultimate section, Section 4, connects the new intake structure to the east to the second wye connection. Finally, Section 5 carries all the flow from the FHRSs back to the lake. Note that Section 5 is shortened in the figure for brevity although it is an order of magnitude longer than all other sections.

Using the Manning formula for uniform open-channel flow, the depth of the water in the trough and corresponding water velocity can be determined for all the sections. Note that 529 gpm was used for each screen in service (i.e., the new intake structures each output 2,116 gpm (529 gpm x 4 screens) and the existing intake structure outputs 4,232 gpm (529 gpm x 8 screens)). In order to verify that all sections provide the required submergence and velocity, the absolute minimum flow rate possible through each subsection is considered. This would allow the site to operate the FHRS individually on each intake structure. Table 2-8 summarizes the design parameters for the

various sections of the FHRS. Note the width and depth meet the 2nd criterion and the velocity meets the 3rd criterion.

Table 2-8 - Parameters for Manning Equation to Validate FRP U-Shaped Trough Size

Parameter	Section No. (See Figure 2-15)				
	1	2	3	4	5
Trough Width, in.	18				
Trough Height, in.	27				
Manning Pipe Roughness Factor	0.011				
Depth of Flow, in.	8 15	18.06	11.24	6.37	7.48
Cross-Section of Flow, ft^2	0.78	2 02	1.16	0.56	0.63
Wetted Perimeter, ft	2.22	3.87	2.73	1 91	2.01
Slope, ft/ft	0.0081	0 0029	0.0028	0.02	0.0144
Velocity, fps	6.06	4.68	4 05	8.42	7.48
Volumetric Flow, gpm	2116	4232	2116	2116	2116

Once the bottom of the fish trough reaches an elevation of El. 254', the trough transitions to a 20" inner diameter FRP pipe. The piping runs until the end of the FHRS. This is done in order to verify all the fish/fish larvae are returned to the lake at the location outside the AOI. The elevation of El. 254' was selected because NAPS is procedurally directed to shutdown at that elevation. Once shutdown, the FHRS would no longer be in service.

Supports for the FHRS are provided in two methods: cantilever beams mounted to the face of the intake structures and concrete pads poured in the ground. The cantilevered supports are made of a 3-foot W8x31 beam welded to a 12" by 12" steel plate. The steel plate is then mounted the face intake structures using four 0.500" by 12" Hilti anchor bolts. Referring back to Figure 2-15, sections 1 and 3 of the FHRS use these types of support while all other sections use the concrete pads. Each concrete pad is 2.5 feet long by 1.3 feet wide and 2.5 feet tall with 6" of the height protruding above ground. The fish trough would be bolted to the concrete pad using supports located intermittently along the trough. These concrete pads are in accordance with the ACI criteria. Note that the maximum spacing between supports, either a cantilever beam or concrete pad, would not exceed 23 feet.

The exact placement of the fish trough and corresponding concrete pads along the peninsula of the proposed routing would require supplemental surveying and would be determined as part of a detailed design. The concrete pads would be placed strategically such that the spacing would

remain within the limits, the size of the supports would remain unchanged, and the slope of the fish trough would be consistent.

2.4.2.8 Electrical Design

As proposed, the existing 4.16 kV switchgear and 480-volt AC motor control center (MCC), 125-volt DC and miscellaneous distribution equipment currently powering the existing four (4) CW pumps and their auxiliaries would be reused to power the four (4) relocated CW pumps and accessory equipment.

The same approach would be taken for the existing circulating water pumps discharge valves being fed from the existing 480-volt AC MCC. The existing motor control center cubicles would be reused to power the newly located discharge valves.

The existing circulating water pump and discharge valve cables would be abandoned in place and new cables would be installed from the existing electrical equipment room in the intake structure control house to their new locations at the two new intake structures.

A new overhead cable tray system would be installed from the existing electrical equipment room in the intake structure control house to the new intake structures and then routed to each relocated circulating water pump. The new tray system would also service each pump's discharge valve.

The new cable tray system from the intake structure control house would have separate cable trays for all voltage levels; i.e. 4.16 kV, 480-volt AC, 120-volt AC, and instrumentation. 125-volt DC cabling would be installed in the same cable tray as the 120-volt AC cables with the addition of a tray barrier/divider to separate them. The cable tray system will contain the following cables.

- Four (4) sets of 5 kV power cables for the circulating water pump motors
- Four (4) sets of misc. 120-volt AC control cables
- Four (4) sets of 125-volt DC solenoid valve control cables
- Four (4) sets of 120-volt AC motor space heater cables
- Four (4) sets of motor stator and bearing shielded RTD cables
- Four (4) sets of motor vibration shielded probe cables
- Six (6) sets of intake structure flood level switch cables
- Four (4) sets of 480-volt AC motor operated circulating water pumps valve power cables
- Four (4) sets of 120-volt AC control cables for the circulating water pumps motor discharge valves.

The 480-volt AC distribution equipment in the existing intake structure control building would be insufficient for future loads, and therefore, two (2) new 480-volt electrical distribution systems would be required to serve the new and relocated equipment at the new intake structures. Each new 480-volt AC electrical distribution system would include one (1) new 500 KVA, 4.16 kV/480-volt AC three phase dry type transformer, one (1) 480-volt AC motor control center, one (1) 480-volt AC distribution panel, two (2) 480 V/208-120-volt AC dry type transformers and two (2)

208/120-volt distribution panels. The preliminary one-line diagrams for the electrical distribution system are provided on drawings DMNNA00034-E-001 and 002 (Appendix B).

Each new 4.16 kV/480-volt AC transformer's secondary would be close coupled to the new 480-volt AC motor control center. The new 480-volt AC motor control center would have a main incoming breaker with electronic circuit protection as well as the starters and breakers to support the new equipment.

Each new 480-volt AC distribution system equipment would be installed in pre-fabricated buildings located at the new intake structures. The buildings would be climate controlled with air conditioning, heat, lighting, fire detection equipment, convenience outlets, etc. Each pre-fabricated power house would be purchased from a power house manufacturer that would install and prewire all distribution equipment; i.e., MCC, distribution panels, provide all HVAC, lighting and lightning protection needs as well as provide the necessary grounding connections for the building. Based on previous experience, the pre-fabricated electrical buildings are the most cost-effective approach. The building preliminary layout is shown on drawing DMNNA000034-E-003 and 004 (Appendix B).

The pre-fabricated electrical buildings would be elevated and installed on piers that would permit cable trays to be installed from the power house building to route the necessary cables to the new loads as well as the cabling for the instrumentation and control systems.

A new cable tray system would be installed to service the new intake structure equipment from the new pre-fabricated elevated power house building. The cable tray system would have separate cable trays for all voltage levels; i.e. 480-volt AC, 120-volt AC, and instrumentation. Instrumentation cabling would be installed in the same cable tray as the 120-volt AC cables with the addition of a tray barrier to separate them. The new cable tray system would contain the necessary cabling to support the powering of the new equipment.

New equipment to be powered from the new MCC includes:

- Eight (8) traveling water screens, four (4) per intake structure, with vendor supplied variable frequency drives
- Two (2) screenwash pumps
- Two (2) trash rakes

Lighting systems would be designed and installed for the new intake structures. Waterproof LED lighting fixtures would be used. Lighting levels are estimated to be 15 foot-candles. Lighting would be attached to the bottom of the cable tray support structures. Maintenance lighting would also be supplied for the large pumps and general area lighting. Maintenance lighting would be located on poles.

A new lightning protection system for the new intakes would be installed. The lightning protection system would be tied into the plant's existing grounding grid.

A new electrical grounding system would be installed at the new intake structures and connected to the existing plant grounding system. All electrical equipment would be grounded.

The incoming 4.16 kV power source for the new MCC buildings are assumed to be provided by NAPS. Costs for this new power source is not included in the electrical estimates

2.4.2.9 Major Components

Table 2-9 below is a list of major new equipment that would be required for retrofitting NAPS with fine-mesh traveling screens.

Table 2-9 - Listing of Major Equipment Required for Installation

Component	Quantity	Notes
Fine-mesh Screen Retrofit	8	Fits existing Through-Flow Traveling Screens
Dual-Flow Traveling Screen	8	6'-8" screen width, spray (fish and debris) systems
Screenwash Pump	2	Provides 180 TDH at 3,200 gpm, includes 200 hp motor
Screenwash valves for New IS	16	3" Globe, debris spray nozzle isolation
	16	2" Globe, fish spray nozzle isolation
	16	2" Fire, pressure reducing for fish spray
Screenwash valves for Existing IS	8	2" Fire, pressure reducing for fish spray

Table 2-10 below is a list of major new structures that would be required for retrofitting NAPS with fine-mesh traveling screens.

Table 2-10 - Listing of Major Structures Required for Installation

Component	Approximate Size or Length	Notes
New Intake Structure Buildings (Qty. 2)	Length: 78' Width: 109' Height: 47'	Four intake bays, two CW pump pits, two structures built
Electrical Substation Buildings (Qty. 2)	Length: 30' Width: 14' Height. 10'	Pre-fabricated, painted steel
Circulating Water East Tunnel	40 ft	Concrete tunnels with 9' by 10' external dimension.
Circulating Water West Tunnel	390 ft	
FHRS Trough	1900 ft	18" wide x 27" tall FRP trough, includes troughs required to retrofit FHRS on existing structure
Screenwash Piping for New IS	10 ft	10" Carbon Steel Piping
	160 ft	8" Carbon Steel Piping
	380 ft	3" Carbon Steel Piping
	160 ft	2" Carbon Steel Piping
Screenwash Piping for Existing IS	128 ft	2" Carbon Steel Piping

2.4.3 Impacts of 2 mm Fine-Mesh Screens

The purpose of this section is to discuss the various impacts associated with retrofitting NAPS with 2 mm fine-mesh traveling water screens. Retrofitting NAPS to fine-mesh traveling water screens would require a significant expansion of the existing intake structure without any increase in cooling water withdrawal capacity, resulting in various construction-related impacts. Additionally, the fine-mesh screens would also result in on-going operational impacts that are considered. Both the initial construction and on-going operation of the fine-mesh screens would have impacts to the power generating capacity of the station. Impacts in other areas beyond operations are also considered, including licensing and environmental impacts.

2.4.3.1 Power Generation

Retrofitting NAPS with fine-mesh screens would decrease net generating capacity of the station due to parasitic losses resulting from the operation of the new dual-flow traveling water screens, screenwash pumps, and trash rake system. Parasitic losses are defined as power consumption necessary to operate the plant, which therefore reduce the net generating capacity of the plant. This ultimately results in long-term recurring costs which must be considered along with the costs of the actual conversion to fine-mesh screens.

The motors for the new screenwash pumps would have a rated brake horsepower (hp) of 200 hp. Since the dual-flow screens would operate continuously, the screenwash pumps would also be required to operate continuously. Therefore, when operation of both new screenwash pumps is considered, the net increase in power consumption would be 298 kW.

The motors for the new dual-flow traveling water screens would have a rated brake horsepower of 3 hp. All eight new dual-flow screens would operate continuously, resulting in a net increase in power consumption of 18 kW.

The motors associated with the new trash rake system would have a combined rated brake horsepower of 14 hp. The trash rake system would be expected to operate intermittently, on an "as-needed" basis. Therefore, the average power consumption is considered negligible and not included in the O&M costs.

From Table 2-11, an additional 316 kW of parasitic losses is estimated as a result of new equipment required to operate the new fine-mesh screens.

Table 2-11 - Estimate of Power Use by New Major Components

Component	Power Consumption (kW)
New Screenwash Pumps	298
New Traveling Water Screens	18
Trash Rake System	Negligible
TOTAL	316

2.4.3.2 Noise

The incremental increase in noise due to the operation of the equipment in the new intake structures is not expected to be of significant concern to the surrounding population or environment due to the location of the equipment, which is very near to the rest of the plant's buildings and equipment.

Sound is energy transmitted through the atmosphere in the form of pressure waves. The measurement of these sound pressure levels is expressed in terms of decibels (dB). Being that sound is a wave form, it also has frequency characteristics which are expressed in hertz (cycles per second). Knowing sound pressure levels and frequencies, the character of a given sound may be analyzed. Sound pressure levels can be A-weighted to adjust for the hearing range of the human ear. The sound loudness as perceived by the human ear is measured in A-weighted decibels (dBA).

Noise from an intake structure generally consists of sounds created by the motors, the speed reduction or power transmission units, and various pumps (circulating water, screenwash, service water). Because existing CW pumps and motors are being relocated for use in the new intake structures, there would be no net increase in noise due to the operation of these pumps. The operation of the new dual-flow traveling water screen motors and screenwash pumps would produce noise that would be incremental to existing level of noise at the intake structure. The

screenwash pumps and dual-flow screens are operated by 200-hp and 3-hp motors, respectively. A 200-hp motor would have a noise level of approximately 75 dBA, and a 3-hp motor would have a noise level of approximately 56 dBA (References 2.4.6.19 and 2.4.6.20). Noise would also be generated by the operation of the screenwash nozzles, although this noise would be contained to within the intake structure (at the surface of the traveling water screens) and would be somewhat minimized.

2.4.3.3 Visual Impacts

The new intake structures required to retrofit NAPS with fine-mesh screens would not create significant visual impacts for the surrounding areas. Although no significant visual impacts are anticipated, the full extent of the visual impacts and any possible permitting challenges would be analyzed fully in a detailed design phase. The final detailed design would minimize any visual impacts, to the extent practical.

As proposed, each of the new intake structures would be 109 feet long and approximately as tall as the existing intake structure. The new intake structures would be constructed alongside of the existing intake structure, near the center of the station's property. Additionally, the new intake structures would be surrounded by Dominion property, and would be somewhat concealed from view from across the lake by a peninsula housing the main parking lot for the station (see Figure 2-16).

As described in Section 2.4.2.7, a new FHRS would also be installed as part of retrofitting NAPS with fine-mesh screens. The FHRS would include separate runs from each intake structure that would combine just to the east of the intake structure area. From that point, the FHRS would travel further east along the shoreline and around the station's parking lot, starting at an elevation approximately equal to the deck of the intake structures and slowly declining to below the water level of Lake Anna. The FHRS would continue from the shoreline of the peninsula housing the main parking lot out into Lake Anna, to help ensure that the returned organisms are outside of the influence of the intake structure. As the water level in the lake falls and rises, more or less of the FHRS that extends from the shore into the lake would become visible. The FHRS would likely be visible from the surrounding areas as well as from boaters on that portion of Lake Anna.

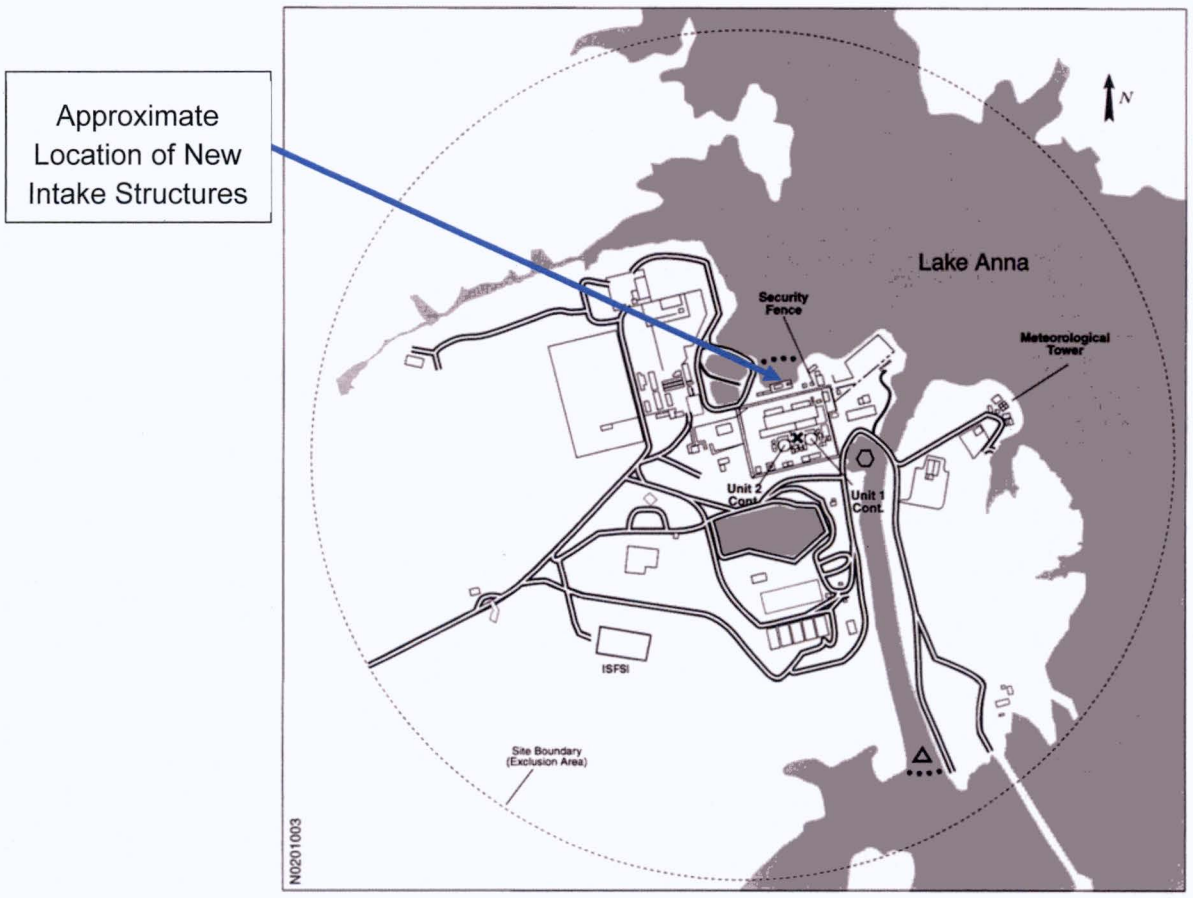


Figure 2-16 : NAPS Site Boundary (Dotted Circle, Reference 2.4.6.1)

2.4.3.4 Water Consumption

The current CCRS at NAPS draws water from Lake Anna into the CW system and discharges heated water into the WHTF via the discharge canal. Generally, the same amount of water is withdrawn and discharged to the lake.

The retrofitting of NAPS with fine-mesh traveling water screens would not alter the existing configuration of how NAPS draws water from Lake Anna and discharges to the WHTF or increase the capacity of the station to withdraw water from Lake Anna. Instead, implementation of fine-mesh screens would only serve to expand the footprint of the intake structure through which cooling water is withdrawn. The only new suction source added to the intake structures would be the new screenwash pumps. However, the discharge flow from the screenwash sprays would either fall into the screenwell, upstream of the CW pumps, or be returned to Lake Anna via the FHRS. Since the cooling system and the new FHRS discharge all of the water that is withdrawn, there are no water consumption impacts associated with the implementation of fine-mesh screens.

2.4.3.5 Ultimate Heat Sink

It is not expected that retrofitting NAPS with fine-mesh screens would negatively impact the station's UHS, nor would it impact the UHS's licensing basis.

The UHS for NAPS provides a water source for the service water system, which is required to supply cooling water to safety-related heat exchangers. The service water system is a closed-loop system using a spray pond (service water reservoir) as its normal heat sink. Makeup for evaporation, drift, and blowdown is provided by the circulating water screenwash pumps or the auxiliary service water pumps, which draw water from Lake Anna. In the event of a failure in the function of the service water reservoir, the system has the ability to draw the required water from Lake Anna. Together, the service water reservoir and Lake Anna form the station's UHS (Reference 2.4.6.21, Page 2-1). The NAPS Technical Specifications provides a maximum service water temperature limit of 95 °F (Reference 2.4.6.2, Page B 3.7.9-3).

If fine-mesh traveling water screens were to be implemented, the existing service water system (including the auxiliary service water pumps and the circulating water screenwash pumps used for makeup flow) would not be modified. Additionally, the implementation of fine-mesh traveling water screens would not have any impact on the service water temperature, which would remain a function of the service water heat rejection system or the ambient water temperature of Lake Anna.

2.4.3.6 Regulatory, Licensing, Environmental, and Safety

As discussed below, significant federal, state and local regulatory review is expected in order to implement this alternative. Implementation would need to take into account the lengthy approval process likely to take place as well as the construction schedule following all required regulatory approvals.

2.4.3.6.1 Potentially Applicable Federal Permits

United States Army Corps of Engineers (USACE) Permit

Retrofitting NAPS with fine-mesh screens would require the construction of two new intake structures outfitted with fine-mesh traveling water screens and the construction of a new fish handling and return system.

While alterations to the intake and fish collection system are usually authorized under Nationwide Permit (NWP) 7, which covers activities related to the construction or modification of outfall structures and associated intake structures, additional project components, including the construction of a fish handling and return system will likely require that the entire project be permitted under a USACE Individual Permit.

If the proposed project requires an USACE permit, it would require a joint permit application, which is issued through the USACE (Norfolk District), Virginia Marine Resources Commission (VMRC), and the Virginia Department of Environmental Quality (DEQ). The DEQ's Virginia Water Protection Permit Program serves as Virginia's Section 401 certification program for federal Section 404 permits issued under the authority of the Clean Water Act. As part of the permit application process, a project description and project plans would be placed on public notice and open to public comment.

National Environmental Protection Act (NEPA)

If a project triggers a federal permit, compliance with NEPA is required; including a review of impacts to or loss of inland tidal wetlands, forested habitat, and loss of marine habitat.

Application for an USACE permit will include the following State and Federal consultations:

- USFWS Consultation
- Virginia Department of Game and Inland Fisheries (VDGIF)
- Consistency with the Virginia Coastal Management Program

These consultations are to ensure that the proposed project would not result in adverse impacts to state and federally listed species, and is consistent with the Virginia Coastal Management Program.

U.S. NRC Review

All plant modifications require implementation of the NAPS design change process, which includes assessments of all U.S. NRC licensing impacts. Plant modifications must follow the process established in 10 CFR 50.59. NRC will review this change and determine whether the alterations to the intake and fish collection system would result in an LAR. As noted in Section 2.4.4, it is anticipated that permitting will take approximately 12 months following the completion of the detailed engineering design. If a LAR is required and the process were to extend beyond 12 months, the construction schedule would be delayed accordingly.

2.4.3.6.2 Potentially Applicable State Permits

Virginia Pollutant Discharge Elimination System Permit (VPDES)

It is anticipated that the proposed intake structure modifications would be evaluated by DEQ as part of renewal process for VPDES Permit number VA0052451. If not evaluated as part of the renewal process, then a permit modification may be required. Part 28.s of the permit fact sheet addresses Final §316(b) Rule special conditions, stating that changes to the intake structures or conditions will be reevaluated at each reissuance to monitor continued compliance with the requirement.

Stormwater General Permit for Stormwater and Dewatering Wastewaters from Construction Activities

Construction activities resulting in land disturbance of greater than 1 acre must apply for permit coverage under the DEQ Construction General Permit Number VAR10, which grants authorization to discharge under the Virginia Stormwater Management Program (VSMP) and the Virginia Stormwater Management Act. The general permit requires the construction activity operator to develop and implement a site specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submitting a registration statement for permit coverage to the VSMP Authority or DEQ.

2.4.3.6.3 Potentially Applicable Local Permits

Louisa County Site Plan Review

A site plan review is required by Louisa County to ensure that development of any commercial or industrial property to verify the proposed development is in compliance with County Codes and Ordinances. The plan review includes the submittal of engineering plans and a site visit by County Staff. Following the approval of the site plan, the applicant must obtain the following permits

(discussed below): a Louisa County Zoning Permit, a Building Permit, and a Land Disturbing Permit.

Louisa County Zoning and Building Permits

Zoning and Building Permit applications are reviewed in a stepwise manner by the Louisa County Planning and Zoning Department. Engineering drawings and application materials are reviewed by the Director to ensure plan compliance with Louisa County Zoning Ordinances. Plans are then reviewed by the Department of Planning and Development, followed by a review by the Building Official. A Zoning and Building permit is issued following approval by the three Departments.

Louisa County Planning and Community Development

The Louisa County Office of Community Planning requires that a Land Disturbance Permit be authorized prior to the disturbance of greater than 10,000 square feet (0.23 acres) of land. The applicant must submit a completed Land Disturbing Permit Application, as well as an erosion control plan prepared according to the Virginia Erosion and Sediment Control Handbook.

Lake Anna Shoreline Sediment Control Plan

If shoreline land disturbance on Lake Anna is greater than 10,000 square feet, shoreline erosion protection measures associated with construction and operation of the project will require review and approval by the Thomas Jefferson Soil and Water Conservation District (TJSWCD). The TJSWCD will require the implementation of one of several recommended methods of shoreland protection measures depending on the individual site or owner preference (where it would be more environmentally beneficial). Any shoreland that is disturbed must be permanently stabilized.

Louisa County Federal Emergency Management Agency (FEMA) Flood Permitting

Portions of the project footprint are located in an area identified by FEMA as in the 100-year floodplain of Lake Anna. Louisa County would require approval of the project through the County floodplain administrator.

2.4.3.7 FMEA and PRA Reviews

In the following failure mode analysis, the modified CW system is assumed to function as designed. Any uncertainties in hydraulic, structural, or electrical analyses would be addressed in the design process and are not considered here. Additionally, what follows is a system-level analysis and is not intended to be an exhaustive evaluation of component-level failures. A more detailed FMEA and PRA analysis would be performed during the detailed design process.

The implementation of fine-mesh screens creates the potential for new failures within the CW system and possible effects on the probability of failure for some existing plant equipment.

The greatest risk imposed from installing fine-mesh screens is the increased likelihood of screen blockage. Large-scale screen blockage would result in a partial loss of flow to the CW system and to the makeup source for the SW system. Limiting the makeup source to the SW system would be a safety-related failure because long-term service water cooling to components that support decay heat removal may become unavailable. Screen blockage may also affect the operation of the fire protection pump and RO supply pump, both of which are housed on the existing intake

structure. Large-scale screen blockage is mitigated through redundancy in this design. Installing eight screens per unit significantly reduces the likelihood of system-wide failure.

Other potential causes of localized screen blockage include any failure in the newly installed screen wash pumps, valves, or piping. While any form of blockage would result in a partial loss of flow to the CW system, the severity is reduced through redundancy, as previously discussed.

Other mechanisms can cause a partial loss of flow in the CW system without affecting the safety-related SW system. Examples include a CW pump failure and a CW pump discharge valve failing shut. The more severe of these two failures is the CW pump failure. If a pump electrically or mechanically fails with no operator action to shut the associated discharge valve, total CW flow could be reduced by greater than 25% due to recirculation of water from the discharge of the online pumps back through the secured pump. If a single pump's discharge valve fails shut, the total flow would be reduced by 25%. Any partial loss of flow in the CW system would reduce the cooling capability of the main condenser, causing a reduction in condenser vacuum, a reduction in power generation, and potentially resulting in a turbine and plant trip. Further consequences of a loss of condenser vacuum during power operations may include condenser or turbine damage. The severity of a partial loss of flow in the CW system is reduced due to redundancy in this design.

As part of this modification, new electrical buildings would be installed on each new intake structure, and the existing 480V electrical distribution system would be overhauled. Modifications to the 4160V system for the CW pumps would also be required but are less extensive. Additionally, the west intake structure would be constructed near an existing transformer area. These design considerations present the risk of electrical fires that may disrupt CW system operation or cause damage to CW equipment. During large electrical fires, surrounding equipment is typically de-energized to aid in firefighting and isolation of the affected components. Considering this, any large electrical fire in or near a CW electrical building has the potential to secure all the equipment for the associated intake structure. Similar to a partial loss of flow due to loss of a CW pump, discussed above, this casualty has the potential to reduce CW flow to a plant by greater than 50%. Several mitigating strategies exist to address this risk. All electrical buildings would be equipped with fire detection equipment to aid in early detection, and all structures would be built to applicable fire protection and electrical safety codes. Regular testing and maintenance would also assist in identifying and correcting any faulty or degraded electrical equipment.

2.4.3.8 Plant Programs

Installation of fine-mesh traveling water screens would have minimal impact on the day-to-day operation of NAPS.

A review of plant programs was conducted to inform the conceptual design and cost estimate during the preparation of this study, as well as to provide an assessment on the magnitude of the impact to the plant. These plant programs require consideration anytime NAPS performs construction projects. The subsequent sections identify the plant programs and provide discussion to evaluate impacts of fine-mesh screens in the CW system.

2.4.3.8.1 10 CFR 50 Appendix J

10 CFR 50 Appendix J governs leakage testing for the primary containment buildings. Containment buildings are the final barrier between fission products and the public, and Appendix J requirements ensure that this barrier remains functional within the appropriate acceptance criteria.

The installation of fine-mesh screens would not affect containment integrity or containment leakage rate. In addition, none of the containment isolation valves or containment penetrations would be impacted by installing fine-mesh screens.

2.4.3.8.2 ASME Code

The installation of fine-mesh screens would not require changes to ASME piping or to pressure vessels designed to the ASME Boiler and Pressure Vessel Code. The impacts to NAPS would be limited to the balance-of-plant systems.

From Section 18.3.2.3 of the UFSAR, the balance-of-plant piping is designed to the requirements of the ANSI B31.1 Power Piping Code. Existing piping inside the power block would not be affected. New piping would only be added for the relocated CW pumps, the new screenwash system modifications and the new FHRS.

Because the new CW system, screenwash system, and FHRS piping would not be highly pressurized pipe, the ANSI B31.1 piping code may not be the most appropriate. However, for simplicity and conservatism, the ANSI B31.1 code may be used during detailed design of the piping. Section 105.3 of ANSI B31.1-2007 allows for the use of non-metallic pipe, such as FRP, which would be installed in the FHRS. The code restricts the application of plastic piping to pressures of 150 psi and temperatures of 140°F. These design criteria are not expected to be reached or exceeded in the FHRS.

The components added by this modification are not designated as safety-related, and therefore would most likely not be added to NAPS's in-service testing and inspection programs. Periodic testing and maintenance should be performed similar to that of the current CW system.

2.4.3.8.3 Boric Acid

Boric acid is used to control reactivity and power level in the primary reactor coolant system. It is also stored in a passive tank to provide reactor inventory and reactivity control in the case of an emergency. The installation of fine-mesh screens would not affect the Boric Acid programmatic controls at NAPS.

2.4.3.8.4 Buried Components

The tunnels that would be installed for the construction of new intake structures would be below standard ground elevation and in direct contact with the soil, meeting the definition for "buried piping" in NEI 09-14, and not "underground piping." Because the tunnels are non-safety-related and do not contain "licensed" liquids or gases, they are not governed by plant Technical Specifications, the ASME code, or the NRC's regulations concerning NEI's groundwater protection initiative. Therefore, the tunnels are solely governed by local, state, and EPA regulations. Refer to Section 2.4.3.6 regarding potential permits required for installation of fine-mesh screens at NAPS.

Once installed, the underground tunnels would be periodically inspected to ensure that they are in good condition and that silting or biofouling has not occurred. If required, the periodic addition of a biofouling agent to prevent biological growth could also inhibit growth of organisms on the tunnel walls.

2.4.3.8.5 Coatings

The most significant concern with coatings in a nuclear plant is their ability to degrade inside containment under a design basis accident. The NRC's Regulatory Guide 1.54 provides guidance for evaluating the service level of protective coatings in a way that satisfies nuclear safety requirements. Regulatory Guide 1.54 defines Service Level III coatings as those used in areas outside the reactor containment where failure could adversely affect the safety function of a safety-related SSC. The coatings applied to new components added to support the installation of fine-mesh screens cannot adversely affect the safety function of a safety-related SSC. Therefore, the coatings used would not be subject to the requirements of Regulatory Guide 1.54. Coatings would be subject to good design practices employed to limit corrosion of metallic components.

2.4.3.8.6 Environmental Qualification

10 CFR Part 50.49 defines rules and requirements for ensuring that electrical equipment that is important to safety can remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shutdown the reactor and maintain it in a safe condition, and to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guidelines in 10 CFR Part 50.34(a)(1), 50.67(b)(2), or 100.11.

The installation of fine-mesh screens would not add any new components that are important to safety. The new components installed would not have the ability to directly impact electrical components important to safety.

2.4.3.8.7 Fire Protection, Appendix R, NFPA 805

10 CFR Part 50 Appendix R provides the fire protection program requirements for NAPS. The new components installed by the addition of fine-mesh screens would be located outside of the power block. Transformers would require fire suppressions systems to comply with NEI and Appendix R requirements. The new electrical buildings would require fire detection systems. The new electrical buildings would be very similar to the existing buildings. Therefore, the fire hazards evaluations for the new intake structures and associated equipment would likely result in the same fire protection requirements as those of the existing structures.

The screenwash systems, FHRS, and travelling water screen motors would all be controlled from the local control houses. The CW pumps and their associated MOV's are controlled from the control room. However, since the same control circuitry would be used for the CW pumps and MOV's, no new wiring would need to be routed to the control room, and no fire barriers would need to be penetrated during implementation.

One fire pump is located on the existing structure, 1-FP-P-1. This pump's ability to operate would not be negatively impacted by the proposed conceptual design. Normal operation is expected.

2.4.3.8.8 FLEX

Following the Fukushima disaster in 2011, the industry responded by implementing compensatory measures for beyond-design basis external events, including measures for core cooling, spent fuel pool cooling, containment cooling, and upgraded spent fuel pool instrumentation. The implementation of Diverse and Flexible Coping Strategies (FLEX), an NRC standard, required the addition of tie-ins to use portable equipment to maintain steam generator cooling, reactor coolant system inventory, and multiple ways to keep spent fuel covered and cool in the spent fuel pool. Infrastructure was also developed to allow for multiple methods of powering equipment from external generators, etc.

Any equipment added during the installation of fine-mesh screens would not impede any planned actions for maintaining spent fuel pool or reactor coolant system inventory, injecting water into steam generators, or maintaining containment cooling, since all of the new components would be located outside of the power block.

2.4.3.8.9 Flow Accelerated Corrosion

Flow accelerated corrosion (FAC) is a form of material degradation that can affect metallic materials that are normally resistant to corrosion because they are protected by an oxide film that forms on the surface. Impacts to the FAC program at NAPS are not anticipated.

Turbulent and fast-flowing water or wet steam can wear away the protective film and lead to continued dissolution of the underlying metal. Flow accelerated corrosion is not the same phenomenon as abrasion (caused by particles in the water), impingement (caused by water droplets in steam), or cavitation (caused by collapsing gas bubbles in a liquid flow). The phenomenon is only considered for carbon steel as stainless steel is much less susceptible to FAC. Carbon steel piping would be installed at the immediate discharge of the relocated CW pumps and throughout the new screenwash headers. FAC tends to occur at water temperatures from 175°F – 450°F in the liquid phase, which is far above the expected temperatures in the CW and screenwash systems. Also, carbon steel piping is already used at the existing CW pump discharges and in the existing screenwash systems.

2.4.3.8.10 Heat Exchangers

The installation of fine-mesh screens would not require the addition of any conventional heat exchangers. The modification would not affect total flow to the main condensers. The regular, tube-side temperatures and chemistry would remain the same and would not adversely affect the operation of the condenser. While these modifications to the CW system would have little effect on the operation of other plant systems, the site circulating water operating procedure would still need to be updated during detailed design to include the new functionality of the redesigned CW system.

2.4.3.8.11 License Renewal and Aging Management

In 2003, the NRC approved a license renewal to extend Unit 1 and 2 operating licenses an additional 20 years. In 2017, Dominion declared its intent to pursue SLR to extend both operating licenses another 20 years. The SLRA is scheduled to be submitted in 2020. Modifications to incorporate any changes to the existing intake design would be considered by NRC during the relicensing process.

Regarding aging management, the NRC published NUREG-1801 to document the technical basis for determining where existing programs are adequate and where existing programs should be augmented for extended periods of operation with regard to license renewal.

The installation of fine-mesh screens would require new components that do not fall in the scope of the NRC's aging management program. A review of the NAPS aging management program would be undertaken during detailed design to ensure that existing analyses and evaluations are not affected by the changes to the CW system.

2.4.3.8.12 Maintenance Rule

The scope of the Maintenance Rule (Regulatory Guide 1.160 and NUMARC 93-01) covers all safety-related structures, systems, and components (SSCs) as well as non-safety-related SSCs that are i) relied upon to mitigate accidents or transients or are used in plant emergency operating procedures, ii) whose failure could prevent SSCs from fulfilling their safety-related function, or iii) whose failure could cause a reactor scram or actuation of a safety-related system. To determine what equipment is within the scope of the Maintenance Rule, the function of the SSC is determined and the above screening criteria is applied.

While the fine-mesh traveling water screens are not safety-related components, their failure could prevent the safety-related ASW pumps from performing their design function. Therefore, the new screens would fall under the scope of the maintenance rule of 10 CFR Part 50.65 and would be included in the maintenance monitoring program governed by this regulation.

2.4.3.8.13 Material Compatibility

The conceptual design has considered material compatibility for each component. From a materials perspective, this design is primarily an extension of the existing design with no notable change in material interfaces. The water source is unchanged, and flowrates through the CW system would remain approximately the same. Thus, there is no potential for increased corrosion of existing plant components. Additionally, there is no increase in corrosion potential due to joining of dissimilar metals, and none of the primary or secondary water chemistry would be affected by the changes. Therefore, there are no significant material compatibility affects anticipated.

2.4.3.8.14 MOVs, AOVs, Relief Valves, and Check Valves

This design includes relocating four of the eight existing motor-operated CW pump discharge valves. No new MOV's would be added from this design. All existing MOV's would remain in the plant's MOV maintenance program to ensure that the actuation time and leakage rates (if they can be tested) are appropriate.

2.4.3.8.15 North American Electric Reliability Corporation

The North American Electric Reliability Corporation (NERC) was formed by the electric utility industry to promote the reliability and adequacy of bulk power transmission in North America. The Energy Policy Act of 2005 authorized the Federal Energy Regulatory Commission (FERC) to designate a national Electric Reliability Organization. NERC acts as this organization in the United States and has the authority to enforce standards on power system utilities in the United States and Canada to ensure electric system reliability.

Since the installation of fine-mesh screens would not significantly alter the generating capacity of the station, significant reliability concerns are not anticipated. The outage that would be required for final tie-in and startup activities would need to be coordinated through NERC.

2.4.3.8.16 Nuclear Energy Insurers Limited

Nuclear Energy Insurers Limited (NEIL) provides insurance to all operating nuclear power plants in the United States. The NEIL loss control manual provides standards for complying with NEIL requirements. During the design phase, conceptual and/or construction drawings may need to be submitted to NEIL for a design review. Of particular interest to NEIL would be the fire protection information, including fire barrier penetration drawings, underground piping drawings, and drawings of any new buildings or structures. For the intake structures and associated electrical buildings, information regarding lightning protection, wind design criteria, cable trays, and interior and exterior walls would need to be submitted to NEIL for their review. The NEIL design requirements (too numerous to list here) should be considered during detailed design. In general, buildings and structures would need to be designed to at least IBC standards. As addressed in Section 2.4.3.8.7, the design of the fire protection systems for the electrical buildings would need to consider NFPA design guidance, which in many ways would be bounded by the Appendix R requirements to which NAPS is committed.

2.4.3.8.17 Obsolescence

All components affected by the installation of fine-mesh screens would either be replacements or newly added components. Some dead-ended cabling and blanked piping would exist after rerouting cabling and piping to support the new intake structures and associated equipment.

2.4.3.8.18 Station Blackout

The Alternate AC (AAC) system was installed at NAPS to provide AC power during a Station Blackout (SBO) event. The AAC system consists of a single, non-safety related 4160 VAC diesel generator. The AAC system is independent of the standby emergency diesel generators. The installation of fine-mesh screens would not affect this system, its operation, or its operating requirements. None of the new SSC's required for fine-mesh screens would be within the scope of SBO, nor would require power for the postulated 4-hour SBO period.

2.4.3.8.19 Steam Generators

No impact is expected to the operation, maintenance, function, and design margins of the steam generators.

2.4.3.8.20 Thermal Fatigue

No impact is expected to the number of expected thermal cycles for the spent fuel pool lining, reactor, and associated piping.

2.4.3.8.21 Vessel Internals

No impact is expected is expected to the design, maintenance, function operation, or safety margins of the reactor vessel internals.

2.4.3.9 Siting, Seismic, Geological, and Hydrological

2.4.3.9.1 Siting Impacts

As detailed in 2.4.2, the two new intake structures would be constructed in the immediate vicinity of the existing intake structure, to the east and to the west, respectively. In general, this location is already a relatively congested area and care would need to be taken to ensure the construction equipment and activities would not prohibit access to the existing site equipment.

A preliminary review of plot plan and underground utilities drawings (References 2.4.6.1, Figures 1.2-2 and 9.5-1, and 2.4.6.22) was performed to assess any major temporary or permanent interferences with existing site buildings or equipment that the new intake structures and associated CW piping would have. It was determined that the existing 2" diameter fire protection piping that runs east of the existing intake structure and the existing 12" diameter fire protection piping that runs along the eastern CW discharge tunnel would both be impacted by the new CW discharge tunnel routing flow from easternmost new intake structure. As part of the detailed design, these fire protection pipes would need to be re-routed to avoid interference with the new CW discharge tunnel.

Additionally, the tie-in of the new piping with the existing CW discharge tunnels would require temporary demolition of the road adjacent to the existing intake. However, the new piping was routed such that it avoided any interference with the existing rail line located to the south of the road. Finally, the proposed location for the west intake structure is in close proximity to the existing intake structure control house and reserve transformer area, and caution would need to be taken not to disturb or interfere with these structures during construction. Note that in addition to the interferences identified from this preliminary review, additional interferences with items such as underground cabling would also be likely to occur. These potential interferences would be further investigated as part of a detailed design, and the design would be modified or the interferences rerouted as needed.

As shown on Page 1 of Appendix B, the CW discharge from the new intake structures is collected in two new discharge tunnels (one for each new intake structure), which route the CW discharge until it ultimately connects with the existing discharge tunnels for Unit 1 and Unit 2, respectively. For the western intake structure, the new discharge tunnel would travel west and south initially to avoid the existing structures, and then east to combine with the existing CW discharge tunnel. Although this conceptual piping route was designed to limit the effects on these existing structures, the final piping route and the extent of the impact to these buildings during and after construction would be finalized in the detail design phase.

During construction, care would need to be taken to avoid interferences between the overhead power lines extending north from the turbine building and cranes performing work in the area. Caution would be needed during mobilization and when performing lifts in the area, to ensure adequate clearance from the overhead lines.

Additionally, as described in Section 2.4.2.7, a new FHRS would be installed as part of retrofitting NAPS with fine-mesh screens. The FHRS would include separate runs from each of the three intake structures that travel eastward until they combine into a single trough. Once combined, the FHRS would then travel further east along the shoreline around the station's parking lot.

The new FHRS would cover a significant amount of distance. However, it would not interfere with any existing site structures and would not impact the use of the station's parking lot.

Note that there are currently four VPDES outfalls (013, 014, 020, and 021) that are located on both sides of the existing intake structure that would be impacted by the new intake structures. Outfall 013 is the emergency discharge for the turbine building sump water and Outfall 014 is a storm water discharge. Outfalls 020 and 021 are associated with the Reverse Osmosis system, with Outfall 020 being a continuous discharge and Outfall 021 being in place for emergency use only. The impact of the new intake structures on these outfalls would be evaluated in full during a detailed design phase, and either the outfalls would be relocated or the preliminary intake designs modified as necessary based on the interferences.

Finally, there are currently plans at NAPS to relocate the replacement "D" reserve station transformer (RSST) to a location beside the other three RSSTs, which are currently located to the west of the existing intake structure. If this relocation were to occur, it may interfere with the western new intake structure or the new CW discharge tunnel. If completed, the plans to relocate the replacement "D" RSST would need to be taken into account during the detailed design phase and the preliminary intake design modified as necessary.

2.4.3.9.2 Seismic Impacts

None of the new equipment required for retrofitting NAPS with fine-mesh screens would be safety-related or designated as Seismic Category I. Therefore, all new equipment and structures would be seismically designed per the requirements for Site Class D (see discussion below), as presented in the International Building Code (Reference 2.4.6.10), ASCE Standard 7-05 (Reference 2.4.6.23), NEHRP Recommended Seismic Provisions (Reference 24), and other applicable building codes.

As part of the existing intake structure, two screenwash pumps and two ASW pumps are designated as Seismic Category I structures. As described in Section 2.4.2.3, these pumps and the safety-related portions of their discharge piping would not be modified as part of retrofitting NAPS with fine-mesh screens. Therefore, none of the construction or components required for implementing fine-mesh screens would be designated as Seismic Category I. Although no impacts were anticipated to the existing Seismic Category I pumps as part of the preliminary FMEA review (see Section 2.4.3.7), a detailed FMEA would be performed as part of a detailed design to ensure that the these pumps would continue to be able to perform their safety-related functions.

2.4.3.9.3 Geologic Impacts

Although the proposed locations of the structures and equipment span across a relatively large portion of the NAPS site, it is expected that the geological subsurface stratigraphy will be similar across the site. Therefore, it is assumed that the results from past geological surveys can reasonably inform the conceptual fine-mesh traveling water screen design. Past geological surveys include borings from original site investigations at Units 1 and 2 as well as the more recent site investigations at the proposed site for Unit 3 (which shares the same geologic characteristics).

Based on these geological surveys, the station's subsurface profile is characterized by four significant zones of weathering as follows (Reference 2.4.6.1, Section 2.5.4.1):

1. Zone I / Zone IIA – Residual saprolite soil that is derived from the weathering of gneiss and schist. This soil is composed of clay, silt, and sand-sized particles with many rock fragments. It is predominantly silty, fine sand with core stone less than 10% of the volume of the mass.
2. Zone IIB – Severely weathered rock that retains its rock structure but is generally soft and is heavily iron stained. Quartz-rich areas are fractured and in part friable. The core stone is from 10% to 50% of the volume of the mass.
3. Zone III – Moderately weathered rock that is generally iron-stained on most joints and fractures, with some staining and weathering of the rock matrix. The core stone is more than 50% of the volume of the mass. The rock generally gives a dull sound when struck with a geologist's pick.
4. Zone IV – Slightly weathered to fresh rock with occasional iron staining on joints or fractures. The rock is generally hard, giving a sharp sound when struck with a geologist's pick.

Based on soil borings taken in the vicinity of the intake, the existing intake structure was constructed on a 64' x 187' mat foundation with a maximum contact pressure of 3,330 pounds per square foot (psf). The existing intake structure's foundation has a founding elevation of El. 218' and a founding material of residual soil, which has an allowable bearing value of 8,000 psf (Reference 2.4.6.1, Figure 2.5-8, Table 2.5-1 and Table 2.5-2). This residual saprolite soil is represented as Zone I and Zone IIA in the boring logs (Reference 2.4.6.1, Section 2.5.3.1 and Figure 2.5-8).

In order to support site-specific foundation level amplification functions, soil profile simulations were prepared for the NAPS service water pump and valve houses, service water reservoir area, and intake structure. The simulations were developed using the original site investigations at Units 1 and 2 as well as the more recent site investigations at the proposed site for Unit 3 (which shares the same geologic characteristics). The properties of the existing intake structure profile, including the shear-wave velocity ($\bar{v}_s$), are shown in Table 2-12 below.

Table 2-12 – Properties of the Intake Structure Profile (Reference 2.4.6.25, Table 3)

Stratum	Top Elevation [ft]	Top Depth [ft]	Thickness [ft]	V_s BE [fps]	V_s Log-SD	Thickness Range [ft]
Saprolite-1	252	0	5	472	0.35	34.5-69.5
Saprolite-2	247	5	5	690	0.35	
Saprolite-3	242	10	5	761	0.35	
Saprolite-4	237	15	5	798	0.35	
Saprolite-5	232	20	5	824	0.35	
Saprolite-6	227	25	5	847	0.35	
Saprolite-7	222	30	5	868	0.35	
Saprolite-8	217	35	5	887	0.35	
Saprolite-9	212	40	5	905	0.35	
Saprolite-10	207	45	5	922	0.35	
Saprolite-11	202	50	2	933	0.35	
ZoneIII_IV	200	52	30	5177	0.41	20-40
ZoneIV	170	82	35	8800	0.1	23-47
Bedrock-1*	135	117	10	9200	0	NA
Bedrock-2	125	127		9200	0	NA

*Stratum Bedrock-1 (10 ft thick) is added with the bedrock properties for bedrock depth variation analysis. This stratum will be removed in site response analysis as described below.

Based on Table 2-13 and the shear-wave velocity values provided in the soil profile simulation, for the purposes of this conceptual design the site is conservatively classified as Site Class D, stiff soil, as defined in the ASCE Standard 7-05 (Reference 2.4.6.23).

Table 2-13 – Site Classification (Reference 2.4.6.23, Table 20.3-1)

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: - Plasticity index PI > 20, - Moisture content $w \geq 40\%$, and - Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1 ft/s = 0.3048 m/s 1 lb/ft^2 = 0.0479 kN/m^2

As stated above, it is assumed that, for the purposes of this conceptual design, the soil characteristics for the fine-mesh screen construction areas would be similar to those used in the soil profile simulations and for the existing intake structure foundation design. This is a reasonable assumption, as the new intake structures would be constructed in the immediate vicinity of the existing intake structure. Therefore, the information above is used to inform the structural design for the new intake structures. As part of a detailed design phase, new soil borings would be taken in the proposed installation locations to validate this assumption and the structural designs of the supports and foundations for the various equipment and structures.

2.4.3.9.4 Hydrological Impact

The primary water source for the station is Lake Anna, which is an impoundment of the North Anna River formed by a dam constructed across the river as part of the overall project development. The impoundment was created specifically with the intent to use it as the primary cooling water source for surface condensers and other heat exchanger equipment at NAPS. Lake Anna was constructed to serve the needs of NAPS and was designed to provide adequate cooling water for an ultimate nuclear station capacity of approximately 4000 MWe. The North Anna River drains a watershed area of 343 square miles above the dam. The power station is situated approximately five miles upstream from the main dam, with all safety-related equipment and systems at a minimum elevation of El. 271' to be protected from flooding (Reference 2.4.6.1, Section 2.4.1).

Lake Anna is approximately 17 miles long and inundates a number of small tributaries. This results in an irregularly shaped shoreline with a total length of approximately 272 miles. To provide optimum thermal performance, Lake Anna is separated into two segments. The larger segment of about 9600 acres is considered the North Anna Reservoir (aka Lake Anna) and functions as a storage impoundment to ensure adequate water supplies for condenser cooling. The smaller segment, termed the Waste Heat Treatment Facility, has an area of about 3400 acres and functions primarily as a heat exchanger to transfer most of the station's heat rejection to the atmosphere (Reference 2.4.6.1, Section 2.4.1).

Typically, the water level of Lake Anna is maintained at El. 250'. However, a downstream release of 40 cfs is maintained and during drought conditions the water level may be drawn down to approximately El. 246' (Reference 2.4.6.1, Section 2.4.1). When Lake Anna elevation falls below 248', the downstream flow is reduced in a stepwise manner to 20 cfs, until El. 250' is regained.

The site for construction of the expanded intake is relatively flat, and no concentration of runoff is expected on the flat areas. The drainage area that will contribute to runoff on the site is not much larger than the site itself. The site would be graded to cause surface runoff to flow away from the turbine building, reactor containments, and any safety-related facilities. The site drainage system has been designed to carry the runoff from a 10-year storm of 5-minute duration with a rainfall intensity of 7 in/hour, per the Drainage Manual of the Virginia Department of Highways. The probable maximum precipitation for a 10-square mile drainage area is estimated to be 29 inches in a 6-hour period or 34 inches in a 24-hour period. Rainfall in excess of the 100-year storm would be temporarily impounded in ditches and gullies away from the station. Should it exceed the capacity of the site drainage system, it would run off the site into Lake Anna and would not affect any safety-related facility (Reference 2.4.6.1, Section 2.4.2). The new CW discharge piping associated with the new intake structures would be buried and would cover a relatively short distance. Therefore, the installation of the pipes would also not alter the existing hydraulic gradients or run-off flow paths.

The new intake structures would be constructed at approximately the same elevation as the existing intake structure, with a deck elevation of El. 265', matching the deck elevation of the existing structure. All pumps, motors, and electrical control buildings would be mounted at or above the deck elevation, which is well above the flood protected elevation of El. 257' for the areas surrounding the turbine building. Additionally, the Technical Requirements Manual requires

the station be taken out of service when the lake level exceeds El. 256'. Finally, the crest of the Lake Anna Dam is at El. 265' and would not be overtopped by the still-water level of the probable maximum flood (Reference 2.4.6.1, Section 2.4.3). Therefore, flooding of the new or relocated pumps, motors, and electrical control buildings associated with retrofitting NAPS with fine-mesh screens would not be of concern.

The FEMA flood insurance rate map (FIRM) for the NAPS site was reviewed to determine what impact the flood areas would have on the construction required for retrofitting the station with fine-mesh screens (Reference 2.4.6.26). It was determined that, apart from the new intake structures that would be constructed on the east and west sides of the existing intake, no new structures or equipment required would be located within a flood zone. As described above, the pumps, motors, and electrical control buildings would be installed at an elevation high enough that flooding would not be of concern.

Finally, the existing groundwater depth at the site was considered to determine any impacts that it may have of the structural design for the new intake structures and components. As described above, all surface and subsurface drainage from the site is towards the reservoir. About 95% of all surface water runs off directly to the reservoir and about 5% percolates vertically to the ground water table, where it then flows towards the reservoir (Reference 2.4.6.1, Section 2.4.13).

Structures for Units 1 and 2 were designed and analyzed using a uniform ground-water level of El. 256'. Since the initial design, additional investigations revealed that it is possible for ground-water elevations to be as high as El. 265' to El. 270' within the station area (Reference 2.4.6.1, Section 2.4.13). Due to the variability of ground-water conditions, it is recommended that boring samples be taken in the proposed locations of the new structures during detailed design to ensure that the ground-water level would not adversely affect the structural foundations.

Additionally, data from the United States Geological Survey (USGS) monitoring well number 380121078001001, which is located in Louisa County approximately 12 miles from the station, shows that the depth to the water table has fluctuated, but has remained between approximately 24 and 34 feet from 1972 to 2018 (Reference 2.4.6.27). Although not necessarily indicative of the ground-water level at the station, these data show no significant upward or downward trends of the ground-water level that would need to be considered.

2.4.3.10 Impact to Virginia's Electrical Grid Supply

The conversion of NAPS to fine-mesh traveling water screens would impact the Virginia electrical supply grid in two ways; (1) a one-time electrical power production loss during installation of the fine-mesh screens; and (2) a continual electrical power production loss due to the increased parasitic losses associated with the fine-mesh traveling water screens.

First, power normally supplied by NAPS would be lost when the units are taken out of service to complete the required modifications to the existing intake structure and construction of the new intake structures to house the additional screens. As shown in Appendix D, retrofitting NAPS with fine-mesh screens would require four weeks of construction related outage. The construction could be planned such that this four-week outage occurs during a planned refueling outage for one of the units, which typically ranges from approximately 20-30 days in duration. This would minimize the incremental impact to the grid, but the power lost from shutting down the second

unit simultaneously would have to be supplied to the grid by alternate sources. If the work was conducted simultaneously with a refueling outage for one of the units, then the additional days of power generation lost due to construction and tie-in of the new intake structures would be 28 days for the non-refueling unit. Assuming a gross output of 1,002 MWe (Reference 2.4.6.1, Figure 10.1-1) and a 91.7% utilization factor (average five-year capacity factor from values presented in the §122.21(r)(8) Operational Status report), this would result in 617,456 MWhr that would be lost from the Virginia electrical grid supply during those days. This power would have to be supplied by alternative sources to make up for the lost generation.

Retrofitting NAPS with fine-mesh screens would also result in increased parasitic losses that would have to be replaced in the electrical supply grid by alternative sources of power. As described in Section 2.4.3.1, the average increase in parasitic losses due to the additional equipment required to implement fine-mesh screens is approximately 316 kW, or 0.316 MWe. These increased parasitic losses result in an annual loss in electricity supplied to the grid of 2,538 MWhr, assuming a utilization factor of 91.7%. Alternate sources of power would be required to replace this lost power on a yearly basis.

2.4.4 Implementation Schedule

A schedule for the detailed permitting, design, procurement and implementation of the fine-mesh traveling water screen retrofit and the new intake structures is presented in Appendix D. The projected start date for the project would be January 1, 2020, assuming the permit is used during 2019.

Completion of the modification to the existing intake structure, relocation of the CW pumps, and retrofitting of the existing through-flow traveling screen mesh would require a plant outage. These items would be the final phase of construction, and it is expected that they could be completed during a normally scheduled re-fueling outage. Testing and tie-ins would also be completed during the planned plant outage for the one unit. The construction schedule would be planned such that these final items could be completed during a previously scheduled outage, minimizing the additional plant downtime associated with these items to a single unit.

For the conceptual design, it is assumed that both units would need to be removed from service during the final phase of construction due to the potential operational impacts to the safety-related equipment (ASW pumps and safety-related spray wash pumps) if construction on one half of the intake structure was performed while the other half was supporting the operation of the second unit. Additionally, the modification to the existing intake structure, relocation of the CW pumps, and retrofitting of the existing screens would all occur in very close proximity to other equipment that supports the operation of the plant (i.e. RO supply pump, fire protection pump, etc.). Although it is possible that a different outage configuration which reduces the construction-related outage time may be possible, a significant amount of analysis would be required to ensure that no challenges to the operation of safety-related and/or other plant support equipment would occur during construction. This analysis could be performed during a detailed design, if exploration of alternative outage configurations was desired; however, without this analytical basis and given the construction concerns described above, a dual-unit outage is assumed to be required for the conceptual design.

The detailed engineering design is estimated to take approximately 12 months. Based on discussions with Dominion, it is anticipated that permitting will take a minimum of 12 months following the completion of the detailed engineering design. As described in Section 2.4.3.6, it is possible that the NRC review of the proposed intake structure modifications would determine that a LAR is required. If the LAR process, or the acquisition of any of the other numerous permits described in Section 2.4.3.6, were to extend beyond 12 months, the construction schedule would be delayed accordingly. Therefore, the schedule presented in Appendix D is contingent upon the renewed VPDES permit being issued in 2019 and is based on an assumed permitting duration of 12 months[6].

Procurement and construction, which would be performed in parallel and could begin once the necessary permitting has been acquired, are estimated to require a total of 20 months, which includes 5 months of procurement and lead time before construction begins. After construction begins, the remaining procurement efforts and construction would be performed in parallel. Additionally, for several tasks it is assumed that multiple crews would work simultaneously to expedite completion. These efforts to expedite the project completion have been considered and incorporated into the project schedule presented in Appendix D. Severe weather conditions have not been considered and could result in schedule delays. Severe weather events such as heavy rain or winter weather pose a hurdle for construction crews, especially when safety is of utmost concern.

The schedule includes the following construction activities:

- Mobilization
    - Construction site set up to include delivery of onsite trailers, construction equipment, and labor
    - Delivery and inspection of pumps and traveling water screens
- General Site Modifications
    - Marking and protecting construction area
    - Rerouting vehicle and pedestrian traffic around construction area
- Construction activities
- Mechanical dredging
    - Placement of cofferdams (sheet piled area for new intake structures)
    - Backfill and compaction
    - Placement of concrete slab, walls and columns

[6] This analysis assumes a one year permitting schedule for 2 mm fine-mesh screens. A delay to the permitting schedule would not impact any conclusions regarding the relative social costs and social benefits of seasonal flow reductions and 2 mm fine-mesh screens over the duration of the analysis period as developed in sections 2.5.1 and 3.6.

- Installation of electrical building
- Installation of piping
- Metalwork and miscellaneous
- Installation of Fish Handling Return System
- Through-Screen Fish Handling Return System Retrofit
- Through-Screen Fine-mesh Retrofit
- Demolition of Intake Bay Walls
- CW Pump Relocation
- CW discharge capping for relocated pumps

- Demobilization
  - Clean-up of construction site
  - Restoration of construction site

The project must follow the guidelines set forth in Section 3.1 of the Environmental Protection Plan (EPP) for North Anna Units 1 and 2. Compliance with the EPP requires that before engaging in additional construction or operational activities which may affect the environment, NAPS prepare and record an environmental evaluation of such activity. NAPS will be required to report brief descriptions, analyses, interpretations, and evaluations of the environmental evaluation and associated plant modifications in the Annual Environmental Operating Report submitted by NAPS.

Based on this technology assessment, there are several siting, engineering, regulatory and construction risks that could pose challenges and/or delays to the implementation schedule for retrofitting NAPS with fine-mesh screens. These risks include:

- In general, the location of the proposed new intake structures is already a relatively congested area. Care would need to be taken to ensure the construction equipment and activities would not prohibit access to the existing site equipment. Additionally, detailed construction schedule planning would be required to ensure simultaneous construction activities could occur without interfering with each other.
- The time required for permitting is dependent on a variety of factors outside of Dominion's control. While one year of permitting was included in the preliminary implementation schedule provided in Appendix D, if permitting delays were to occur, the implementation schedule would be delayed accordingly.
- The overhead power lines extending north from the turbine building could pose a challenge for cranes to work effectively in the area. Caution would need to be taken during mobilization and when performing lifts, and schedule delays may occur if efficient construction techniques are limited by interferences with the overhead lines.

- Although drawings of existing underground utilities were reviewed when developing the preliminary design, there is still the risk that excavating a large area could impact existing utilities, particularly when the area of construction is relatively small and congested like the NAPS intake area. Additionally, there is risk that interferences with unknown underground utilities not documented on site drawings could occur.
- The construction of the new intake structures would require a large construction crew and a relatively large construction area, which could impact station security. If extensive time is required to process the construction crew through security, it may adversely affect the implementation schedule. This is also true for the large amount of excavation work required to construct the CW tunnels connecting the new intake structures to the existing intake structures.
- A hydraulic study is included in the cost assessment to validate the approach taken in this conceptual design. There is risk the study will determine the CW pumps will need to be relocated within the existing intake structure, which would significantly increase implementation costs, lengthen the schedule and likely increase outage time (and therefore electricity costs).
- Extreme weather could inhibit the construction, and therefore, is considered a risk to this schedule. Heavy rain or winter weather pose a hurdle for construction crews, especially when safety is of utmost concern.

2.4.5 Cost Estimates

2.4.5.1 Capital Costs

The total recommended construction budget to install the fine-mesh traveling water screens, construct the FHRS and retrofit the existing through-flow traveling water screens (with both a FHRS and fine-mesh screens) is estimated as $33,400,000 based upon 2018 dollars. Construction estimation tools, vendor quotations, and previous project experience are utilized for this estimate. Additionally, a factor of 1.75 was applied to the modifications to the existing intake canal near the safety-related ASW and screenwash pumps to account for an increased nuclearized cost (Reference 2.4.6.17). As described in Section 2.4.4, in several instances multiple crews were assumed in order to complete the project within a reasonable timeframe. Any overtime costs that may be incurred by these additional crews were not considered in this cost estimate.

The capital costs estimated for retrofitting NAPS with fine-mesh traveling water screens include costs related to design, procurement, implementation, and startup activities. Estimates for significant and unique components or construction activities included in the design were derived from vendor quotations or past project experience. Estimates for construction labor, materials, and basic equipment for construction were derived from RS Means for Fredericksburg, Virginia based on open shop labor. Open shop labor was used because the majority of construction firms in the area are not unionized (Reference 2.4.6.16). The cost estimates are located in Appendix C for detailed reference.

Based on industry standards and experience, the recommended consulting engineering budget for installation of fine-mesh traveling water screens is $2,000,000 based upon 2018 dollars. The estimated permitting cost is $407,000 based upon 2018 dollars.

Table 2-14 lists the major cost categories for retrofitting NAPS with fine-mesh screens along with the respective costs for each category. The construction budget does not include engineering field support during construction or NAPS's staff support of the project. This cost estimate is a Class 5 estimate per ASTM E2516-11 (Reference 2.4.6.7), which is a high-level estimate intended for use in screening and feasibility determinations.

The contingency and adjustments include general contractor management, construction management fees, and a 30% adjustment for nuclear safety concerns, construction constraints due to nuclear security procedures for on-site personnel, and hazardous construction conditions (i.e., near water, in the immediate vicinity of existing equipment).

Table 2-14 - Breakdown of Cost by Major Category (Values are Rounded)

Category	Cost[7]
Structures	$7,100,000
Mechanical Items	$8,200,000
Electrical Items	$1,500,000
Additional Construction Activities and Equipment	$1,000,000
Earthwork	$2,400,000
Piping and Valves	$100,000
Contingency / Adjustments	$13,000,000
TOTAL[8]	$33,400,000

Appendix C shows an itemized cost estimate which includes tabulated subtotals for contingencies, permitting, and construction management costs. Sources for each cost estimate are also included within the table. The items that affect the total cost the most for this option are:

- Dual-Flow Traveling Water Screens
- Through-Flow Traveling Water Screen Retrofit
- Concrete and Substructure

Given that this is a Class 5 estimate, some information associated with the cost of implementation of a new intake structure for fine-mesh traveling water screens such as field conditions, structural

[7] All values are rounded to the nearest $100,000

[8] The total cost presented here is the sum of all the unrounded project costs (as presented in Appendix C) rounded to the nearest $100,000. This total may differ from the sum of the category costs presented above due to intermediate rounding difference.

design requirements, material selection, and construction schedule demands have only been preliminarily determined. Certain costs have been estimated with assumptions that are aimed to be accurate but remain uncertain, such as:

- Mobilization and equipment transportation costs
- Specialized equipment and materials required
- Labor required for screen retrofit

Finally, given the preliminary nature of this assessment, there are several items remaining to be investigated during detailed design that may affect the cost. These considerations include the following:

- An assessment of required spares would need to be evaluated during detailed design. Critical spares are not included in the cost estimate but in certain cases may be essential to maintaining reliable plant operation.
- A detailed routing plan for the screenwash piping and FHRS would be required.
- A seismic study of the existing Intake Structure with the addition of the two new Intake Structures would be required to validate the existing Seismic I Intake Structure is not impacted.
- A hydraulic model study of the new and existing intakes would be required to determine if vortexing would be a potential concern. Based on the results of the hydraulic model study, vortex suppression devices such as flow straighteners may be required.

For an economic evaluation of the social and compliance costs associated with capital costs please refer to Section 2.5.1.2 and 2.5.2.2.

2.4.5.2 O&M Costs

Retrofitting NAPS with fine-mesh screens would result in new operation and maintenance costs. These costs would result from the new equipment that would be installed as part of the retrofit.

The United States Bureau of Labor Statistics provides periodic reports on the cost of labor across the country. The most recent such report at the time of this assessment was released December 15, 2017. This document reported a national average hourly cost to employer of $62.25 for private sector employees working in utilities (Reference 2.4.6.8). Based on the city cost factor for Fredericksburg, VA from RS Means, this rate is multiplied by 0.82 to account for geographic differences in local labor rates. Therefore, an adjusted rate of $51.05 is used. This rate is applied to estimate annual operation and maintenance costs.

The estimated number of hours to operate and maintain each piece of equipment is based on previous experience and inspection schedules provided by equipment vendors. It should be noted that the maintenance hours listed are expected for personnel experienced with the equipment and following well-established maintenance routines. The hours will likely be higher in the initial years while the maintenance procedures are established, and personnel become familiar with the equipment. The screenwash pumps maintenance activities include verification that the pump is

operating within design conditions, checks for leaks, as well as weekly inspections of the pump lubricant and semi-annual inspections of the pump foundations and coupling alignment. The dual-flow traveling screens maintenance activities would include inspections of the chain mechanisms and removal and repair of various sub-components.

The maintenance activities of the existing through-flow traveling screens is assumed to not increase. The maintenance activities associated with the trash rake system and the associated screenwash system's valves and pipes are assumed negligible since operation of the trash rake system and changes to the screenwash system's valve lineup are expected to occur relatively infrequently.

The estimated number of hours to operate and inspect each piece of equipment is multiplied by the average hourly cost to employer to determine the annual cost to operate each piece of equipment.

Table 2-15 - Estimated Additional Operation and Maintenance Costs per Year

Component	Man-Hours	Annual Costs (2018 $)
Screenwash Pump	1,000	$51,000
Dual-Flow Traveling Water Screen	2,400	$122,500
Trash Rake System	125	$6,400
TOTAL	3,525	$179,900

For an economic evaluation of the social and compliance costs associated with O&M costs please refer to Section 2.5.1.3 and 2.5.2.3.

2.4.5.3 Electricity Costs

As described in Section 2.4.3.1, the total reduction in net generating capacity would be due to the operation of additional equipment required to support the intake structure. The parasitic losses associated with retrofitting NAPS to traveling screens with fine-mesh would result in 2,538 MWhr of losses annually. As discussed in Section 2.4.3.10, there would be an additional one-time loss of 617,456 MWhr due to the four-week construction outage loss that would be required for the installation of fine-mesh screens. Note that dollar value estimates of the social and compliance costs due to reduced electricity generation are developed in Section 2.5.1.4 and 2.5.2.4.

2.4.6 References

2.4.6.1 North Anna Power Station Updated Final Safety Analysis Report, Revision 53.03.

2.4.6.2 North Anna Units 1 and 2 Technical Specifications and Bases, Amendment Nos. 278 and 261.

2.4.6.3 "Hydraulic Institute Standards for Centrifugal, Rotary, and Reciprocating Pumps," 12th Edition, 1969.

2.4.6.4 ASCE, "Design of Water Intake Structure for Fish Protection," ASCE Task Committee of Fish-Handling Capability of Intake Structures, 1982.

2.4.6.5 EPRI Document: 1021372, "Evaluation of factors affecting larval fish survival in fish return systems at cooling water intakes," 2010.

2.4.6.6 White, F.M., "Fluid Mechanics," 7th Edition.

2.4.6.7 ASTM E2516-11, "Standard Classification for Cost Estimate Classification System," ASTM International, 2011

2.4.6.8 Employer Costs for Employee Compensation – December 2017, U. S. Department of Labor, Bureau of Labor Statistics News Release, Table 10, 3/20/2018.

2.4.6.9 Electric Power Monthly with Data for December 2017, U.S. Energy Information Administration.

2.4.6.10 International Building Code, 2015.

2.4.6.11 ACI 350-06, Code Requirements for Environmental Engineering Concrete Structure and Commentary, 2006.

2.4.6.12 ACI 350.3-06, Seismic Design of Liquid-Containing Concrete Structures and Commentary, 2006.

2.4.6.13 ACI 318-14, Building Code Requirements for Structural Concrete and Commentary, 2014.

2.4.6.14 AISC 360-16, Specification for Structural Steel Buildings, 2016.

2.4.6.15 ASCE 7-14, Minimum Design Loads for Buildings and Other Structures, 2014.

2.4.6.16 Union Members in Virginia – 2015, U.S. Department of Labor, Bureau of Labor Statistics News Release, 2/16/2017.

2.4.6.17 Analysis of Projected vs. Actual Costs for Nuclear and Coal-Fired Power Plants, The Mitre Corporation, September, 1976.

2.4.6.18 Procedure 1-OP-48.2, Revision 42, Operation of Circulating Water System.

2.4.6.19 W22 NEMA Premium Efficiency 200 HP Motor, WEG Code: 11879196 | Catalog Number: 20018ET3GRB504F3-W22, Accessed 4/19/2018,

2.4.6.20 https://www.weg.net/catalog/weg/US/en/Electric-Motors/AC-Motors—NEMA/Severe-Duty/TEFC-Cast-Iron/TEFC-W22-NEMA-Premium/W22-NEMA-Premium-Efficiency-200-HP-4P-504-5T-3Ph-460-V-60-Hz-IC411—TEFC—Foot-mounted/p/11879196.

2.4.6.21 W22 NEMA Premium Efficiency 3 HP Motor, WEG Code: 12606407 | Catalog Number: 00318ET3V182TC-W22, Accessed 4/19/2018,

2.4.6.22 https://www.weg.net/catalog/weg/US/en/Electric-Motors/AC-Motors—NEMA/Severe-Duty/TEFC-Cast-Iron/TEFC-W22-NEMA-Premium/W22-NEMA-Premium-Efficiency-3-HP-4P-182-4TC-3Ph-200-400-V-60-Hz-IC411—TEFC—Foot-mounted/p/12606407.

2.4.6.23 SDBD-NAPS-SW, System Design Basis Document for Service Water System.

2.4.6.24 Drawing 11715-FB-101B, Revision 21, Underground Yard Water & Fire Protection.

2.4.6.25 ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures.

2.4.6.26 FEMA P-750, 2009 Edition, NEHRP Recommended Seismic Provisions.

2.4.6.27 Calculation 25784-000-K0C-0000-00013, Revision 0, Soil Profile Simulation for Service Water Reservoir Area and Intake Structure.

2.4.6.28 FEMA Flood Insurance Rate Map, Map Number 51109C01175B, Panel 175, Effective Date November 5, 1997.

2.4.6.29 USGS Groundwater Watch, Site Number 380121078001001, Accessed 4/19/2018 https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=380131078001001.

2.4.6.30 Drawing 11715-FAR-213 Sheet 1, Revision 1, Equipment Location – Appendix R, Intake Structure, Plan El. 265'-0", North Anna Power Station – Unit 1.

2.4.6.31 Drawing 11715-FC-5A Sheet 1, Revision 12, C.W. Intake Tunnel – Sh. 1.

2.4.6.32 EPA-821-R-14-002, "Technical Development Document for the Final Section 316(b) Existing Facilities Rule," May 2014.

2.4.6.33 Drawing 11715-2.45-3C Sheet 1, Revision 3, Section Illustration – 16 ½ x 8 Type "A" Head – 4 Stage 12CC Bowl Assembly

2.4.6.34 Drawing 11715-2.45-10B Sheet 1, Revision 2, Section Illustration – 16 ½ x 8 Type "A" Head – 4 Stage 12CC Bowl Assembly

2.4.6.35 Drawing 12050-2.45-3C Sheet 1, Revision 3, Section Illustration – 16 ½ x 8 Type "A" Head – 4 Stage 12CC Bowl Assembly

2.4.6.36 Drawing 12050-2.45-10B Sheet 1, Revision 2, Section Illustration – 16 ½ x 8 Type "A" Head – 4 Stage 12CC Bowl Assembly

2.4.6.37 Engineering Transmittal ME-94-050, Revision 0, Replacement of Traveling Screen Baskets, NAPS, Units 1 & 2.

2.5 Social and Compliance Cost Estimates

2.5.1 Social Cost Estimates

This section provides information on the social costs of installing and operating two cooling water intake structure (CWIS) alternatives at NAPS. The two CWIS alternatives are: (1) seasonal flow reductions and (2) 2 mm fine-mesh screens. These options are being considered as alternatives for reducing entrainment mortality at NAPS.[9] We refer to these collectively as NAPS Entrainment Technology Alternatives.

2.5.1.1 Overview of Methodology

2.5.1.1.1 Components of Social Costs Estimated in This Study

The major categories of social costs are typically: (1) capital costs; and (2) operating and maintenance (O&M) costs (EPA 2014b, p. 8-8). The Final §316(b) Rule notes three additional categories that should be accounted for in evaluating the social cost of entrainment technology alternatives—energy penalty costs, installation downtime costs, and administrative costs (EPA 2014a, p.48370). Since both installation downtime costs and energy penalty costs relate to changes in NAPS electricity output, we refer to them collectively as electricity costs. To assess the social costs of installing and operating NAPS Entrainment Technology Alternatives, social costs were calculated for the following four categories:

1. Capital costs: one-time social costs associated with acquiring, constructing, and installing equipment as well as replacement of major components.
2. Operation and maintenance (O&M) costs: recurring social costs associated with operation and maintenance of the equipment, excluding any costs related to ongoing power losses.
3. Electricity costs: the social costs related to changes in electricity generation and capacity at NAPS, which include the costs to replace lost electricity output at NAPS net of any cost savings at NAPS.
4. Administrative costs: the social costs incurred by CMEC and public agencies to administer the alternatives (including costs of permit applications).

The Final §316(b) Rule also calls for assessing costs related to non-water quality environmental and other impacts (EPA 2014a, p. 48428). The (r)(12) section of this document quantifies the losses in electricity output with sufficient detail to allow these cost estimates to be developed. This social cost analysis includes valuation of costs related to changes in electricity generation at NAPS but not other potential non-water environmental costs.

2.5.1.1.2 Baseline Scenario

The social costs, compliance costs (Section 2.5.2), and social benefits (Section 3.6) estimates are measured relative to a baseline scenario that reflects the future circumstances if neither of the two entrainment technologies were implemented. In the absence of the installation of new entrainment controls, the study assumes that the costs based upon the current configuration

[9] Pursuant to 40 CFR 122.21(r)(11)(i), the benefits valuation study must take into account gains to impingement due to the entrainment technologies. Since the alternatives to be evaluated are designed to reduce entrainment, costs related to technologies designed specifically to reduce impingement are only relevant to the extent that they affect the baseline.

would continue in the future over the time frame of our analysis. The current system in place at NAPS thus represents the baseline conditions for the economic analysis of the NAPS Entrainment Technology Alternatives.

2.5.1.1.3 Discounting of Social Costs

Social costs are discounted at social discount rates. Social discount rates of 3 and 7 percent, as recommended in the Final §316(b) Rule were used (EPA 2014a, p. 48367). Based upon the information provided by ENERCON in Sections 2.3 and 2.4, estimates of the net present values and annualized values for costs of the NAPS Entrainment Technology Alternatives were developed. (To be consistent with terminology in the Final §316(b) Rule, discounted values are referred to as "net present values."). The costs provided to us are assumed to begin on January 1, 2020 and end on December 31, 2043. The analysis end date reflects the 20-year useful life of the 2 mm fine-mesh screens (WTR 2018), which are predicted to become operational at the end of 2023 (Section 2.4.4).[10]

2.5.1.2 Capital Costs

Capital costs consist of the labor and material costs associated with the acquisition, construction, and installation of the NAPS Entrainment Technology Alternatives. Cost data for initial capital cost expenditure are broken down into three phases: permitting, engineering, and procurement/construction. In this section we (a) summarize ENERCON's estimates of the total overnight capital costs and (b) provide estimates of the net present value of costs after accounting for the timing of these expenditures.

2.5.1.2.1 Components of Capital Costs

Overnight capital costs are engineering estimates of the total costs of installing the necessary structures and equipment based on contemporary prices for materials, equipment, and labor, assuming the modifications could be completed immediately (i.e., "overnight"). Thus, they exclude interest charges during construction, which engineering cost estimates sometimes include; discounting implicitly incorporates such interest charges because earlier expenditures receive more weight in the present value calculations.

Overnight capital costs include costs related to permitting, engineering, and construction. Detailed estimates of overnight capital costs were developed by ENERCON for the NAPS Entrainment Technology Alternatives (Section 2.4.5). Since the seasonal flow reductions technology option

[10] Assuming a different useful life—and thus a different analysis end date—would of course affect the total benefits and total costs of the alternatives, as well as the annualized costs and benefits. One effect of a shorter useful life would be to change the annualized cost of the capital costs, with a shorter life resulting in higher annualized costs and a longer life resulting in lower annualized costs for this component. Note, however, that although annualized capital costs would be lower with a longer lifetime, conclusions regarding the *relative* costs and benefits are not affected by the lifetime assumption because of the relationship of annual costs to annual benefits once technologies are in place. Extending the analysis period by assuming a longer useful life would increase the number of years for which benefits would be accrued, but such an extension would also increase the number of years for which operational costs would be incurred (i.e., fixed O&M costs plus parasitic and efficiency power loss costs). For both of the NAPS Entrainment Technology Alternatives, the annual costs (i.e., fixed O&M costs plus operational power loss costs) are *greater* than the annual social benefits (provided in Section 3.6). As a result, assuming a longer useful life would not allow total benefits to "catch up" to total costs.

would involve modifications to the operation of NAPS but would not require any additional construction, its capital cost is $0 (Section 2.3.5). Table 2-16 summarizes the overnight capital costs from installation of the other alternative, 2 mm fine-mesh screens.

Table 2-16: Overnight Capital Costs (Millions, 2018$)

Technology	Overnight Permitting Costs	Overnight Engineering Costs	Overnight Construction Costs	Overnight Capital Costs
Seasonal Flow Reductions	$0.00	$0.00	$0.00	$0.00
2 mm Fine-Mesh Screens	$0.41	$2.00	$33.40	$35.81

Note: All dollar values are in millions of real 2018 dollars. Overnight capital costs exclude interest and escalation costs because these are implicitly incorporated in the present value calculations.
Source: Section 2.4.5.

2.5.1.2.2 Timing and discounted capital costs

ENERCON developed information on the timing of capital costs for 2 mm fine-mesh scenes. We use this timeline to estimate the expenditures that would be incurred in each month (Section 2.4.4). Table 2-17 provides the preliminary project schedule including assumptions on permitting, engineering, and construction timing. It is assumed that costs for the various project phases would be spread evenly over the months that they are incurred.

Table 2-17: Project Schedule

	Seasonal Flow Reductions	2 mm Fine-Mesh Screens
Project Start Date	1/1/2020	1/1/2020
Project End Date	1/1/2020	9/30/2023
Engineering Start Date	-	1/1/2020
Engineering End Date	-	12/31/2020
Permitting Start Date	-	1/1/2021
Permitting End Date	-	12/31/2021
Construction Start Date	-	1/1/2022
Construction End Date	-	9/30/2023
Outage Start Date	-	9/1/2023
Outage End Date	-	9/28/2023

Note: Assumes a January 2020 project start date across all technologies. Project duration values reflect the total length of the project (start of engineering through construction outage).
Source: Scheduling information: Section 2.4.4.

Using these annual expenditures, we develop estimates of the net present values and annualized values of expenditures for capital costs. Table 2-18 shows the net present value and annualized values estimates of capital costs for the NAPS Entrainment Technology Alternatives.

Table 2-18: Net Present Value and Annualized Capital Cost Estimates (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	3%	7%	3%	7%
Seasonal Flow Reductions	$0.00	$0.00	$0.00	$0.00
2 mm Fine-Mesh Screens	$33.08	$29.90	$1.92	$2.51

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month.

Source: Sections 2.3.5 and 2.4.5.

2.5.1.3 Operating and Maintenance Costs

Since the seasonal flow reductions alternative would not require any construction, we assume that they would be implemented in the first year of the analysis period (2020). We assume that the fine-mesh screens alternative would be operational starting the month after the end of the construction phase. The 2 mm fine-mesh screens alternative would involve installation of equipment that would require ongoing upkeep and thus O&M costs.

2.5.1.3.1 Schedules and Annual Fixed O&M Costs

Table 2-19 provides annual fixed O&M costs as well as operation schedules for each alternative. ENERCON determines that there would not be any fixed O&M costs required to implement the seasonal flow reductions technology and thus the O&M costs are $0 (Section 2.3.5).

Table 2-19: O&M Cost Schedule and Annual Fixed O&M Costs (2018$)

Technology	Operation Start Date	Operation End Date	Annual Fixed O&M Costs
Seasonal Flow Reductions	2020	2043	$0
2 mm Fine-Mesh Screens	2023	2043	$179,900

Note: Assumes a January 2020 project start date across all alternatives. Seasonal flow reductions would become operational at the start of the analysis period beginning in 2020. 2 mm fine-mesh screens would become operational in October 2023, the month after the completion of construction.

Source: Scheduling information: Section 2.4.4. Cost information: Sections 2.3.5 and 2.4.5

2.5.1.3.2 Fixed O&M Costs

Table 2-20 provides net present values and annualized value estimates of the fixed O&M costs for 2 mm fine-mesh screens over the course of the analysis period, assuming the annual costs are spread evenly throughout the year.

Table 2-20: Net Present Value and Annualized Fixed O&M Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	3%	7%	3%	7%
Seasonal Flow Reductions	$0.00	$0.00	$0.00	$0.00
2 mm Fine-Mesh Screens	$2.46	$1.54	$0.14	$0.13

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month.

Source: Sections 2.3.5 and 2.4.5.

2.5.1.4 Electricity Costs

2.5.1.4.1 Potential categories of electricity costs

The construction and operation of a technology change to the CWIS at NAPS could affect NAPS' electricity output in three ways.

1. Construction outages: reductions in the electricity output of the plant when a new technology requires an outage in addition to the regularly-scheduled maintenance outages of the plant.
2. Efficiency losses: reductions in the electricity output of the plant when a new technology decreases the efficiency of electricity generation at the plant.
3. Parasitic losses: reductions in the electricity output of the plant when a new technology requires electricity from the plant.

2.5.1.4.2 Changes in Electricity Output Due to NAPS Entrainment Technology Alternatives

This section provides information on the change in electricity output due to the NAPS Entrainment Technology Alternatives. This information was developed by ENERCON (Sections 2.3.3.1 and 2.4.3.10).

Electricity Losses from Construction Outages

Retrofitting NAPS with fine-mesh screens is estimated to require a four-week construction-related outage to complete testing and tie-ins. As shown in Table 2-21, this outage is proposed to occur during the last month of construction (Section 2.4.4). It is noted in Section 2.4.4 that the outage would be planned such that it would occur during a planned refueling outage for one of the units. Accordingly, the net impact of the outage would be the lost generation from one unit only (1,002 MW). We use information developed by ENERCON (Section 2.4.3.10) on the MWh loss in generation due to the construction outage. The implementation of seasonal flow reductions is not

anticipated to require an additional outage. Table 2-22 shows the reduced electricity output that would occur because of the additional plant outage for the 2 mm fine-mesh screens.

Table 2-21: Construction Outage Schedule

Technology	Outage Start Date	Outage End Date
Seasonal Flow Reductions	No Outage	No Outage
2 mm Fine-Mesh Screens	9/1/2023	9/28/2023

Note: Assumes a January 2020 project start date across all alternatives.
Source: Section 2.4.4

Table 2-22. Construction-Related Reductions in Net Electricity Output (MWh)

Technology	Outage Loss (MWh)
Seasonal Flow Reductions	0
2 mm Fine-Mesh Screens	617,456

Source: Section 2.4.3.10; NERA calculations as explained in text.

Annual Efficiency Power Losses

The seasonal flow reductions alternative would result in reduced operational efficiency at NAPS for the months of May and June. ENERCON has indicated that the seasonal flow reductions alternative would result in capacity losses of 15.19 MW for May and 25.09 MW for June. Using a capacity factor of 91.7% based on information from ENERCON (Section 2.3.3.9), the seasonal flow reductions alternative would entail a total annual efficiency power loss of 26,929 MWh. ENERCON concludes that the 2 mm fine-mesh screens would not affect the operational efficiency of the plant (Section 2.4.3.10). Table 2-23 summarizes the annual MWh losses in electricity output due to operational efficiency effects of the seasonal flow reductions alternative.

Table 2-23. Annual Efficiency Losses (MWh)

Technology	Efficiency Loss (MWh)
Seasonal Flow Reductions	26,929
2 mm Fine-Mesh Screens	0

Source: Sections 2.3.3.1 and 2.4.3.10; NERA calculations as explained in text.

Annual Parasitic Losses

The 2 mm fine-mesh screens alternative would require electricity to operate and thus would reduce the net electricity output at NAPS (parasitic loss). ENERCON has indicated that operation of the 2 mm fine-mesh screens alternative would result in parasitic losses of 0.316 MW at NAPS.

Using the estimated plant capacity factor of 91.7% (as noted above), the annual parasitic power loss from 2 mm fine-mesh screens would be 2,538 MWh.

ENERCON has indicated that the seasonal flow reductions alternative would allow NAPS to take individual CW pumps offline, resulting in a reduction of the electrical power consumed by NAPS of 1.49 MW for both May and June. Using the estimated plant capacity factor of 91.7% (as noted above), the total annual parasitic power gain from seasonal flow reductions would be 2,000 MWh. (Section 2.3.3.1). Table 2-24 summarizes estimates of the parasitic losses due to the operation of the NAPS Entrainment Technology Alternatives based on this information. Note that the negative value for the seasonal flow reductions alternative indicates the reduced parasitic load for this alternative relative to the Baseline Scenario.

Table 2-24. Annual Parasitic Losses (MWh)

Technology	Parasitic Loss (MWh)
Seasonal Flow Reductions	-2,000
2 mm Fine-Mesh Screens	2,538

Source: Sections 2.3.3.1 and 2 4.3.10; NERA calculations as explained in text.

2.5.1.4.3 Wholesale Electricity Price Forecast

Monthly wholesale electricity prices are used to value the social costs (and the compliance costs) of the decrease in power output at NAPS due to the installation and operation of NAPS Entrainment Technology Alternatives. Wholesale electricity prices are an appropriate measure of the real-resource costs of relatively small changes in power output because they reflect the marginal costs of supplying an additional unit of electricity to the grid. We developed forecasts of monthly wholesale electricity prices in Virginia over the relevant time frame to value replacement electricity at NAPS. These projections are based initially on annual wholesale electricity price projections from EIA (2018b). We supplement the annual wholesale price projections from EIA with monthly price information from PJM (2018a, 2018b) to estimate the monthly electricity prices relevant for generation in Virginia.

Electricity Price Forecast Methodology

In particular, to value replacement electricity at NAPS, we first develop monthly wholesale electricity price projections for Virginia using annual wholesale electricity price projections from the U.S. Energy Information Administration's National Energy Modeling System[11] (NEMS) (EIA 2018a). The steps are as follows.

1. *Develop annual wholesale electricity prices over the period 2020-2043 for the Virginia Region.* The NEMS data consist of annual projections of wholesale electricity prices

[11] The EIA uses NEMS to form baseline projections for national and regional energy prices and quantities, which are published in the *Annual Energy Outlook* each year. NEMS is a detailed energy and economic model developed and maintained by the EIA Office of Energy Analysis to provide projections of domestic energy-economy markets in the long term and to perform policy analyses requested by decision-makers in the White House, Congress, Department of Energy, and other government agencies.

(including generation, capacity and ancillary services) for the years 2018 through 2050, and are the foundation of our price projections. Figure 2-17 displays the NEMS projections of average annual wholesale electricity prices (converted to 2018 dollars using annual inflation rate information from BEA) for the "SERC Reliability Corporation / Virginia-Carolina" region. Note that this is the electricity market module region in NEMS that includes the Dominion transmission and distribution zone and best reflects the relevant region for changes in NAPS generation (We have provided a map of EIA's electricity market module regions in Figure 2-18). Accordingly, we use these projections as annual forecasts of Virginia state wholesale electricity prices.

2. *Calculate ratios of monthly to annual wholesale electricity prices for Virginia.* This step involves converting the annual price forecasts to monthly price forecasts using historical hourly load and marginal location price data from PJM.[12,13] Using this hourly historical PJM data over the period 2012-2017 for the Dominion transmission and distribution zone of PJM, we calculate ratios of load-weighted average prices for each month to load-weighted average annual prices for the Dominion transmission and distribution zone. As shown in Table 2-25, the ratios of average monthly to average annual wholesale electricity prices in this region range from 0.86 in November to 1.34 in January.

[12] PJM is responsible for operating and planning the regional power system and administering wholesale electricity prices for parts or all of several eastern/mid-western US states including Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia (See Figure 2-19). PJM coordinates dispatch and sets wholesale electricity prices (which differ from retail electricity prices primarily because they do not include transmission and distribution costs) through hourly uniform clearing price auctions using bids from suppliers and demand-response resources.

[13] See http://learn.pjm.com/electricity-basics/market-for-electricity.aspx for an overview of the wholesale electricity market and http://learn.pjm.com/who-is-pjm.aspx for an overview of PJM.

Table 2-25: Ratios of Average Monthly to Average Annual Electricity Prices In Virginia

Month	Ratio
January	1.34
February	1.13
March	1.08
April	0.88
May	0.93
June	0.87
July	1.04
August	0.90
September	0.95
October	0.91
November	0.86
December	0.91

Note: This information is based on historical hourly load and price data from 2012-2017.
Source: PJM (2018a, 2018b); NERA calculations as explained in text.

3. *Calculate monthly Virginia wholesale electricity price projections.* We multiply the annual Virginia wholesale electricity prices by the ratios of monthly price variability to obtain estimates of monthly wholesale electricity prices in Virginia from 2020 through 2043. Table 2-26 and Figure 2-20 provide our average monthly wholesale electricity price projections for Virginia in 2018 dollars.

Table 2-26: Monthly Virginia Wholesale Electricity Price Projections (2018$/MWh)

Month	2020	2025	2030	2035	2040	2043
January	95.76	85.62	80.08	77.36	75.53	75.23
February	80.77	72.22	67.54	65.24	63.70	63.45
March	77.70	69.47	64.98	62.77	61.28	61.04
April	63.35	56.65	52.98	51.18	49.97	49.77
May	66.46	59.42	55.57	53.69	52.42	52.21
June	62.65	56.02	52.39	50.61	49.41	49.22
July	74.53	66.64	62.32	60.21	58.78	58.55
August	64.31	57.50	53.78	51.95	50.72	50.52
September	68.40	61.15	57.19	55.25	53.94	53.73
October	64.97	58.09	54.33	52.48	51.24	51.04
November	61.43	54.93	51.37	49.62	48.45	48.26
December	65.54	58.60	54.81	52.95	51.69	51.49

Note: Prices have been converted from 2017 dollars in the EIA data to 2018 dollars using historical inflation information from BEA.

Source: Historical data from PJM (2018a, 2018b); Table: Electric Power Projections by Electricity Market Module Region of Annual Energy Outlook Table Browser (EIA 2018a); NERA calculations as explained in text

2.5.1.4.4 Social Costs of Changes in Electricity Output

Construction Outage Costs

Table 2-27 summarizes the net present value and annualized values of the estimated social costs of providing replacement electricity as a result of the construction outage for the 2 mm fine-mesh screens alternative. These values reflect the difference between the social cost of replacement generation (based upon projected electricity prices as explained above) and the cost savings because NAPS is not operating during the outage.

It is our understanding that there would not be any savings in fuel costs associated with the outage. We developed estimates of the potential savings in non-fuel operating costs during the outage based on information from the Energy Information Administration *Annual Energy Outlook 2018* (EIA 2018b), using values for nuclear generating units. Table 2-27 includes the resulting estimates of O&M savings due to the four-week outage, including net present values and annualized values.

Table 2-27: Net Present Values and Annualized Values of Construction Outage Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions				
Outage Replacement Power Cost	$0.00	$0.00	$0.00	$0.00
Outage Fuel Cost Savings	$0.00	$0.00	$0.00	$0.00
Outage Variable O&M Savings	$0.00	$0.00	$0.00	$0.00
Net Construction Outage Power Cost	**$0.00**	**$0.00**	**$0.00**	**$0.00**
2 mm Fine-Mesh Screens				
Outage Replacement Power Cost	$35.31	$30.70	$2.05	$2.58
Outage Fuel Cost Savings	$0.00	$0.00	$0.00	$0.00
Outage Variable O&M Savings	-$1.30	-$1.13	-$0.08	-$0.10
Net Construction Outage Power Cost	**$34.00**	**$29.57**	**$1.98**	**$2.49**

Note: All values are in millions of 2018 dollars. The construction outage cost savings include those due to reduced fuel costs and reduced variable O&M costs. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month

Source: EIA (2018a, 2018b); PJM (2018a, 2018b); NERA calculations as explained in text.

Efficiency and Parasitic Costs

Table 2-28 summarizes the net present value and annualized social costs from reduced electricity output due to efficiency losses from the NAPS Entrainment Technology Alternatives. As discussed above, implementation of the seasonal flow reductions would reduce the operational efficiency of NAPS in the months of May and June.

Table 2-28: Net Present Values and Annualized Values of Efficiency Loss Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions	$25.63	$18.10	$1.49	$1.52
2 mm Fine-Mesh Screens	$0.00	$0.00	$0.00	$0.00

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month. Power costs calculations based on wholesale electricity price estimates as explained in Section 2.5.1.4.3

Source: Sections 2.3.3.1 and 2.4.3.10; NERA calculations as explained in text.

Table 2-29 summarizes the net present value and annualized social costs related to parasitic losses from the NAPS Entrainment Technology Alternatives. As noted earlier, the 2 mm fine-mesh screens would require electricity to operate and thus would lead to parasitic loss costs relative to the Baseline Scenario. The seasonal flow reductions would allow NAPS to take individual CW pumps offline, resulting in a reduction of the electrical power consumed by the site. The negative value for the seasonal flow reductions alternative indicates the reduced parasitic load for this alternative relative to the Baseline Scenario.

Table 2-29: Net Present Values and Annualized Values of Parasitic Loss Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions	-$1.92	-$1.36	-$0.11	-$0.11
2 mm Fine-Mesh Screens	$2.03	$1.29	$0.12	$0.11

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month. Power costs calculations based on wholesale electricity price estimates as explained in Section 2.5.1.4.3

Source: Sections 2.3.3.1 and 2.4.3.10; NERA calculations as explained in text.

2.5.1.5 Administrative Costs

Administrative costs refer to the costs to Dominion and VA DEQ to administer the alternatives (including costs of permit applications). The Final §316(b) Rule calls for including administrative costs incurred by the facility and the administrative agency in the calculation of social costs (EPA 2014, p. 48428).

2.5.1.5.1 Private Administrative Costs

Dominion has provided estimates of administrative costs due to each technology option (Dominion 2018). Also provided were estimates for the administrative costs associated with the existing system of technologies (i.e., current configuration and no additional entrainment technology), which serves as the Baseline Scenario (Dominion 2018). Table 2-30 provides net present values of Dominion's incremental administrative costs for both technology options relative to the Baseline Scenario, assuming that annual costs are spread evenly throughout the year. Note that Dominion anticipates they would not incur any additional administrative costs for seasonal flow reductions relative to the Baseline Scenario. Accordingly, the private admin costs associated with seasonal flow reductions are $0.00.

Table 2-30: Net Present Value and Annualized Private Administrative Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions	$0.00	$0.00	$0.00	$0.00
2 mm Fine-Mesh Screens	$0.06	$0.05	$0.00	$0.00

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month.

Source: Dominion (2018); NERA calculations as explained in text.

2.5.1.5.2 Public Administrative Costs

VA DEQ provided estimates of annual administrative costs it will incur due to each technology (VA DEQ 2018). Also provided were estimates for the administrative costs associated with the existing system of technologies (i.e., current configuration and no additional entrainment technology), which serves as the Baseline Scenario (VA DEQ 2018). Table 2-31 provides present and annualized value estimates for net public administrative costs for both technology options, assuming that annual costs are spread evenly throughout the year. Note that the $0.00 values in the table are due to rounding and indicate values of less than $10,000.

Table 2-31: Net Present Value and Annualized Public Administrative Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions	$0.01	$0.01	$0.00	$0.00
2 mm Fine-Mesh Screens	$0.01	$0.00	$0.00	$0.00

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month.

Source: VA DEQ (2018); NERA calculations as explained in text.

2.5.1.6 Total Monetized Social Costs

Table 2-32 summarizes the net present values and annualized values of the total monetized social costs for the two technology options. The total social costs include the sum of capital costs, O&M costs, electricity costs, and administrative costs. As Table 2-32 reports, the net present value of total monetized social costs for the seasonal flow reductions are $23.72 million using a 3 percent discount rate and $16.75 million using a 7 percent discount rate. The equivalent net present

values of costs for 2 mm fine-mesh screens are $71.65 million using a 3 percent discount rate and $62.36 million using a 7 percent discount rate.

The annualized costs associated with total monetized social costs for seasonal flow reductions are $1.38 million using a 3 percent discount rate and $1.41 million using a 7 percent discount rate. The annualized costs associated with total monetized social costs for 2 mm fine-mesh screens are $4.16 million using a 3 percent discount rate and $5.24 million using a 7 percent discount rate.

Table 2-32: Net Present Value and Annualized Total Quantified Social Costs (Millions, 2018$)

	Net Present Value		Annualized Cost	
Technology	**3%**	**7%**	**3%**	**7%**
Seasonal Flow Reductions				
Capital	$0.00	$0.00	$0.00	$0.00
O&M	$0.00	$0.00	$0.00	$0.00
Electricity	$23.72	$16.75	$1.38	$1.41
Administrative	$0.01	$0.01	$0.00	$0.00
Total	**$23.72**	**$16.75**	**$1.38**	**$1.41**
2 mm Fine-Mesh Screens				
Capital	$33.08	$29.90	$1.92	$2.51
O&M	$2.46	$1.54	$0.14	$0.13
Electricity	$36.04	$30.86	$2.09	$2.59
Administrative	$0.07	$0.06	$0.00	$0.00
Total	**$71.65**	**$62.36**	**$4.16**	**$5.24**

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rates of 3 and 7 percent are used. Costs are assumed to occur monthly, at the start of each month.

Source: NERA calculations as explained in text.

2.5.2 Compliance Cost Estimates

2.5.2.1 Overview of Methodology

The Final §316(b) Rule requires estimation of "compliance costs," which are defined as costs borne by facility owners (EPA 2014, p. 48428). Compliance costs differ from the social costs described in Section 2.5.1 for several reasons. The following adjustments are made to each category of social costs from Section 2.5.1 to develop compliance cost estimates:

- *Adjustment to Reflect After-Tax Costs.* Compliance costs are after-tax payments that reflect the company's reduction in taxes due to increased expenditures that reduce net income. Based on a federal corporate income tax rate of 21 percent, a Virginia corporate income tax rate of 6 percent and an assumption that Virginia taxes are deductible from

federal tax, we calculate an effective tax rate on net income at NAPS of 25.7 percent (115th US Congress 2018, VA Tax 2018).

- *Discount Rate.* To discount compliance costs to net present value terms, we used a discount rate that represents the private cost of capital, as opposed to the social discount rates used in Section 2.5.1. Based on information from the U.S. Energy Information Administration's Annual Energy Outlook 2018, we use a (real) private discount rate of 4.5 percent (EIA 2018c), as explained below.
- *Timing of Costs.* Social costs are incurred at the time of the expenditures—since that is when actual resources are expended—but private costs are based on when Dominion is assumed to incur the costs. We assume Dominion's capital costs are financed through a loan, as described in Section 2.5.2.2 below. For other categories of costs, Dominion's private costs would be incurred in the same time periods as assumed for social costs.

2.5.2.2 Capital Costs

To calculate compliance costs, we assume that Dominion would finance capital costs through a 20-year loan at an interest rate equal to the real after-tax cost of debt for the power sector of 4.2 percent (EIA 2018b, 2018c) beginning on January 1, 2020. We account for the full private costs associated with the loan, including principal and interest payments on the loans. The compliance costs associated with construction of the 2 mm fine-mesh screens are equal to the after-tax annual costs of financing the loan.

Table 2-33 summarizes the net present value and annualized values of the compliance capital costs.

The net present value of the capital compliance costs is zero for seasonal flow reductions and $26.03 million for 2 mm fine-mesh screens. The annualized costs associated with capital compliance costs are zero for seasonal flow reductions and $1.75 million for 2 mm fine-mesh screens.

Table 2-33: Net Present Value and Annualized Compliance Capital Cost Estimates (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions	$0.00	$0.00
2 mm Fine-Mesh Screens	$26.03	$1.75

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month.

Source: Sections 2.3.5 and 2.4.5; NERA calculations as explained in text.

2.5.2.3 Operating and Maintenance Costs

Because operational costs are assumed to be paid by Dominion as they are incurred, the only adjustment from social costs to compliance costs is to convert all social operational costs to after-tax compliance costs. We do this by applying the corporate income tax rate described in Section 2.5.2.1.

Table 2-34 summarizes the present and annualized value estimates for compliance costs related to O&M costs.

The net present value of total O&M compliance costs is zero for the seasonal flow reductions alternative and $1.52 million for 2 mm fine-mesh screens. The annualized costs associated with total O&M compliance costs are zero for seasonal flow reductions and $0.10 million for 2 mm fine-mesh screens.

Table 2-34: Net Present Value and Annualized Compliance Fixed O&M Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions	$0.00	$0.00
2 mm Fine-Mesh Screens	$1.52	$0.10

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month.

Source: Sections 2.3.5 and 2.4.5; NERA calculations as explained in text.

2.5.2.4 Electricity Costs

2.5.2.4.1 Construction Outage Costs

During the construction outage, Dominion would not be able to generate and sell electricity from one of the two units. As discussed in Section 2.5.1.4.4, the cost to Dominion of foregone electricity sales would be partially offset by the operational cost savings from not operating the unit. The net loss to Dominion is equal to lost revenues (based upon projected electricity prices and the electricity losses) minus the O&M costs that are not incurred—this is the same calculation as for social costs. Thus, the only adjustment from social costs to compliance costs is to convert the annual losses to after-tax losses. We do this by applying the corporate income tax rate as described in Section 2.5.2.1.

Table 2-35 summarizes the present and annualized value estimates for compliance costs related to the net construction outage costs.

The net present value of construction outage compliance costs is zero for the seasonal flow reductions alternative and $24.55 million for 2 mm fine-mesh screens. The annualized costs associated with construction outage compliance costs are zero for seasonal flow reductions and $1.65 million for 2 mm fine-mesh screens.

Table 2-35: Net Present Value and Annualized Values of Construction Outage Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions		
Outage Power Cost	$0.00	$0.00
Outage Fuel Cost Savings	$0.00	$0.00
Outage Variable O&M Savings	$0.00	$0.00
Net Construction Outage Power Cost	**$0.00**	**$0.00**
2 mm Fine-Mesh Screens		
Outage Power Cost	$24.86	$1.67
Outage Fuel Cost Savings	$0.00	$0.00
Outage Variable O&M Savings	-$0.32	-$0.02
Net Construction Outage Power Cost	**$24.55**	**$1.65**

Note: The construction outage cost savings include those due to reduced fuel costs and reduced variable O&M costs. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. All values are in millions of 2018 dollars.

Source: EIA (2018a, 2018b); PJM (2018a, 2018b); NERA calculations as explained in text.

2.5.2.4.2 Efficiency and Parasitic Power Loss Costs

Since operational power loss costs are assumed to be paid by Dominion as they are incurred, the only adjustment from social costs to compliance costs is to convert all social operational power loss costs to after-tax compliance costs. We do this by applying the corporate income tax rate described in Section 2.5.2.1.

Table 2-36 summarizes the present and annualized value estimates for compliance costs related to efficiency loss costs.

The net present value of efficiency loss compliance costs is $16.56 million for the seasonal flow reductions alternative and zero for 2 mm fine-mesh screens. The annualized costs associated with efficiency loss compliance costs are $1.12 million for seasonal flow reductions and zero for 2 mm fine-mesh screens.

Table 2-36: Net Present Values and Annualized Values of Efficiency Loss Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions	$16.56	$1.12
2 mm Fine-Mesh Screens	$0.00	$0.00

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month Power costs calculations based on wholesale electricity price estimates as explained in Section 2.5.1.4.3

Source: Sections 2.3.3.1 and 2.4.3.10; NERA calculations as explained in text.

Table 2-37 summarizes the present and annualized value estimates for compliance costs related to parasitic loss costs. The net present value of parasitic loss compliance costs is -$1.24 million for the seasonal flow reductions alternative and $1.26 million for 2 mm fine-mesh screens. The annualized costs associated with parasitic loss compliance costs are $0.08 million for seasonal flow reductions and $0.09 million for 2 mm fine-mesh screens.

Table 2-37: Net Present Values and Annualized Values of Parasitic Loss Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions	-$1.24	-$0.08
2 mm Fine-Mesh Screens	$1.26	$0.09

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month. Power costs calculations based on wholesale electricity price estimates as explained in Section 2.5.1.4.3

Source: Sections 2.3.3.1 and 2.4.3 10; NERA calculations as explained in text.

2.5.2.5 Administrative Costs

Only the administrative costs incurred by Dominion are included in the compliance costs estimates. Thus, public administrative costs (those incurred by VA DEQ) are excluded from the compliance cost calculations.

Since administrative costs are assumed to be paid for by Dominion as they are incurred, the only adjustment from social costs to compliance costs is to convert the private administrative costs to after-tax costs by applying the corporate income tax rate as described in Section 2.5.2.1. Table 2-38 provides the net present value and annualized value of the administrative cost estimates for

each technology. Note that Dominion anticipates they would not incur any additional administrative costs for seasonal flow reductions relative to the Baseline Scenario. Accordingly, the private admin costs associated with seasonal flow reductions are $0.00.

The net present value of administrative compliance costs is $0.00 million for the seasonal flow reductions alternative and $0.06 million for 2 mm fine-mesh screens. The annualized costs associated with administrative compliance costs are $0.00 million for seasonal flow reductions and $0.00 million for 2 mm fine-mesh screens.

Table 2-38: Net Present Value and Annualized Total Compliance Administrative Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions	$0.00	$0.00
2 mm Fine-Mesh Screens	$0.06	$0.00

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month. Compliance administrative costs include only administrative costs incurred directly by the facility.

Source: Dominion (2018); NERA calculations as explained in text.

2.5.2.6 Total Monetized Compliance Costs

Table 2-39 summarizes the total monetized compliance costs for each technology alternative in terms of net present values and annualized values. As Table 2-39 reports, the net present values of total monetized compliance costs are $15.32 million for seasonal flow reductions and $53.42 million for 2 mm fine-mesh screens. For these two alternatives, the annualized compliance costs are $1.03 million and $3.60 million, respectively.

Table 2-39: Net Present Value and Annualized Total Quantified Compliance Costs (Millions, 2018$)

	Net Present Value	Annualized Cost
Technology	**4.5%**	**4.5%**
Seasonal Flow Reductions		
Capital	$0.00	$0.00
O&M	$0.00	$0.00
Electricity	$15.32	$1.03
Administrative	$0.00	$0.00
Total	**$15.32**	**$1.03**
2 mm Fine-Mesh Screens		
Capital	$26.03	$1.75
O&M	$1.52	$0.10
Electricity	$25.81	$1.74
Administrative	$0.06	$0.00
Total	**$53.42**	**$3.60**

Note: All dollar values are in millions of real 2018 dollars. Present values are calculated as of January 1, 2020 for costs incurred from 2020 to 2043. Annualized costs are calculated based on costs from 2020 to 2043. Annual discount rate of 4.5 percent is used. Costs are assumed to occur monthly, at the start of each month.

Source: NERA calculations as explained in text.

2.5.3 Summary

The analysis developed in this section addresses requirements set forth in Section 122.21(r)10 of the Final §316(b) Rule. The economic cost analyses in Sections 2.5.1 and 2.5.2 rely on well-established economic methodologies and are consistent with the EPA guidelines for preparing economic analyses (EPA 2014b). Table 2-39 provides net present value estimates of the total monetized social costs for each technology option, with estimates provided for capital costs, O&M costs, electricity costs, and administrative costs. Using a 3 percent discount rate, the net present value of total social costs is $23.72 for seasonal flow reductions and $71.65 for fine-mesh screens. Using a 7 percent discount rate, the net present value of total social costs is $16.75 for flow reductions and $62.36 for 2 mm fine-mesh screens.

2.5.4 References

115th U.S. Congress. 2017. Public Law No. 115-97, the Tax Cut and Jobs Act. December.

Dominion Resources, Inc. (Dominion). 2018. Re: Administrative Costs Associated with Implementing the Final Rule (Spreadsheet). June.

PJM. 2018a. Historical Metered Load Data, 2012-2017. http://www.pjm.com/markets-and-operations/ops-analysis/historical-load-data.aspx (Accessed May 10, 2018)

PJM 2018b. PJM Data Miner Location Marginal Pricing. https://dataminer.pjm.com/dataminerui/pages/secure/lmp.jsf (Accessed May 10, 2018)

PJM. 2018c. PJM Transmission Zone Map. https://dataminer.pjm.com/dataminerui/pages/secure/lmp.jsf

U.S. Bureau of Economic Analysis (BEA). 2018. National Data Table Browser. Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. https://www.bea.gov/ (Accessed May 20, 2018)

U.S. Energy Information Administration (EIA). 2018a. Annual Energy Outlook Table Browser – Energy Information Administration. Table 77. Retrieved from http://www.eia.gov/oiaf/aeo/tablebrowser/. (Accessed June 8, 2018).

U.S. Energy Information Administration (EIA). 2018b. Assumptions to the Annual Energy Outlook 2018: Electricity Market Module Washington, DC. April.

U.S. Energy Information Administration (EIA). 2018c. Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2018. Washington, DC. February.

U.S. Energy Information Administration (EIA). 2018d. Electricity Market Module Regions. Retrieved from https://www.eia.gov/outlooks/aeo/pdf/nerc_map.pdf

U.S. Environmental Protection Agency (EPA). 2014a. National Pollutant Discharge Elimination System—Final Regulations To Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities (Final Rule). Federal Register, Volume 79, No. 158. August 15.

U.S. Environmental Protection Agency (EPA). 2014b. Guidelines for Preparing Economic Analyses (Guidelines). Washington, DC: EPA, May.

Virginia Department of Environmental Quality (VA DEQ). 2018. Re: Administrative Costs Associated with Implementing the Final Rule. February.

Virginia Tax. 2018. Corporate Income Tax. https://www.tax.virginia.gov/corporation-income-tax

WTR Engineering (WTR). 2018. Equipment Life Expectancy, Fish Recovery & Return Fine Mesh Traveling Screens.

2.5.5 Figures

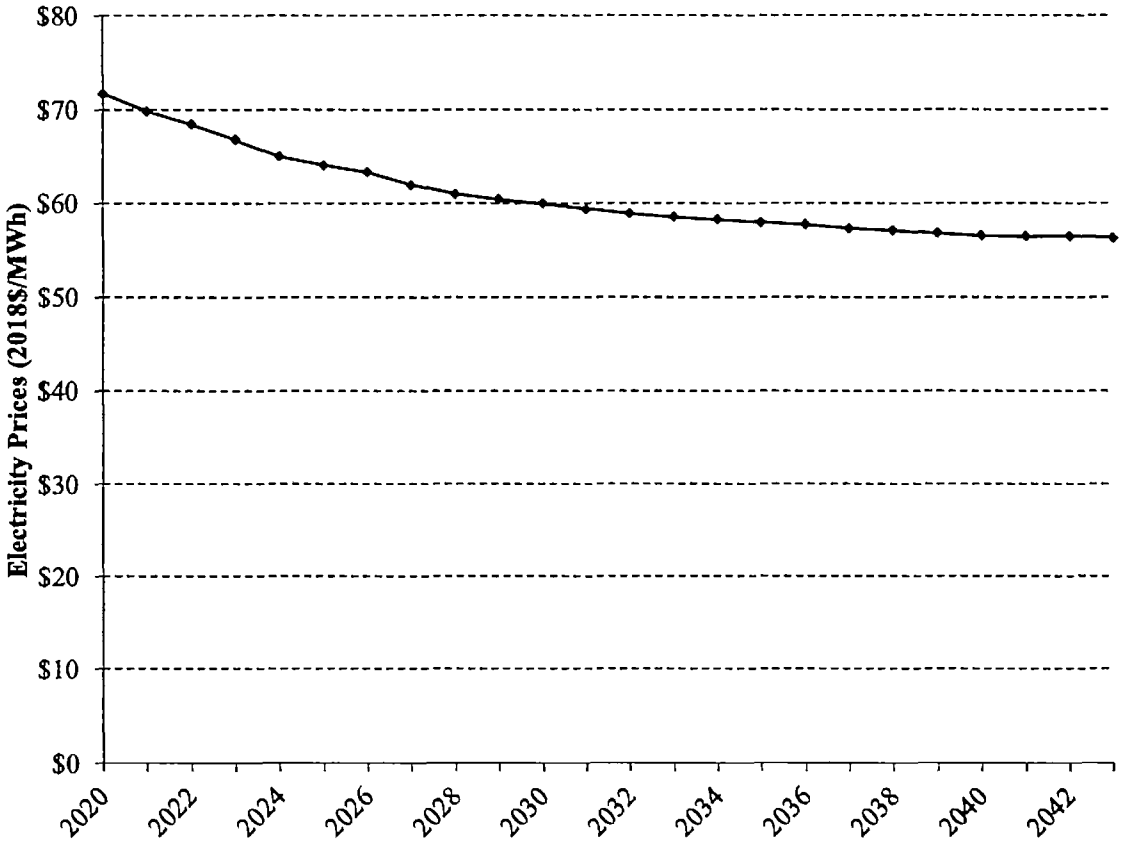


Figure 2-17: Projected Average Annual SERC Reliability Corporation/ Carolina-Virginia Region Wholesale Electricity Prices (2018$/MWh)

Note: Dollar year conversions are based historical inflation from BEA.

Source: SERC / Virginia-Carolina Region, Annual Energy Outlook 2018 (EIA 2018a); NERA calculations as explained in text.

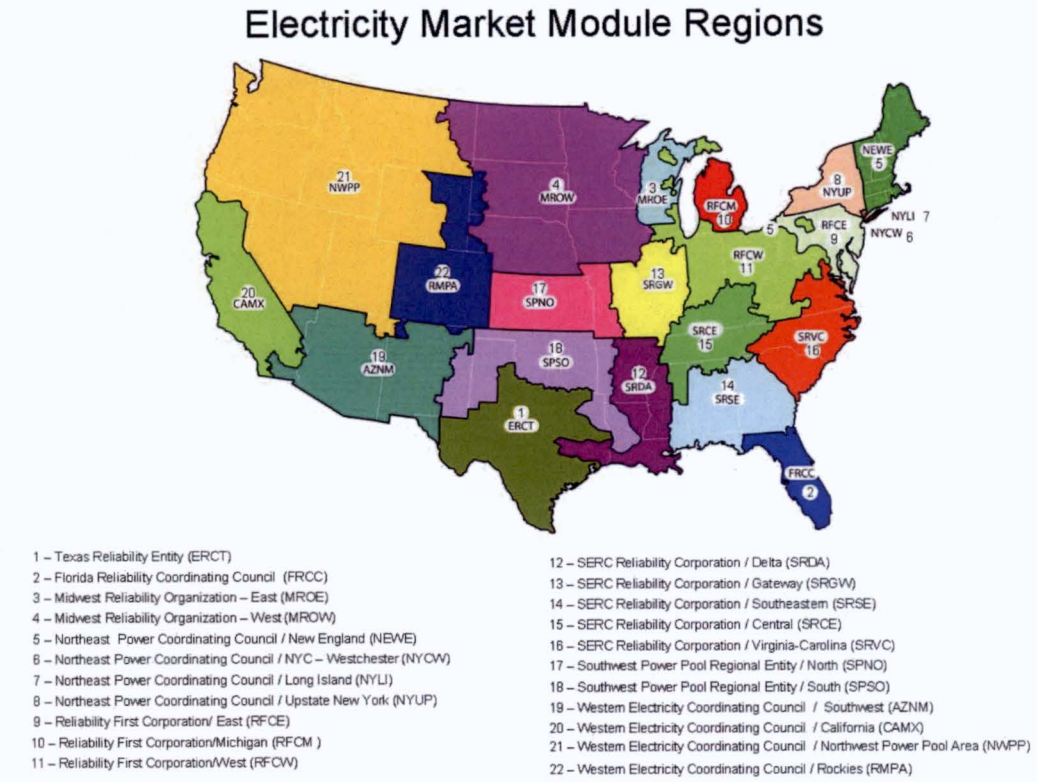


Figure 2-18: NEMS Electricity Market Module Regions

Source: EIA 2018d.

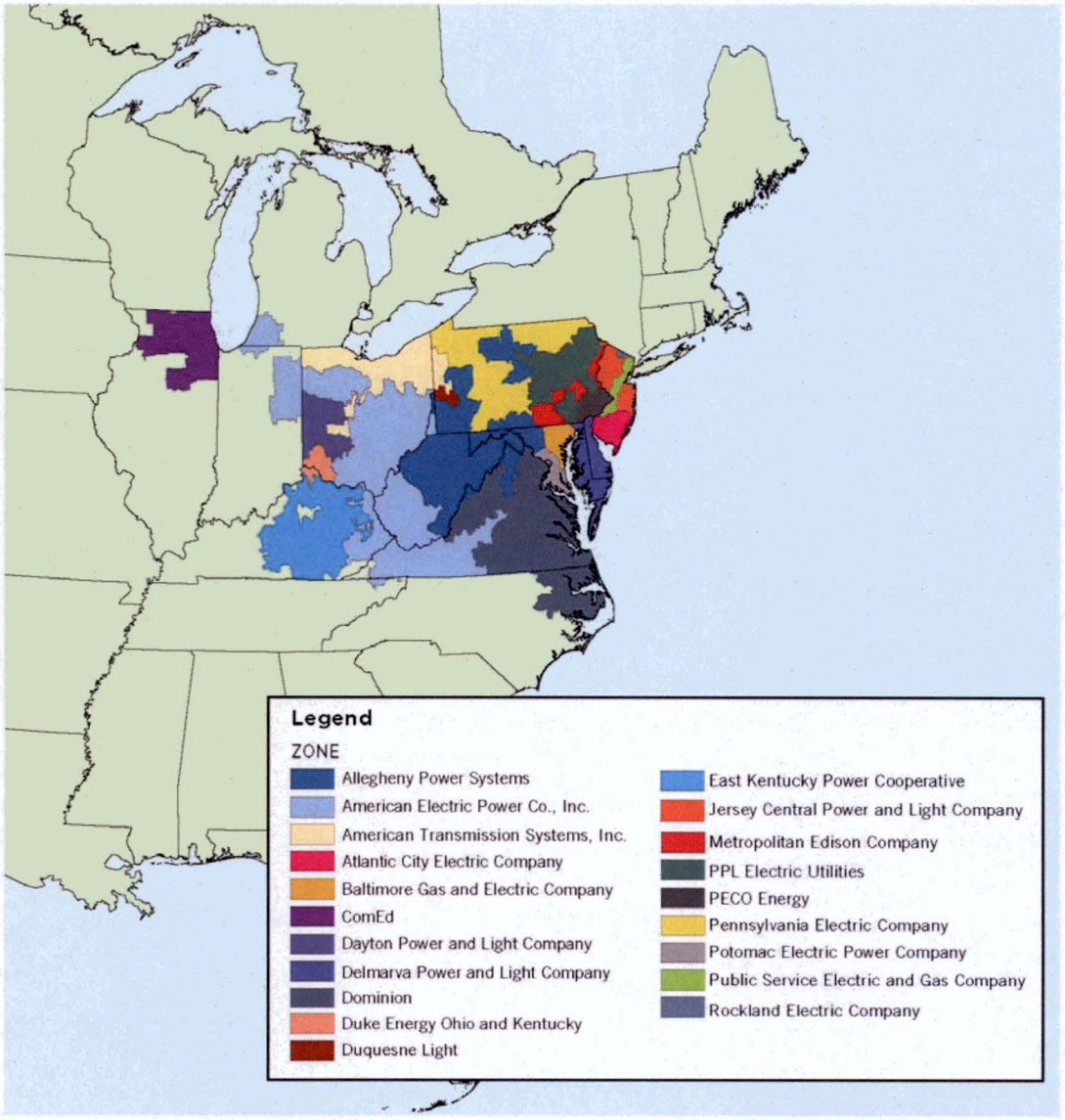


Figure 2-19: PJM Map by Zone

Source: PJM 2018c.

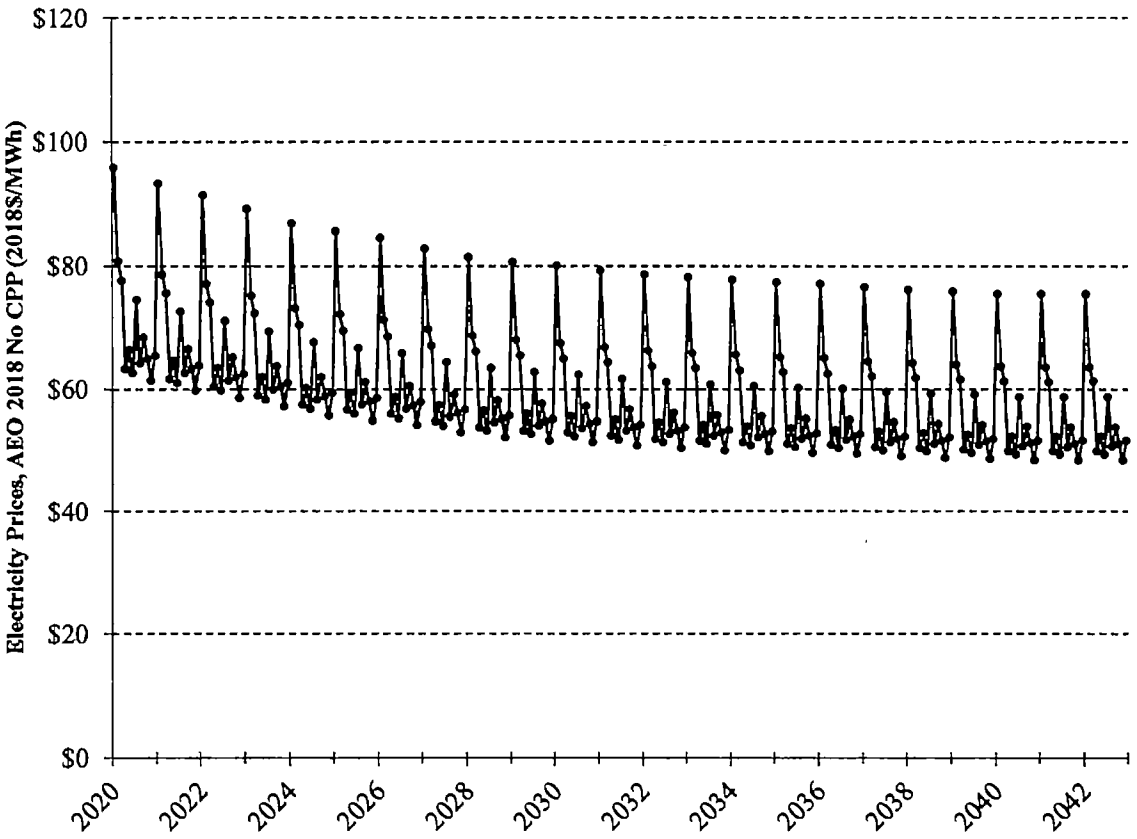


Figure 2-20: Monthly Virginia Wholesale Electricity Price Projections (2018$/MWh)

Source: NERA calculations as explained in text.

3 Benefits Valuation Study (40 CFR § 122.21 (r)(11))

3.1 §122.21(r)(11) Requirements

Existing water-withdrawal facilities subject to the Final §316(b) Rule and withdraw greater than 125 MGD for AIF for which 25% or more is used exclusively for cooling purposes must submit a Benefits Valuation Study consistent with the following requirements as specified in §122.21 (r)(11):

> *"The owner or operator of an existing facility that withdraws greater than 125 MGD AIF must develop for submission to the Director an evaluation of the benefits of the candidate entrainment reduction technologies and operational measures evaluated in paragraph (r)(10) of this section including using the Entrainment Characterization Study completed in paragraph (r)(9) of this section. Each category of benefits must be described narratively, and when possible, benefits should be quantified in physical or biological units and monetized using appropriate economic valuation methods. The benefits valuation study must include, but is not limited to, the following elements:*
>
> *(iv) Incremental changes in the numbers of individual fish and shellfish lost due to impingement mortality and entrainment as defined in 40 CFR 125.92, for all life stages of each exposed species;*
>
> *(v) Description of basis for any estimates of changes in the stock sizes or harvest levels of commercial and recreational fish or shellfish species or forage fish species;*
>
> *(vi) Description of basis for any monetized values assigned to changes in the stock size or harvest levels of commercial and recreational fish or shellfish species, forage fish, and to any other ecosystem or non use benefits;*
>
> *(vii) A discussion of mitigation efforts completed prior to October 14, 2014 including how long they have been in effect and how effective they have been;*
>
> *(viii) Discussion, with quantification and monetization, where possible, of any other benefits expected to accrue to the environment and local communities, including but not limited to improvements for mammals, birds, and other organisms and aquatic habitats;*
>
> *(ix) Discussion, with quantification and monetization, where possible, of any benefits expected to result from any reductions in thermal discharges from entrainment technologies."*

3.2 Introduction

In this section, the biological benefits of potentially implementing either 2 mm fine-mesh screens or seasonal flow reductions (collectively referred to as "NAPS Entrainment Technology Alternatives") were estimated in terms of additional recreational catch in Lake Anna as input data for monetizing the social benefits. The economic assessment included in this section then calculates monetary estimates of the social benefits of reduced entrainment due to the NAPS

Entrainment Technology Alternatives that would accrue over the lifetime of these technology options (2020–2043). The net present values of total monetized social benefits for the seasonal flow reductions are estimated to be about $126,000 at a 3 percent discount rate and $88,000 using a 7 percent discount rate for benefits over the period from 2020 to 2043. The net present values of total monetized social benefits for 2 mm fine-mesh screens are estimated to be about $514,000 using a 3 percent discount rate and $324,000 using a 7 percent discount rate.

3.3 Impingement and Entrainment Information

3.3.1 Impingement Mortality Data

Those organisms collected from a screen or retained on a sieve with a maximum opening of 0.56 inches (14.2 mm), equivalent to the diagonal opening of a ½ × ¼ inch mesh screen or ⅜-inch square mesh screen are referred to as impingement as specified by §125.92(n) of the Final §316(b) Rule. Impingement also includes entrapment of any life stages of fish and shellfish on the outer part of an intake structure. There are no impingement abundance data available for NAPS since the Final §316(b) Rule was issued in 2014. Special Condition 19 of the current VPDES Permit VA0052451 states a 1985 environmental report on impingement and entrainment studies at NAPS indicated minimal or no adverse environmental impact. Condition A.4.a of the VPDES Permit effectively does not allow NAPS to have a fish handling and return system to return fish and debris retained by the travelling screen with the screen wash to the lake. As discussed in Section 6, NAPS meets BTA for impingement mortality standard by complying with §125.94(c)(1) because NAPS's cooling system, which includes Lake Anna and the WHTF, meets the definition of a CCRS.

3.3.2 Entrainment Abundance Data

3.3.2.1 Entrainment Monitoring Data

The biological benefit evaluation of entrainment reduction technologies at NAPS was based on the monthly entrainment densities estimated from the two-year entrainment characterization study performed to address §122.21(r)(9) and described further by HDR (2018). Entrainment abundance at NAPS and potential reduction benefits of implementing seasonal flow reductions or installing 2 mm fine-mesh screens are limited to fish because no shellfish were collected during the two years of sampling. Entrainment density was estimated from ichthyoplankton samples collected from a 335-micron mesh hoop net used to filter approximately 100 m^3 of intake water pumped through a 4-inch PVC pipe opening at each of three depths (near-surface, mid-depth, and near-bottom) in front of the bar rack 2B or 2A at NAPS Unit 2. A sample was collected once every six hours within a 24-hour sampling event. Sampling was completed twice a month from April 2016 through September 2016 and March 2017 through September 2017. In addition to identification and enumeration of unique taxa and life stages, morphometric measurements (e.g., total length, egg diameter, greatest body depth, and head capsule width) of representative subsampled individuals for each taxon were used to derive exclusion fractions for adjusting sample densities of ichthyoplankton for different screen mesh size based on physical size exclusion (HDR 2018).

The entrainment density data represented 18 taxonomic categories and five life stages that were used for estimating entrainment abundance and reductions by species under each entrainment

reduction alternative (Table 3-1). Entrainment is defined as those life stages of fish and shellfish in the intake water flow entering and passing through a CWIS, but excluding those organisms that would be retained on a sieve with a maximum opening of 0.56 inches (14.2 mm), equivalent to the diagonal opening of a ½ × ¼ inch mesh screen or ⅜-inch square mesh screen as specified by §125.92(h) of the Final §316(b) Rule. At NAPS, the existing traveling water screens have ⅛-inch by ½-inch rectangular screen mesh which excludes fish and shellfish with a maximum width greater than 3.2 mm (⅛ inch) that would have been entrained through a 0.56-inch (14.2 mm) opening. Entrainable organisms that would be excluded from passing through NAPS's existing traveling screen mesh or other fine-mesh screen and instead become impinged referred to in the Final §316(b) Rule as impinged entrainables or "converts." The existing CWIS at NAPS does not have a fish handling and return system to potentially return converts washed from the existing traveling water screens back to Lake Anna alive; therefore, entrainment densities and total entrainment loss estimates for the existing CWIS at NAPS Units 1 and 2 combined used in this evaluation were based on ichthyoplankton densities at each depth stratum averaged by month (pooled across diel periods and sampling events) and adjusted to exclude individuals greater than 0.56-inches (14.2 mm) in body depth (i.e., baseline entrainment density data described in Appendix F, and based on HDR [2018] and the entrainment characterization study for addressing §122.21(r)(9))(Table 3-2 and Table 3-3).

3.3.2.2 Actual Intake Flow Data

The three case scenarios of monthly water withdrawal volumes used for extrapolating entrainment density to entrainment abundance estimates were based on a three-year average of monthly actual intake flows at NAPS Units 1 and 2 combined from January 2015 through December 2017 as specified by HDR (2018; Appendix A). The three-year AIF for NAPS Units 1 and 2 combined was 1,857 MGD. The entrainment abundance calculations for the existing CWIS and 2 mm fine-mesh screens were based on three-year average monthly AIF (Table 3-4). For the biological benefit evaluation of seasonal flow reductions, the existing 3-year AIF for May and June was reduced by a proposed 21.875% consistent with the Comprehensive Technical Feasibility and Cost Evaluation Study, Section 2, in response to §122.21(r)(10) (Table 3-5).

3.3.3 Entrainment Abundance Estimates for the Existing CWIS

3.3.3.1 Calculation Methods of Entrainment Abundance

The monthly entrainment density ($E_{t,i,m}$) for taxon t and life stage i at NAPS was calculated as:

$$D_{E,t,i,m} = \frac{\sum_{h=1}^{N_h} D_{E\,t,i,m,h}}{N_h} \qquad \text{(Equation 1)}$$

where $D_{E,t,i,m,h}$ = entrainment density (number per 100 m^3) of taxon t and life stage i at month m and depth stratum h; and

N_h = number of depth strata sampled (=3), which assumes each sampled stratum of water column equally contributes to intake flow and the sample density for each sampled stratum was representative of one third of the water column.

The monthly entrainment abundance ($E_{t,i,m}$) for taxon t and life stage i at NAPS was calculated as.

$$E_{t,i,m} = D_{E\,t,i,m} V_m \quad \text{(Equation 2)}$$

where DE, t, i, m = entrainment density (number per 100 m3) of taxon t and life stage i at month m, and

V_m = AIF volume (m^3) for Units 1 and 2 combined at month m .

Annual entrainment abundance of taxon t and life stage i ($E_{t,i}$) at NAPS Units 1 and 2 combined was estimated by summation of $E_{t,i,m}$ as:

$$E_{t,i} = \sum_{m=1}^{N_m} E_{t,i,m} \quad \text{(Equation 3)}$$

where N_m = number of months within the annual period (season).

To characterize inter-annual variability, annual entrainment abundance was estimated separately for each of the two years of entrainment data during the same 6-month period (April through September) common to both years. The variation (e.g., coefficient of variation) observed based on two years of April through September is assumed to be representative of a typical annual entrainment season. At NAPS, entrainment from October through February was assumed to be zero or negligible. The average monthly mean densities from March through September were summed to represent typical annual entrainment abundance at NAPS Units 1 and 2 combined based on AIF. With exception of March, which was only sampled in 2017, each month was represented by the average of monthly abundance from two years of sampling.

3.3.3.2 Species Apportionment

The monetization of the benefits of implementing entrainment reduction technologies at NAPS requires the comparison in equivalent loss of recreationally important species (i e., equivalent catch), directly and indirectly via trophic transfers, between a candidate entrainment-reduction technology and the existing CWIS. This assessment estimates the losses and benefits from annual entrainment of all taxa identified from sampling, but to do so, required unidentifiable fish taxa and several fish taxa identified to genus or family or species complexes to be apportioned to species level for modelling and ultimately to provide benefit data as input for monetization. Prior to species apportionment, monthly entrainment densities for each taxon and life stage were averaged among the three depth strata (n=3 for each monthly mean). In addition, unidentified larvae (2.9%), yolk-sac larvae (3.4%), and post yolk-sac larvae (91.3%) were combined into a single larval stage for this assessment (Table 3-6). Juveniles (2.0%) considered entrainable from pump samples were assumed to be young of the year (YOY) for this evaluation.

The taxa identified to higher-than-species level were apportioned to species proportionally to the monthly mean densities of the species and life stages identified for that respective month, or adjacent month when no other related species were identified (Table 3-7 and Table 3-8). The first step to species apportionment was allocating the densities of unidentified taxa (1.9% in 2016 and

0.6% in 2017) among the remaining taxa (Table 3-9). The only taxon of eggs were identified in May of both years as Herring and Shad which were classified as Gizzard Shad because that was the Herring and Shad species of larvae in that month. Larvae identified as Herring and Shads, representing 43.4% of the total entrainment density in 2016 and 68.8% of the total entrainment density in 2017, were apportioned to Blueback Herring, Gizzard Shad and Threadfin Shad (Table 3-10). Larvae identified as Threadfin/Gizzard Shad, representing 2.9% of the total entrainment density in 2016 and 12.9% of the total entrainment density in 2017, were apportioned to these two species according to the monthly ratio between these two species (Table 3-11). Larvae identified to Sunfish family level (0.8% of total entrainment density) in 2016 were apportioned to the identified sunfish species as presented in Table 3-12. Common Sunfish (*Lepomis* sp.) larvae were re-classified as Bluegill *(L. macrochirus*). Other members of the genera known to live in Virginia are Green Sunfish (*L. cyanellus*), Redbreast Sunfish (*L. auritus*), Longear Sunfish (*L. megalotis*), Pumpkinseed (*L. gibbosus*), Redear Sunfish (*L. microlophus*) (Jenkins and Burkhead 1994), but were not identified at any life stage during the 2016 and 2017 entrainment sampling. Larvae identified as Crappie (*Poxomis* sp.) were re-classified as Black Crappie (*Pomoxis nigromaculatus*). Darter larvae (*Etheostoma* sp.) were re-classified as Tessellated Darter (*E. olmstedi*).

3.3.3.3 Entrainment Abundance Estimates for the Existing CWIS

The species-apportioned monthly entrainment densities for the existing CWIS in Year 1 (Table 3-13) and Year 2 (Table 3-14) were used to estimate monthly entrainment density and abundance representative of an annual season from March through September (Table 3-15 and Table 3-18). To characterize the variability by comparison between the two years of entrainment abundance, monthly and total entrainment abundance were estimated for the April through September period for Year 1 (Table 3-16) and Year 2 (Table 3-17). Monthly and total entrainment abundance representative of a typical annual season (March through September) is presented in Table 3-18. Of the projected 68,564,980 entrained fish per season, Threadfin Shad larvae (43%), Gizzard Shad larvae (28%), and Bluegill larvae (20%) were estimated to be the most abundant entrained species and life stages. Largemouth YOY represented about 1%. The monthly entrainment abundance was highest in July and lowest in September.

3.3.4 Entrainment Reductions from Seasonal Flow Reductions

3.3.4.1 Calculation Methods of Entrainment Abundance for Seasonal Flow Reductions

The species-apportioned monthly entrainment densities for the existing CWIS as shown in Table 3-13, Table 3-14 and Table 3-15 and respective monthly AIF volume shown in Table 3-5 were used to estimate monthly and total entrainment abundance assuming NAPS implemented a proposed 21.875% flow reduction in May and June.

3.3.4.2 Entrainment Abundance Estimates for Seasonal Flow Reductions

Monthly entrainment abundance with a proposed 21.875% intake flow reduction in May and June is shown for an average March through September season in Table 3-19. A total entrainment abundance estimate of 61,744,007 individuals for a March through September season represented an overall entrainment reduction of 9.9% when AIF was reduced by 21.875% during May and June (Table 3-20). This included about a 22% reduction in entrainment of Largemouth

Bass larvae and YOY and 18% reduction in entrainment of Black Crappie larvae, both economically valuable game fish.

Monthly and total entrainment abundance estimates for the April through September period for Year 1 (2016) and Year 2 (2017) are presented in Table 3-21 and Table 3-22, respectively. Total entrainment abundance for April through September ranged from 49,136,507 in 2016 to 73,104,074 in 2017 and corresponded to an overall entrainment reduction of 10.5% in 2016 (Table 3-23) and 9.7% in 2017 (Table 3-24). A coefficient of variation of 20% represents the inter-annual variability in total entrainment abundance from April through September.

3.3.5 Entrainment Reductions from 2 mm Fine-Mesh Screens

3.3.5.1 Calculation Methods of Entrainment Abundance for 2 mm Fine-Mesh Screens

Assuming NAPS installed and operated 2 mm fine-mesh screens, entrainment abundance was estimated following the same calculations described by Equation 1 through Equation 3 in 3.3.3.1, except entrainment density for individual species and life stages were initially adjusted to account for physical size exclusion and survival of impinged converts.

The physical size exclusion factor (F_e) of individual taxon *t* and life stage *i* from passing through a 2 mm fine-mesh screen was estimated as the proportion of measured individuals for taxon *t* and life stage *i* that was less than or equal to 2 mm in maximum body depth (Table 3-25). The installation and operation of 2 mm fine-mesh screens also includes installation and operation of a FHRS to realize any potential fish protection benefits from excluding entrainable fish. The fish mesh screen survival (S_{FMS}) of taxon *t* and life stage *i* for a 2 mm fine-mesh screen at NAPS was estimated by available initial impingement survival estimates off fine-mesh screens for each taxon or closely related taxon and life stage from the literature. Because delayed or latent survival estimates varied in duration or were not available in the literature, the S_{FMS} based on initial survival provided a conservative overestimate of the true survival, and thereby the fish protection benefit of 2 mm fine-mesh screens (Table 3-26). In lieu of site-specific S_{FMS} which were not available at NAPS, S_{FMS} estimates were largely obtained from studies reviewed and compiled by EPRI (2013) that were deemed acceptable to their quality standards. When ranges in were available, the median value was used in effort to balance the uncertainty in both directions. Survival of fish excluded by fine mesh screens is affected by many factors such as time between screen washes, debris loading, spray wash pressure, screen approach velocity, water temperature, and pre-existing disease and condition of the impinged fish population (EPRI 2013). When information was available, literature-based survival estimates that most closely match mesh size, duration on the screens (rotation speed), and through-screen velocity to expected values for NAPS were used.

At NAPS, the through-screen velocity for 2 mm fine-mesh screens was expected to be 1.44 fps at the design intake flow, assuming the screen is 100% clean (see §122.21(r)(10)). The maximum total on-screen duration of impinged fish for the 2 mm fine-mesh screens at NAPS (from the lowest point of the screen up to a FHRS spray) is estimated to be 12.4 minutes, assuming continuous operation (see §122.21(r)(10)). The maximum "out of water" on-screen duration for the NAPS screens (from the minimum water level up to the FHRS spray) is estimated to be 7.6 minutes, assuming continuous operation.

The monthly entrainment density adjusted for a 2 mm fine-mesh screen (D_{FMS}) for species *t* and life stage *i* was estimated as

$$D_{FMS,t,i,m} = D_{E\,t,i,m}(1 - F_{e,t,i}) + [D_{E\,t,i,m}(F_{e,t,i})(1 - S_{FMS,t,i})] \quad \text{(Equation 4)}$$

The monthly entrainment density apportioned to species and adjusted for exclusion by a 2 mm fine-mesh screen was estimated for each year (Table 3-27 and Table 3-28) and an average March through September season (Table 3-29).

3.3.5.2 Entrainment Abundance Estimates for 2 mm Fine-Mesh Screens

Monthly entrainment abundance with a 2 mm fine-mesh screen is shown for an average March through September season in Table 3-30. A total entrainment abundance estimate of 62,591,613 individuals for a March through September season represented an overall entrainment reduction of 8.7% by installing and operating a 2 mm fine-mesh screen (Table 3-20). This included about a 77% and 82% reduction in entrainment of Largemouth Bass larvae and YOY, respectively, 88% reduction in entrainment of Channel Catfish and White Catfish larvae, 77% reduction in entrainment of Bluegill YOY, and 1.5% reduction in entrainment of Black Crappie larvae, all recreationally important fish species.

Monthly and total entrainment abundance estimates for the April through September period for Year 1 (2016) and Year 2 (2017) are presented in Table 3-31 and Table 3-32, respectively. Total entrainment abundance for April through September ranged from 46,342,751 in 2016 to 77,593,043 in 2017 and corresponded to an overall entrainment reduction of 15.6% in 2016 (Table 3-23) and 4.2% in 2017 (Table 3-24). A coefficient of variation of 25% represents the inter-annual variability in total entrainment abundance with 2 mm fine-mesh screens from April through September.

3.3.6 Tables and Figures

Table 3-1. List of unique taxa and life stages identified as entrainable organisms[1] in lab samples collected by pump sampling in front of the bar racks at NAPS from April through September 2016 and March through September 2017.

		2016					2017					
Common Name	**Scientific Name**	**UIDL**	**Egg**	**YSL**	**PYSL**	**JUV**	**UIDL**	**Egg**	**YSL**	**PYSL**	**JUV**	**Adult**
Blueback Herring	*Alosa aestivalis*					X				X		
Channel Catfish	*Ictalurus punctatus*				X					X		
Common Sunfishes	*Lepomis* spp.				X	X				X		
Crappie	*Pomoxis* spp.				X							
Darters	*Etheostoma* spp.				X				X			
Gizzard Shad	*Dorosoma cepedianum*			X	X				X	X	X	
Golden Shiner	*Notemigonus crysoleucas*				X							
Herrings and Shad	Clupeidae	X	X	X	X		X	X	X	X		
Largemouth Bass	*Micropterus salmoides*				X	X					X	
Minnow	Cyprinidae				X					X		
Spottail Shiner	*Notropis hudsonius*									X		
Sunfish	Centrarchidae				X							
Threadfin Shad	*Dorosoma petenense*				X					X	X	
Threadfin/Gizzard Shad	*Dorosoma* spp				X					X		
Unidentified Finfish	Unidentified	X					X					
White Catfish	*Ameiurus catus*				X							
White Perch	*Morone americana*			X	X				X	X		
Yellow Perch	*Perca flavescens*			X					X	X		

[1] Organisms with a body depth less than 0.56 inches (14.2 mm) were considered entrainable based on the definition in the Final §316(b) Rule.

UIDL = Unidentified Larvae; YSL = Yolk-Sac Larvae; PYSL = Post Yolk-Sac Larvae; JUV = Juvenile

Table 3-2. Monthly mean density estimates (N/100 m^3) of entrainable ichthyoplankton at each depth stratum sampled by pump during 2016 at NAPS.

Taxon	Life Stage	Depth Stratum	Apr	May	Jun	Jul	Aug	Sep	Mean
Blueback Herring	JUV	Near-surface		0.12					0.02
		Mid-depth		0.37					0.06
		Near-bottom		0.12					0.02
Channel Catfish	PYSL	Near-bottom				0.12	0.62		0.12
Common Sunfishes	PYSL	Near-surface			0.92	0.60	0.25		0.29
		Mid-depth		1.37	0.99	1.10	0 87		0.72
		Near-bottom			5.36	3.23	6.31	0.48	2.56
	JUV	Near-surface					0.24		0.04
		Mid-depth					0.25		0.04
		Near-bottom					0.12		0.02
Crappie	PYSL	Mid-depth	0.12	0.36					0.08
Darters	PYSL	Near-bottom		0.25					0.04
Gizzard Shad	YSL	Near-bottom	0.12	1.00					0.19
	PYSL	Near-surface			0.12				0.02
		Mid-depth				0 25			0.04
		Near-bottom			0.37	0.12			0.08
Golden Shiner	PYSL	Near-surface	0.11						0.02
Herrings and Shad	UIDL	Near-surface		0.12					0.02
		Mid-depth	0.62	0.62					0.21
		Near-bottom	0.36	0.62					0.16
	Egg	Near-bottom		0 12					0.02
	YSL	Mid-depth	0 99	0.75					0.29
	PYSL	Near-surface		0.12					0.02
		Mid-depth	1.47	4.58	2.07	8.58	0.12		2.80
		Near-bottom		2.87	3.11	0.75			1.12
Largemouth Bass	PYSL	Near-surface		0.12					0 02
	JUV	Near-surface		1.18	0 12				0.22
Minnow	PYSL	Mid-depth	0.12						0 02
Sunfish	PYSL	Near-surface				0.12			0.02
		Mid-depth		0.12	0.12		0.12		0.06
Threadfin Shad	PYSL	Mid-depth			0.12	0.25			0.06
		Near-bottom				0.50			0.08
Threadfin/Gizzard Shad	PYSL	Near-surface				0.12			0.02
		Mid-depth		0.25	0.25	0.12	0.25		0.14
		Near-bottom			0.25	0.25	0.37		0.15
Unidentified Finfish	UIDL	Near-surface		0.12	0.34				0 08
		Mid-depth		0.24					0.04
		Near-bottom	0.37		0.12				0.08
White Catfish	PYSL	Near-bottom				0.12			0.02
White Perch	YSL	Mid-depth	0.12						0.02
		Near-bottom	0.25						0.04
	PYSL	Mid-depth	1.95	0.24					0.37
		Near-bottom	0.25	0.37					0.10
Yellow Perch	YSL	Near-surface	0.11						0.02
		Mid-depth	0.37						0.06
		Near-bottom	0.12						0.02
All Taxa Mean		.	2.49	5.34	4.75	5.41	3.18	0.16	3.56

UIDL = Unidentified Larvae; YSL = Yolk-Sac Larvae; PYSL = Post Yolk-Sac Larvae; JUV = Juvenile

Table 3-3. Monthly mean density estimates (N/100 m^3) of entrainable ichthyoplankton at each depth stratum sampled by pump during 2017 at NAPS.

Taxon	Life Stage	Depth Stratum	Mar	Apr	May	Jun	Jul	Aug	Sep	Mean
Blueback Herring	PYSL	Mid-depth		0.25						0.04
Channel Catfish	PYSL	Near-bottom					0.37	0.12		0.07
Common Sunfishes	PYSL	Near-surface			0.99	1.24	0.25	0.24		0.39
		Mid-depth			0.12		0.62			0.11
		Near-bottom				1.35	2.23	0.87	0.25	0.67
Darters	YSL	Near-bottom		0.25						0.04
Gizzard Shad	YSL	Mid-depth			0.12					0.02
	PYSL	Near-bottom					0.12			0.02
	JUV	Mid-depth					0.12			0.02
Herrings and Shad	UIDL	Mid-depth			0.25					0.04
		Near-bottom		0.12						0.02
	Egg	Near-surface			0.62					0.09
	YSL	Near-surface			0 12					0 02
	PYSL	Near-surface			3.32		0.49			0.55
		Mid-depth	0.24	1.60	9.67	13.39	17.75			6 09
		Near-bottom		1.61	2.98	4.30	8.79			2 53
Largemouth Bass	JUV	Near-surface			0.24	0.12				0.05
Minnow	PYSL	Near-surface				0.12				0.02
		Mid-depth				0.25				0.04
Spottail Shiner	PYSL	Near-surface		0.12						0.02
Threadfin Shad	PYSL	Near-surface					0.25			0.04
		Mid-depth					0.50			0.07
		Near-bottom					1.49			0.21
	JUV	Mid-depth					0.12			0.02
Threadfin/Gizzard Shad	PYSL	Near-surface					0.62			0.09
		Mid-depth				1.00	5.33			0.90
		Near-bottom				0.37	4.71	0.12		0.74
Unidentified Finfish	UIDL	Near-surface			0.37					0.05
		Mid-depth			0.12					0.02
		Near-bottom	0.12							0.02
White Perch	YSL	Near-surface		0.37						0.05
		Near-bottom	0.12							0.02
	PYSL	Near-surface		0.62	0.25					0.12
		Mid-depth	0.12	0.37						0.07
		Near-bottom	0.11	0 12	0.12					0.05
Yellow Perch	YSL	Near-surface	0.12							0 02
		Mid-depth	0.12							0.02
		Near-bottom		0.25						0.04
	PYSL	Near-bottom	0.37							0.05
All Taxa Mean			0.45	1.89	6.43	7.39	14.59	0.45	0 08	4.47

UIDL = Unidentified Larvae; YSL = Yolk-Sac Larvae; PYSL = Post Yolk-Sac Larvae; JUV = Juvenile

Table 3-4. Monthly average actual intake flow (AIF) in million gallons per day (MGD) and total AIF volume in thousands of cubic meters for Units 1 and 2 at NAPS during January 2015 through December 2017.

Month	3-Year Average AIF (MGD)			Total AIF Volume (x1000 m^3)
	Unit 1	Unit 2	Total	
Jan	696.0	658.4	1,354.5	158,946
Feb	683.8	650.7	1,334.5	141,441
Mar	622.9	565.0	1,187.9	139,399
Apr	880.4	843.6	1,723.9	195,772
May	1,100.4	1,121.9	2,222.3	260,782
Jun	1,141.2	1,154.6	2,295.8	260,715
Jul	1,172.9	1,154.0	2,327.0	273,064
Aug	1,162.9	1,141.3	2,304.2	270,393
Sep	912.8	909.3	1,822.1	206,921
Oct	945.6	1,072.7	2,018.4	236,852
Nov	990.4	1,044.0	2,034.4	231,036
Dec	789.4	747.2	1,536.6	180,316
Total	924.9	921.9	1,846.8	2,555,637

Table 3-5. Monthly average actual intake flow (AIF) and total AIF volume with proposed May and June flow reductions (21.875%) for Units 1 and 2 at NAPS based on AIF from January 2015 through December 2017.

Month	3-Year Average AIF (MGD)			Total AIF Volume (x1000 m^3)
	Unit 1	Unit 2	Total	
Jan	696.0	658.4	1,354.5	158,946
Feb	683.8	650.7	1,334.5	141,441
Mar	622.9	565.0	1,187.9	139,399
Apr	880.4	843.6	1,723.9	195,772
May	859.7	876.5	1,736.2	203,736
Jun	891.6	902.0	1,793.6	203,684
Jul	1,172.9	1,154.0	2,327.0	273,064
Aug	1,162.9	1,141.3	2,304.2	270,393
Sep	912.8	909.3	1,822.1	206,921
Oct	945.6	1,072.7	2,018.4	236,852
Nov	990.4	1,044.0	2,034.4	231,036
Dec	789.4	747.2	1,536.6	180,316
Total	884.0	880.4	1,764.4	2,441,560

Table 3-6. Overall mean (n=39) and percent composition of monthly depth-stratified densities of entrainable life stages identified in samples collected by pump sampling in front of the bar racks at NAPS from April through September 2016 and March through September 2017.

Life Stage	N/100m^3	%
Unidentified Larvae (UIDL)	0.006	2.9
Egg	0.001	0.5
Yolk-sac Larvae (YSL)	0.007	3.4
Post Yolk-sac Larvae (PYSL)	0.195	91.3
Juvenile (JUV)	0.004	2.0
Total	0.213	100.0

Table 3-7. Monthly entrainment density estimates (N/100 m^3) by lab-identified taxon and life stage[1] from pump samples collected in 2016 at NAPS.

Taxon	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Blueback Herring	JUV		0.20					0.03	1.0
Channel Catfish	Larvae				0.04	0.21		0.04	1.2
Common Sunfishes	Larvae		0.46	2.42	1.65	2.48	0.16	1.19	33.6
	JUV					0.20		0.03	1.0
Crappie	Larvae	0.04	0.12					0.03	0.8
Darters	Larvae		0.08					0.01	0.4
Gizzard Shad	Larvae	0.04	0.33	0.17	0.12			0.11	3.1
Golden Shiner	Larvae	0.04						0.01	0.2
Herrings and Shad	Egg		0.04					0.01	0.2
	Larvae	1.15	3.23	1.73	3.11	0.04		1.54	43.4
Largemouth Bass	Larvae		0.04					0.01	0.2
	JUV		0.39	0.04				0.07	2.0
Minnow	Larvae	0.04						0.01	0.2
Sunfish	Larvae		0.04	0.04	0.04	0.04		0.03	0.8
Threadfin Shad	Larvae			0.04	0.25			0.05	1.4
Threadfin/Gizzard Shad	Larvae		0.08	0.17	0.16	0.21		0.10	2.9
Unidentified Finfish	Larvae	0.12	0.12	0.15				0.07	1.9
White Catfish	Larvae				0.04			0.01	0.2
White Perch	Larvae	0.86	0.21					0.18	5.0
Yellow Perch	Larvae	0.20						0.03	0.9
Total		2.49	5.34	4.75	5.41	3.18	0.16	3.56	100.0

[1] Unidentified larvae (UIDL), yolk-sac larvae (YSL) and post yolk-sac larvae (PYSL) were consolidated to a single larval stage

JUV = Juvenile

Table 3-8. Monthly entrainment density estimates (N/100 m^3) by lab-identified taxon and life stage[1] from pump samples collected in 2017 at NAPS.

Taxon	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Blueback Herring	Larvae		0.08						0.01	0.3
Channel Catfish	Larvae					0.12	0.04		0.02	0.5
Common Sunfishes	Larvae			0.37	0.87	1.03	0.37	0.08	0.39	8.7
Darters	Larvae		0.08						0.01	0.3
Gizzard Shad	Larvae			0.04		0.04			0.01	0.3
	JUV					0.04			0.01	0.1
Herrings and Shad	Egg			0.21					0.03	0.7
	Larvae	0.08	1.11	5.45	5.90	9.01			3.08	68.9
Largemouth Bass	JUV			0.08	0.04				0.02	0.4
Minnow	Larvae				0.12				0.02	0.4
Spottail Shiner	Larvae		0.04						0.01	0.1
Threadfin Shad	Larvae					0.75			0.11	2.4
	JUV					0.04			0.01	0.1
Threadfin/Gizzard Shad	Larvae				0.46	3.56	0.04		0.58	13.0
Unidentified Finfish	Larvae	0.04		0.16					0.03	0.7
White Perch	Larvae	0.12	0.49	0.12					0.11	2.4
Yellow Perch	Larvae	0.21	0.08						0.04	0.9
Total		0.45	1.89	6.43	7.39	14.59	0.45	0.08	4.48	100.0

[1] Unidentified larvae (UIDL), yolk-sac larvae (YSL) and post yolk-sac larvae (PYSL) were consolidated to a single larval stage

JUV = Juvenile

Table 3-9. Species apportionment of entrained unidentified fish larvae based on monthly composition of other taxa entrained at NAPS during April through September 2016 and March through September 2017.

Year	Month	Taxon	Identified Taxon Larval Density (N/100 m^3)	Proportion	Unidentified Fish Larval Density (N/100 m^3)	Apportioned Larval Density (N/100 m^3)
2016	Apr	Crappie	0.04	0.02	0.12	0.002
		Gizzard Shad	0.04	0.02	0.12	0.002
		Golden Shiner	0.04	0.02	0.12	0.002
		Herrings and Shad	1.15	0.49	0.12	0.059
		Minnow	0.04	0.02	0.12	0.002
		White Perch	0.86	0.36	0.12	0.044
		Yellow Perch	0.20	0.08	0.12	0.010
	May	Common Sunfishes	0.46	0.10	0.12	0.012
		Crappie	0.12	0.03	0.12	0.003
		Darters	0.08	0.02	0.12	0.002
		Gizzard Shad	0.33	0.07	0.12	0.009
		Herrings and Shad	3.23	0.70	0.12	0.085
		Largemouth Bass	0.04	0.01	0.12	0.001
		Sunfish	0.04	0.01	0.12	0.001
		Threadfin/Gizzard Shad	0.08	0.02	0.12	0.002
		White Perch	0.21	0.04	0.12	0.005
	Jun	Common Sunfishes	2.42	0.53	0.15	0.082
		Gizzard Shad	0.17	0.04	0.15	0.006
		Herrings and Shad	1.73	0.38	0.15	0.058
		Sunfish	0.04	0.01	0.15	0.001
		Threadfin Shad	0.04	0.01	0.15	0.001
		Threadfin/Gizzard Shad	0.17	0.04	0.15	0.006
2017	Mar	Herrings and Shad	0.08	0.20	0.04	0.008
		White Perch	0.12	0.29	0.04	0.012
		Yellow Perch	0.21	0.51	0.04	0.021
	May	Common Sunfishes	0.37	0.06	0.16	0.010
		Gizzard Shad	0.04	0.01	0.16	0.001
		Herrings and Shad	5.45	0.91	0.16	0.147
		White Perch	0.12	0.02	0.16	0.003

Table 3-10. Species apportionment of entrained eggs and larvae identified as Herrings and Shads based on monthly species composition of entrained Blueback Herring, Threadfin Shad and Gizzard Shad larvae at NAPS during April through September 2016 and March through September 2017.

Year	Month	Species	Life Stage		Identified Species Density (N/100 m^3)	Proportion	Herring and Shad Density (N/100 m^3)	Species-Apportioned Density (N/100 m^3)
2016	Apr	Gizzard Shad	Larvae		0.04	1.00	1.150	1.150
				1	0.04	1.00	0.059	0.059
	May	Gizzard Shad	Egg[2]			1.00	0.041	0.041
			Larvae		0.33	1.00	3.228	3.228
				1	0.33	1.00	0.085	0.085
	Jun	Gizzard Shad	Larvae		0.17	0.80	1.726	1.384
				1	0.17	0.80	0.058	0.047
		Threadfin Shad	Larvae		0.04	0.20	1.726	0.342
				1	0.04	0.20	0.058	0.012
	Jul	Gizzard Shad	Larvae		0.12	0.33	3.108	1.029
		Threadfin Shad	Larvae		0.25	0.67	3.108	2.080
	Aug	Gizzard Shad	Larvae			0.33	0.041	0.014
		Threadfin Shad	Larvae			0.67	0.041	0.028
2017	Mar	Blueback Herring	Larvae			1.00	0.080	0.080
				1		1.00	0.008	0.008
	Apr	Blueback Herring	Larvae		0.08	1.00	1.109	1.109
	May	Gizzard Shad	Egg			1.00	0.206	0.206
			Larvae		0.04	1.00	5.448	5.448
				1	0.04	1.00	0.147	0.147
	Jun	Gizzard Shad	Larvae			0.05	5.899	0.311
		Threadfin Shad	Larvae			0.95	5.899	5.589
	Jul	Gizzard Shad	Larvae		0.04	0.05	9.009	0.474
		Threadfin Shad	Larvae		0.75	0.95	9.009	8.535

[1] Estimates noted by "1" are unidentified taxa apportioned to Herring and Shads (Table 3-9).
[2] Proportion for eggs were based on monthly larval clupeid species composition because no eggs were identified to species.

Table 3-11. Species apportionment of entrained larvae identified as Threadfin/Gizzard Shad based on monthly species composition of entrained Threadfin Shad and Gizzard Shad larvae at NAPS during April through September 2016 and March through September 2017.

Year	Month	Species		Identified Species Density (N/100 m^3)	Proportion	Threadfin/Gizzard Shad Larval Density (N/100 m^3)	Species-Apportioned Larval Density (N/100 m^3)
2016	May	Gizzard Shad		0.33	1.00	0.083	0.083
			1	0.33	1.00	0.002	0.002
	Jun	Gizzard Shad		0.17	0.80	0.166	0.133
			1	0.17	0.80	0.006	0.004
		Threadfin Shad		0.04	0.20	0.166	0.033
			1	0.04	0.20	0.006	0.001
	Jul	Gizzard Shad		0.12	0.33	0.164	0.054
		Threadfin Shad		0.25	0.67	0.164	0.109
	Aug	Gizzard Shad			0.33	0.207	0.068
		Threadfin Shad			0.67	0.207	0.138
2017	Jun	Gizzard Shad			0.05	0.456	0.024
		Threadfin Shad			0.95	0.456	0.432
	Jul	Gizzard Shad		0.04	0.05	3.555	0.187
		Threadfin Shad		0.75	0.95	3.555	3.368
	Aug	Gizzard Shad			0.05	0.042	0.002
		Threadfin Shad			0.95	0.042	0.039

[1] Estimates noted by "1" are unidentified taxa apportioned to Threadfin/Gizzard Shad (Table 3-9).

Table 3-12. Species apportionment of entrained larvae identified as Sunfishes (Family Centrarchidae) based on monthly species composition of entrained Common Sunfish (*Lepomis* sp.), Crappie (*Pomoxis* sp.) and Largemouth Bass larvae at NAPS during April through September 2016 and March through September 2017.

Year	Month	Species		Identified Taxon Larval Density (N/100 m^3)	Proportion	Sunfish Larval Density (N/100 m^3)	Species-Apportioned Density (N/100 m^3)
2016	May	Common Sunfishes[2]		0.46	0.74	0.040	0.030
			1	0.46	0.74	0.001	0.001
		Crappie[3]		0.12	0.19	0.040	0.008
			1	0.12	0.19	0.001	0.000
		Largemouth Bass		0.04	0.06	0.040	0.003
			1	0.04	0.06	0.001	0.000
	Jun	Common Sunfishes		2.42	1.00	0.042	0.042
			1	2.42	1.00	0.001	0.001
	Jul	Common Sunfishes		1.65	1.00	0.039	0.039
	Aug	Common Sunfishes		2.48	1.00	0.042	0.042

[1] Estimates noted by "1" are unidentified taxa apportioned to Sunfishes (Centrarchidae) (Table 3-9).
[2] Larvae identified as Common Sunfish (*Lepomis* sp.) were classified as Bluegill (*Lepomis macrochirus*)
[3] Larvae identified as Crappie (*Poxomis* sp.) were classified as Black Crappie (*Pomoxis nigromaculatus*)

Table 3-13. Monthly entrainment density estimates (N/100 m^3) apportioned to species based on pump samples collected in 2016 at NAPS.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae	0.04	0.13					0.03	0.8
Blueback Herring	YOY		0.20					0.03	1.0
Bluegill	Larvae		0.50	2.55	1.68	2.52	0.16	1.23	34.7
	YOY					0.20		0.03	1.0
Channel Catfish	Larvae				0.04	0.21		0.04	1.2
Gizzard Shad	Egg		0.04					0.01	0.2
	Larvae	1.25	3.74	1.74	1.21	0.08		1.34	37.6
Golden Shiner	Larvae	0.08						0.01	0.4
Largemouth Bass	Larvae		0.04					0.01	0.2
	YOY		0.39	0.04				0.07	2.0
Tessellated Darter	Larvae		0.08					0.01	0.4
Threadfin Shad	Larvae			0.43	2.44	0.17		0.51	14.2
White Catfish	Larvae				0.04			0.01	0.2
White Perch	Larvae	0.90	0.21					0.19	5.2
Yellow Perch	Larvae	0.21						0.03	1.0
Total		2.49	5.34	4.75	5.41	3.18	0.16	3.56	100.0

Table 3-14. Monthly entrainment density estimates (N/100 m^3) apportioned to species based on pump samples collected in 2017 at NAPS.

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Blueback Herring	Larvae	0.09	1.19						0.18	4.1
Bluegill	Larvae			0.38	0.87	1.03	0.37	0.08	0.39	8.7
Channel Catfish	Larvae					0.12	0.04		0.02	0.5
Gizzard Shad	Egg			0.21					0.03	0.7
	Larvae			5.64	0.33	0.70	0.00		0.95	21.3
	YOY					0.04			0.01	0.1
Largemouth Bass	YOY			0.08	0.04				0.02	0.4
Spottail Shiner	Larvae		0.04		0.12				0.02	0.5
Tessellated Darter	Larvae		0.08						0.01	0.3
Threadfin Shad	Larvae				6.02	12.65	0.04		2.67	59.8
	YOY					0.04			0.01	0.1
White Perch	Larvae	0.13	0.49	0.13					0.11	2.4
Yellow Perch	Larvae	0.23	0.08						0.04	1.0
Total		0.45	1.89	6.43	7.39	14.59	0.45	0.08	4.47	100.0

Table 3-15. Monthly entrainment density estimates (N/100 m^3) apportioned to species representative of a typical annual season of March through September based on pump samples collected from April through September 2016 and March through 2017 at NAPS.

Taxon	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae		0.02	0.07					0.01	0.3
Blueback Herring	Larvae	0.09	0.60						0.10	2.6
	YOY			0.10					0.01	0.4
Bluegill	Larvae			0.44	1.71	1.36	1.44	0.12	0.72	19.1
	YOY						0.10		0.01	0.4
Channel Catfish	Larvae					0.08	0.12		0.03	0.8
Gizzard Shad	Egg			0.12					0.02	0.5
	Larvae		0.63	4.69	1.04	0.95	0.04		1.05	27.7
	YOY					0.02			0.00	0.1
Golden Shiner	Larvae		0.04						0.01	0.2
Largemouth Bass	Larvae			0.02					0.00	0.1
	YOY			0.24	0.04				0.04	1.1
Spottail Shiner	Larvae		0.02		0.06				0.01	0.3
Tessellated Darter	Larvae		0.04	0.04					0.01	0.3
Threadfin Shad	Larvae				3.23	7.54	0.10		1.55	41.0
	YOY					0.02			0.00	0.1
White Catfish	Larvae					0.02			0.00	0.1
White Perch	Larvae	0.13	0.70	0.17					0.14	3.8
Yellow Perch	Larvae	0.23	0.15						0.05	1.4
Total		0.45	2.19	5.89	6.07	10.00	1.82	0.12	3.79	100.0

Table 3-16. Year-1 monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016.

Taxon	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae	83,306	341,022					424,328	0.8
Blueback Herring	Larvae								
	YOY		530,284					530,284	1.0
Bluegill	Larvae		1,298,131	6,635,689	4,599,740	6,810,005	331,471	19,675,036	35.8
	YOY					550,571		550,571	1.0
Channel Catfish	Larvae				113,161	560,704		673,865	1.2
Gizzard Shad	Egg		108,181					108,181	0.2
	Larvae	2,449,633	9,751,332	4,534,744	3,292,625	222,067		20,250,401	36.9
	YOY								
Golden Shiner	Larvae	160,072						160,072	0.3
Largemouth Bass	Larvae		109,783					109,783	0.2
	YOY		1,027,032	106,694				1,133,726	2.1
Spottail Shiner	Larvae								
Tessellated Darter	Larvae		219,461					219,461	0.4
Threadfin Shad	Larvae			1,119,390	6,656,164	448,917		8,224,471	15.0
	YOY								
White Catfish	Larvae				113,644			113,644	0.2
White Perch	Larvae	1,763,357	549,008					2,312,365	4.2
Yellow Perch	Larvae	410,170						410,170	0.7
Total		4,866,538	13,934,234	12,396,517	14,775,334	8,592,264	331,471	54,896,358	100.0

Table 3-17. Year-2 monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during March through September 2017.

Taxon	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae								
Blueback Herring	Larvae	2,330,597						2,454,285	3.0
	YOY								
Bluegill	Larvae		996,956	2,257,186	2,820,079	1,002,950	171,987	7,249,158	8.9
	YOY								
Channel Catfish	Larvae				340,041	112,295		452,336	0.6
Gizzard Shad	Egg		537,594					537,594	0.7
	Larvae		14,702,010	872,604	1,920,079	5,914		17,500,607	21.4
	YOY				113,387			113,387	0.1
Golden Shiner	Larvae								
Largemouth Bass	Larvae								
	YOY		212,783	108,497				321,280	0.4
Spottail Shiner	Larvae	76,180		325,597				401,777	0.5
Tessellated Darter	Larvae	161,873						161,873	0.2
Threadfin Shad	Larvae			15,697,538	34,540,894	106,381		50,344,813	61.7
	YOY				113,537			113,537	0.1
White Catfish	Larvae								
White Perch	Larvae	967,802	330,803					1,482,070	1.8
Yellow Perch	Larvae	162,603						479,157	0.6
Total		3,699,055	16,780,146	19,261,422	39,848,017	1,227,540	171,987	81,611,874	100.0

Table 3-18. Average annual season (March through September) of monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae		41,653	170,511					212,164	0.3
Blueback Herring	Larvae	123,688	1,165,299						1,288,987	1.9
	YOY			265,142					265,142	0.4
Bluegill	Larvae			1,147,544	4,446,438	3,709,910	3,906,478	251,729	13,462,099	19.6
	YOY						275,286		275,286	0.4
Channel Catfish	Larvae					226,601	336,500		563,101	0.8
Gizzard Shad	Egg			322,888					322,888	0.5
	Larvae		1,224,817	12,226,671	2,703,674	2,606,352	113,991		18,875,505	27.5
	YOY					56,694			56,694	0.1
Golden Shiner	Larvae		80,036						80,036	0.1
Largemouth Bass	Larvae			54,892					54,892	0.1
	YOY			619,908	107,596				727,504	1.1
Spottail Shiner	Larvae		38,090		162,799				200,889	0 3
Tessellated Darter	Larvae		80,937	109,731					190,668	0.3
Threadfin Shad	Larvae				8,408,464	20,598,529	277,649		29,284,642	42.7
	YOY					56,769			56,769	0.1
White Catfish	Larvae					56,822			56,822	0.1
White Perch	Larvae	183,465	1,365,580	439,906					1,988,951	2.9
Yellow Perch	Larvae	316,554	286,387						602,941	0.9
Total		623,707	4,282,799	15,357,193	15,828,971	27,311,677	4,909,904	251,729	68,565,980	100.0

Table 3-19. Average annual season (March through September) of monthly entrainment abundance estimates apportioned to species from a a proposed 21.875% seasonal (May–June) flow reduction in cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae		41,653	133,212					174,865	0.3
Blueback Herring	Larvae	123,688	1,165,299						1,288,987	2.1
	YOY			207,143					207,143	0.3
Bluegill	Larvae			896,519	3,473,779	3,709,910	3,906,478	251,729	12,238,415	19.8
	YOY						275,286		275,286	0.4
Channel Catfish	Larvae					226,601	336,500		563,101	0.9
Gizzard Shad	Egg			252,256					252,256	0.4
	Larvae		1,224,817	9,552,087	2,112,246	2,606,352	113,991		15,609,493	25.3
	YOY					56,694			56,694	0.1
Golden Shiner	Larvae		80,036						80,036	0.1
Largemouth Bass	Larvae			42,884					42,884	0.1
	YOY			484,303	84,059				568,362	0.9
Spottail Shiner	Larvae		38,090		127,187				165,277	0 3
Tessellated Darter	Larvae		80,937	85,727					166,664	0 3
Threadfin Shad	Larvae				6,569,112	20,598,529	277,649		27,445,290	44.5
	YOY					56,769			56,769	0.1
White Catfish	Larvae					56,822			56,822	0.1
White Perch	Larvae	183,465	1,365,580	343,677					1,892,722	3.1
Yellow Perch	Larvae	316,554	286,387						602,941	1.0
Total		623,707	4,282,799	11,997,808	12,366,383	27,311,677	4,909,904	251,729	61,744,007	100.0

Table 3-20. Two-year average annual (March through September) entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on a 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 and March through September 2017.

Taxon	Life Stage	Annual Entrainment Existing CWIS	Seasonal Flow Reduction			2 mm Fine-Mesh Screen		
			N	dN	%dN	N	dN	%dN
Black Crappie	Larvae	212,164	174,865	37,299	17.6	209,056	3,108	1.5
Blueback Herring	Larvae	1,288,987	1,288,987			1,288,987		
	YOY	265,142	207,143	57,999	21.9	145,351	119,791	45.2
Bluegill	Larvae	13,462,099	12,238,415	1,223,684	9 1	9,367,729	4,094,370	30.4
	YOY	275,286	275,286			63,316	211,970	77.0
Channel Catfish	Larvae	563,101	563,101			67,572	495,529	88.0
Gizzard Shad	Egg	322,888	252,256	70,632	21.9	322,888		
	Larvae	18,875,505	15,609,493	3,266,012	17.3	18,815,012	60,493	0.3
	YOY	56,694	56,694			14,004	42,690	75.3
Golden Shiner	Larvae	80,036	80,036			80,036		
Largemouth Bass	Larvae	54,892	42,884	12,008	21.9	12,658	42,234	76.9
	YOY	727,504	568,362	159,142	21.9	123,675	603,829	83.0
Spottail Shiner	Larvae	200,889	165,277	35,612	17.7	200,889		
Tessellated Darter	Larvae	190,668	166,664	24,004	12.6	190,668		
Threadfin Shad	Larvae	29,284,642	27,445,290	1,839,352	6.3	29,077,039	207,603	0.7
	YOY	56,769	56,769			14,022	42,747	75.3
White Catfish	Larvae	56,822	56,822			6,819	50,003	88.0
White Perch	Larvae	1,988,951	1,892,722	96,229	4.8	1,988,951		
Yellow Perch	Larvae	602,941	602,941			602,941		
Total		68,565,980	61,744,007	6,821,973	9.9	62,591,613	5,974,367	8.7

Table 3-21. Year-1 monthly entrainment abundance estimates apportioned to species from a proposed 21.875% seasonal (May–June) flow reduction in from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae	83,306	266,424					349,730	0 7
Blueback Herring	Larvae								
	YOY		414,285					414,285	0.8
Bluegill	Larvae		1,014,165	5,184,132	4,599,740	6,810,005	331,471	17,939,513	36.5
	YOY					550,571		550,571	1 1
Channel Catfish	Larvae				113,161	560,704		673,865	1.4
Gizzard Shad	Egg		84,516					84,516	0.2
	Larvae	2,449,633	7,618,228	3,542,769	3,292,625	222,067		17,125,322	34.9
	YOY								
Golden Shiner	Larvae	160,072						160,072	0.3
Largemouth Bass	Larvae		85,768					85,768	0.2
	YOY		802,369	83,354				885,723	1.8
Spottail Shiner	Larvae								
Tessellated Darter	Larvae		171,454					171,454	0.3
Threadfin Shad	Larvae			874,523	6,656,164	448,917		7,979,604	16.2
	YOY								
White Catfish	Larvae				113,644			113,644	0.2
White Perch	Larvae	1,763,357	428,913					2,192,270	4.5
Yellow Perch	Larvae	410,170						410,170	0.8
Total		4,866,538	10,886,122	9,684,778	14,775,334	8,592,264	331,471	49,136,507	100.0

Table 3-22. Year-2 monthly entrainment abundance estimates apportioned to species from a proposed 21.875% seasonal (May–June) flow reduction in cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during March through September 2017.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae								
Blueback Herring	Larvae	2,330,597						2,454,285	3.3
	YOY								
Bluegill	Larvae		778,872	1,763,426	2,820,079	1,002,950	171,987	6,537,314	8 9
	YOY								
Channel Catfish	Larvae				340,041	112,295		452,336	0.6
Gizzard Shad	Egg		419,996					419,996	0.6
	Larvae		11,485,945	681,722	1,920,079	5,914		14,093,660	19 1
	YOY				113,387			113,387	0.2
Golden Shiner	Larvae								
Largemouth Bass	Larvae								
	YOY		166,237	84,763				251,000	0.3
Spottail Shiner	Larvae	76,180		254,373				330,553	0 4
Tessellated Darter	Larvae	161,873						161,873	0.2
Threadfin Shad	Larvae			12,263,701	34,540,894	106,381		46,910,976	63.6
	YOY				113,537			113,537	0.2
White Catfish	Larvae								
White Perch	Larvae	967,802	258,440					1,409,707	1.9
Yellow Perch	Larvae	162,603						479,157	0.6
Total		3,699,055	13,109,490	15,047,985	39,848,017	1,227,540	171,987	73,727,781	100.0

Table 3-23. Year-1 annual entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on a 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016.

		2016						
		Annual Entrainment Existing	Seasonal Flow Reduction			2 mm Fine-Mesh Screen		
Species	Life Stage	CWIS	N	ΔN	%ΔN	N	ΔN	%ΔN
Black Crappie	Larvae	424,328	349,730	74,598	-17.6	418,112	6,216	-1.5
Blueback Herring	Larvae							
	YOY	530,284	414,285	115,999	-21.9	290,702	239,582	-45.2
Bluegill	Larvae	19,675,036	17,939,513	1,735,523	-8.8	13,691,675	5,983,361	-30.4
	YOY	550,571	550,571			126,631	423,940	-77.0
Channel Catfish	Larvae	673,865	673,865			80,863	593,002	-88.0
Gizzard Shad	Egg	108,181	84,516	23,665	-21.9	108,181		
	Larvae	20,250,401	17,125,322	3,125,079	-15.4	20,149,223	101,178	-0.5
	YOY							
Golden Shiner	Larvae	160,072	160,072			160,072		
Largemouth Bass	Larvae	109,783	85,768	24,015	-21.9	25,316	84,467	-76.9
	YOY	1,133,726	885,723	248,003	-21.9	192,733	940,993	-83.0
Spottail Shiner	Larvae							
Tessellated Darter	Larvae	219,461	171,454	48,007	-21.9	219,461		
Threadfin Shad	Larvae	8,224,471	7,979,604	244,867	-3.0	8,143,610	80,861	-1.0
	YOY							
White Catfish	Larvae	113,644	113,644			13,637	100,007	-88.0
White Perch	Larvae	2,312,365	2,192,270	120,095	-5.2	2,312,365		
Yellow Perch	Larvae	410,170	410,170			410,170		
Total		54,896,358	49,136,507	5,759,851	-10.5	46,342,751	8,553,607	-15.6

Table 3-24. Year-2 annual entrainment abundance estimates apportioned to species from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on a 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2017.

Species	Life Stage	2017						
		Annual Entrainment Existing CWIS	Seasonal Flow Reduction			2 mm Fine-Mesh Screen		
			N	ΔN	%ΔN	N	ΔN	%ΔN
Black Crappie	Larvae							
Blueback Herring	Larvae	2,330,597	2,330,597			2,330,597		
	YOY							
Bluegill	Larvae	7,249,158	6,537,314	711,844	-9.8	5,043,779	2,205,379	-30.4
	YOY							
Channel Catfish	Larvae	452,336	452,336			54,280	398,056	-88.0
Gizzard Shad	Egg	537,594	419,996	117,598	-21.9	537,594		
	Larvae	17,500,607	14,093,660	3,406,947	-19.5	17,480,799	19,808	-0.1
	YOY	113,387	113,387			28,007	85,380	-75.3
Golden Shiner	Larvae							
Largemouth Bass	Larvae							
	YOY	321,280	251,000	70,280	-21.9	54,617	266,663	-83.0
Spottail Shiner	Larvae	401,777	330,553	71,224	-17.7	401,777		
Tessellated Darter	Larvae	161,873	161,873			161,873		
Threadfin Shad	Larvae	50,344,813	46,910,976	3,433,837	-6.8	50,010,468	334,345	-0.7
	YOY	113,537	113,537			28,044	85,493	-75.3
White Catfish	Larvae							
White Perch	Larvae	1,298,605	1,226,242	72,363	-5.6	1,298,605		
Yellow Perch	Larvae	162,603	162,603			162,603		
Total		80,988,167	73,104,074	7,884,093	-9.7	77,593,043	3,395,124	-4.2

Table 3-25. Maximum body depth (BD) statistics and 2 mm physical size exclusion factor for ichthyoplankton identified to lowest taxon possible from pump samples collected at NAPS during April through September 2016 and March through September 2017.

Taxon	Life Stage	Number of Individuals with BD > 2 mm	Number of Individuals Measured	2 mm Size Exclusion Factor	Minimum BD	Mean BD	Maximum BD
Blueback Herring	Larvae	0	2	0.000	0.5	0.5	0.5
Blueback Herring	YOY	3	5	0.600	2.0	2.6	3.0
Bluegill	YOY	4	4	1.000	17.0	26.3	30.0
Channel Catfish	Larvae	10	10	1.000	2.5	2.9	3.3
Common Sunfishes	Larvae	27	71	0.380	0.5	1.7	5.0
Common Sunfishes	YOY	5	5	1.000	5.0	8.2	12.0
Crappie	Larvae	0	3	0.000	0.4	0.5	0.5
Darters	Larvae	0	3	0.000	0.6	0.8	1.0
Gizzard Shad	Larvae	7	14	0.500	0.4	1.7	4.0
Gizzard Shad	YOY	1	1	1.000	5.0	5.0	5.0
Golden Shiner	Larvae	0	1	0.000	0.5	0.5	0.5
Herrings and Shad	Larvae	0	71	0.000	0.3	0.7	1.8
Largemouth Bass	Larvae	1	1	1.000	3.4	3.4	3.4
Largemouth Bass	YOY	9	9	1.000	3.5	4.9	7.0
Minnow	Larvae	0	4	0.000	0.7	0.8	1.0
Spottail Shiner	Larvae	0	1	0.000	0.7	0.7	0.7
Sunfish	Larvae	28	75	0.373	0.4	1.7	5.0
Threadfin Shad	Larvae	15	17	0.882	0.7	2.3	4.0
Threadfin Shad	YOY	1	1	1.000	5.0	5.0	5.0
Threadfin/Gizzard Shad	Larvae	4	27	0.148	0.6	1.5	3.4
White Catfish	Larvae	1	1	1.000	3.1	3.1	3.1
White Perch	Larvae	0	28	0.000	0.5	0.6	1.8
Yellow Perch	Larvae	0	9	0.000	0.6	0.9	1.2

Table 3-26. Fine-mesh screen survival (S_{FMS}) estimates of entrainable fish taxa excluded (impinged and washed off) from entrainment through 2 mm fine-mesh screens at NAPS based on available estimates of initial survival in the literature.

Species	Life Stage	S_{FMS}	Surrogate	Reference	Comments
Black Crappie	Larvae	0.8	Lepomis sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Blueback Herring	Larvae	0.015		(Taft et al. 1981) as cited in EPRI 2013	Big Bend Station, 0.5 mm screen mesh, 0.5-1.0 fps intake velocity
Blueback Herring	JUV	0.753		(Normandeau 1995)	1994 Roseton Generating Station, dual-flow screens
Bluegill	Larvae	0.8	Lepomis sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Bluegill	JUV	0.77		(EPRI 2013)	Survival range 53-100%; Lepomis sp.; Predicted post-impingement survival of juvenile and adult fish using 2.0 mm mesh, traveling water screen
Channel Catfish	Larvae	0.88	Ictalurus sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Gizzard Shad	Egg	0.432	Alosa sp.	(Taft et al. 1981) as cited in EPRI 2013	Big Bend Station, 0.5 mm screen mesh, 0.5-1.0 fps intake velocity
Gizzard Shad	Larvae	0.1		(Kuhl and Mueller 1988) as cited in EPRI 2013	1984-87, Prairie Island Generating Plant, 0.5 mm traveling water screen, PYS Range (4.1-22.5 mm), rotation speed (3 fpm)
Gizzard Shad	JUV	0.753	Blueback Herring	(Normandeau 1995)	1994 Roseton Generating Station, dual-flow screens
Golden Shiner	Larvae	0.1	Spottail Shiner	(Kuhl and Mueller 1988) as cited in EPRI 2013	1984-87, Prairie Island Generating Plant, 0.5 mm traveling water screen, PYS Range (4.1-22.5 mm), rotation speed (3 fpm)
Largemouth Bass	Larvae	0.8	Lepomis sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Largemouth Bass	JUV	0.83	Micropterus sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Spottail Shiner	Larvae	0.1		(Kuhl and Mueller 1988) as cited in EPRI 2013	1984-87, Prairie Island Generating Plant, 0.5 mm traveling water screen, PYS Range (4.1-22.5 mm), rotation speed (3 fpm)
Tessellated Darter	Larvae	0.198	Yellow Perch	(ESEERCO 1981) as cited in EPRI 2013	PYSL; 1.5 fps and 8 min duration; 1979-80 Laboratory Evaluation on fine screen mesh

(Continued)

Table 3-26. Continued.

Species	Life Stage	S_{FMS}	Surrogate	Reference	Comments
Threadfin Shad	JUV	0.753	Blueback Herring	(Normandeau 1995)	1994 Roseton Generating Station, dual-flow screens
White Catfish	Larvae	0.88	Ictalurus sp.	(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
White Perch	Larvae	0.23		(EPRI 2013)	Predicted post-impingement survival using 2.0 mm mesh, traveling water screen
Yellow Perch	Larvae	0.198	Yellow Perch	(ESEERCO 1981) as cited in EPRI 2013	PYSL; 1.5 fps and 8 min duration; 1979-80 Laboratory Evaluation on fine screen mesh

Table 3-27. Monthly entrainment density estimates (N/100 m^3) apportioned to species and adjusted for 2 mm fine-mesh screens based on pump samples collected in 2016 at NAPS.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae	0.04	0.13					0.03	0.9
Blueback Herring	Larvae								
	YOY		0.11					0.02	0.6
Bluegill	Larvae		0.35	1.77	1.17	1.75	0.11	0.86	28.5
	YOY					0.05		0.01	0.3
Channel Catfish	Larvae				0.00	0.02		0.00	0.2
Gizzard Shad	Egg		0.04					0.01	0.2
	Larvae	1.25	3.72	1.73	1.20	0.08		1.33	44.1
	YOY								
Golden Shiner	Larvae	0.08						0.01	0.5
Largemouth Bass	Larvae		0.01					0.00	0.1
	YOY		0.07	0.01				0.01	0.4
Spottail Shiner	Larvae								
Tessellated Darter	Larvae		0.08					0.01	0.5
Threadfin Shad	Larvae			0.43	2.41	0.16		0.50	16.6
	YOY								
White Catfish	Larvae				0.00			0.00	0.0
White Perch	Larvae	0.90	0.21					0.19	6.1
Yellow Perch	Larvae	0.21						0.03	1.2
Total		2.48	4.72	3.93	4.80	2.07	0.11	3.02	100.0

Table 3-28. Monthly entrainment density estimates (N/100 m^3) apportioned to species and adjusted for 2 mm fine-mesh screens based on pump samples collected in 2017 at NAPS.

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae									
Blueback Herring	Larvae	0.09	1.19						0.18	4.3
	YOY									
Bluegill	Larvae			0.27	0.60	0.72	0.26	0.06	0.27	6.3
	YOY									
Channel Catfish	Larvae					0.01	0.00		0.00	0.1
Gizzard Shad	Egg			0.21					0.03	0.7
	Larvae			5.64	0.33	0.70	0.00		0.95	22.2
	YOY					0.01			0.00	0.0
Golden Shiner	Larvae									
Largemouth Bass	Larvae									
	YOY			0.01	0.01				0.00	0.1
Spottail Shiner	Larvae		0.04		0.12				0.02	0.5
Tessellated Darter	Larvae		0.08						0.01	0.3
Threadfin Shad	Larvae				6.01	12.53	0.04		2.66	61.9
	YOY					0.01			0.00	0.0
White Catfish	Larvae									
White Perch	Larvae	0.13	0.49	0.13					0.11	2.5
Yellow Perch	Larvae	0.23	0.08						0.04	1.0
Total		0.45	1.89	6.25	7.08	13.99	0.30	0.06	4.29	100.0

Table 3-29. Monthly entrainment density estimates (N/100 m^3) apportioned to species adjusted for a 2 mm fine-mesh screen during a typical annual entrainment season of March through September based on pump samples collected from April through September 2016 and March through 2017 at NAPS.

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae		0.02	0.06					0.01	0.4
Blueback Herring	Larvae	0.09	0.60						0.10	2.8
	YOY			0.06					0.01	0.2
Bluegill	Larvae			0.31	1.19	0.95	1.01	0.08	0.50	14.5
	YOY						0.02		0.00	0.1
Channel Catfish	Larvae					0.01	0.01		0.00	0.1
Gizzard Shad	Egg			0.12					0.02	0.5
	Larvae		0.62	4.68	1.03	0.95	0.04		1.05	30.2
	YOY					0.01			0.00	0.0
Golden Shiner	Larvae		0.04						0.01	0.2
Largemouth Bass	Larvae			0.00					0.00	0.0
	YOY			0.04	0.01				0.01	0.2
Spottail Shiner	Larvae		0.02		0.06				0.01	0.3
Tessellated Darter	Larvae		0.04	0.04					0.01	0.3
Threadfin Shad	Larvae				3.22	7.47	0.10		1.54	44.4
	YOY					0.01			0.00	0.0
White Catfish	Larvae					0.00			0.00	0.0
White Perch	Larvae	0.13	0.70	0.17					0.14	4.1
Yellow Perch	Larvae	0.23	0.15						0.05	1.5
Total		0.45	2.19	5.48	5.51	9.39	1.19	0.08	3.47	100.0

Table 3-30. Average annual season (March through September) of monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through 2 mm fine-mesh screens at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae		41,653	167,403					209,056	0.3
Blueback Herring	Larvae	123,688	1,165,299						1,288,987	2.1
	YOY			145,351					145,351	0.2
Bluegill	Larvae			798,652	3,094,030	2,581,560	2,718,340	175,147	9,367,729	15.0
	YOY						63,316		63,316	0.1
Channel Catfish	Larvae					27,192	40,380		67,572	0.1
Gizzard Shad	Egg			322,888					322,888	0.5
	Larvae		1,222,792	12,199,987	2,689,410	2,590,246	112,577		18,815,012	30.1
	YOY					14,004			14,004	0.0
Golden Shiner	Larvae		80,036						80,036	0.1
Largemouth Bass	Larvae			12,658					12,658	0.0
	YOY			105,384	18,291				123,675	0.2
Spottail Shiner	Larvae		38,090		162,799				200,889	0.3
Tessellated Darter	Larvae		80,937	109,731					190,668	0.3
Threadfin Shad	Larvae				8,394,602	20,408,346	274,091		29,077,039	46 5
	YOY					14,022			14,022	0.0
White Catfish	Larvae					6,819			6,819	0.0
White Perch	Larvae	183,465	1,365,580	439,906					1,988,951	3 2
Yellow Perch	Larvae	316,554	286,387						602,941	1.0
Total		623,707	4,280,774	14,301,960	14,359,132	25,642,189	3,208,704	175,147	62,591,613	100.0

Table 3-31. Year-1 monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through 2 mm fine-mesh screens at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae	83,306	334,806					418,112	0.9
Blueback Herring	Larvae								
	YOY		290,702					290,702	0 6
Bluegill	Larvae		903,647	4,617,566	3,200,980	4,738,853	230,629	13,691,675	29.5
	YOY					126,631		126,631	0 3
Channel Catfish	Larvae				13,579	67,284		80,863	0.2
Gizzard Shad	Egg		108,181					108,181	0.2
	Larvae	2,445,584	9,703,516	4,507,145	3,273,651	219,327		20,149,223	43.5
	YOY								
Golden Shiner	Larvae	160,072						160,072	0.3
Largemouth Bass	Larvae		25,316					25,316	0.1
	YOY		174,595	18,138				192,733	0.4
Spottail Shiner	Larvae								
Tessellated Darter	Larvae		219,461					219,461	0.5
Threadfin Shad	Larvae			1,108,368	6,591,865	443,377		8,143,610	17.6
	YOY								
White Catfish	Larvae				13,637			13,637	0.0
White Perch	Larvae	1,763,357	549,008					2,312,365	5.0
Yellow Perch	Larvae	410,170						410,170	0.9
Total		4,862,489	12,309,232	10,251,217	13,093,712	5,595,472	230,629	46,342,751	100.0

Table 3-32. Year-1 monthly entrainment abundance estimates apportioned to species from cooling water withdrawn through 2 mm fine-mesh screens at NAPS Units 1 and 2 combined based on the 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2017.

Species	Life Stage	Apr	May	Jun	Jul	Aug	Sep	Total	%
Black Crappie	Larvae								
Blueback Herring	Larvae	2,330,597						2,454,285	3.1
	YOY								
Bluegill	Larvae		693,656	1,570,493	1,962,139	697,827	119,664	5,043,779	6.4
	YOY								
Channel Catfish	Larvae				40,805	13,475		54,280	0.1
Gizzard Shad	Egg		537,594					537,594	0.7
	Larvae		14,696,458	871,675	1,906,840	5,826		17,480,799	22 3
	YOY				28,007			28,007	0 0
Golden Shiner	Larvae								
Largemouth Bass	Larvae								
	YOY		36,173	18,444				54,617	0.1
Spottail Shiner	Larvae	76,180		325,597				401,777	0.5
Tessellated Darter	Larvae	161,873						161,873	0.2
Threadfin Shad	Larvae			15,680,836	34,224,827	104,805		50,010,468	63.9
	YOY				28,044			28,044	0.0
White Catfish	Larvae								
White Perch	Larvae	967,802	330,803					1,482,070	1.9
Yellow Perch	Larvae	162,603						479,157	0.6
Total		3,699,055	16,294,684	18,467,045	38,190,662	821,933	119,664	78,216,750	100.0

1. Unidentified fish larvae apportioned to species based on monthly composition among other taxa.
2. Threadfin Shad/Gizzard Shad larvae were apportioned to species based on the monthly proportion of Threadfin Shad and Gizzard Shad larvae, with some exceptions when neither shad species were identified. The proportional abundance of Threadfin Shad and Gizzard Shad in July 2016 was used to apportion Threadfin/Gizzard Shad during August 2016 and in July 2017 was used to apportion Threadfin/Gizzard Shad during June and August 2017.

3.4 Biological Benefits of Entrainment Reduction Technologies

3.4.1 Technical Approach

The technical approach used in this assessment to evaluate the biological benefits from entrainment reduction technologies at NAPS is described by the flow chart in Figure 3-1. The methods used in this evaluation adapt the general approach described by the EPA (2004, 2014d) in their benefits valuation, which converts entrained species and life stages to equivalent loss (numbers of fish), and then directly and indirectly into harvest foregone (biomass) of commercial and recreational fishery species.

In most benefit evaluations where commercial fisheries are present, an equivalent fishery yield model (also known as harvest foregone model) is used to estimate the loss in commercial catch in pounds (EPRI 2012; EPA 2004, 2014d) and often relies on regional fishing mortality rates derived from stock assessments. This approach is not relevant to NAPS because there is no commercial fishery in Lake Anna and catch-and-release practice is popular in the recreational fishery (i.e. few fish kept or "harvested").

Instead, the equivalent fishery yield model was adapted to estimate the number of fish that would have died as a result of recreational angling if the entrained life stages of fish had survived. From the equivalent fishery yield (fishery deaths), equivalent harvest and catch estimates were used to assess the direct and indirect benefit to the recreational fishery from reductions in entrainment abundance (and mortality) if entrainment reduction technologies (seasonal flow reductions and 2 mm fine-mesh screens) were implemented at NAPS. The biomass from natural mortalities (assuming 100% predation) that would have resulted if fishery species had not been entrained provided an indirect forage benefit to predatory species (assumed to be Age-2 Largemouth Bass) at 10:1 forage-to-predator biomass conversion. The equivalent fishery yield model of the number of equivalent Age-2 Largemouth Bass was also estimated from the lifetime total production foregone from entrainment of forage species.

3.4.1.1 Commercial Fishery Benefits

There is no commercial fishery in Lake Anna and thus the entrainment reduction alternatives at NAPS would have no benefits to commercial fishers.

3.4.1.2 Recreational Fishery Benefits

The recreational fishery benefits were estimated from the direct reduction in entrainment of species considered important to recreational fisheries and from the indirect gains to recreational species from reduction in entrainment of forage species. Entrained species at NAPS were classified by species importance to the recreational fishery, game fish status in Virginia, and economic value categories (Table 3-33).

3.4.2 Biological Benefits Estimation Methods

3.4.2.1 Age-1 Equivalent and Equivalent Adult Models

The number of Age-1 equivalents and equivalent adults of entrained ichthyoplankton was estimated following established methods by Saila et al. (1997), EPA (2004), EPRI (2004, 2012), and Barnthouse (2005). This analysis estimates the number of Age-1 fish or adult fish (age at first

sexual maturity) that would have resulted if the larvae had not been entrained (Horst 1975; Goodyear 1978). It was conservatively assumed that entrainment mortality was 100%, and all entrained species were lost to the environment. The number of equivalent adult fish (N_A) for each life stage entrained was estimated as follows:

$$N_A = (E_i)(S_{i,A}), \qquad \text{(Equation 5)}$$

Where:

N_A = number of equivalent individuals that would have survived to age 1 or adulthood (stage *A*) if they had not been entrained during early life stage *i*,

$S_{i,A}$ = fraction of fish expected to survive from life stage *i* to adulthood (age of equivalence) as determined by age at first maturity, and

E_i = number entrained during life stage *i* (*e.g.*, eggs, larvae, age 1).

The $S_{i,A}$ parameter was estimated as follows:

$$S_{i,A} = (S_{adj,i}) \prod_{j=i+1}^{j_{max}} (S_j), \qquad \text{(Equation 6)}$$

where:

$S_{adj,i}$ = survival fraction adjusted for mixed ages within the entrained life stage *i* and calculated as $2S_i\exp(-\text{Log}_e(1+S_i))$ (EPRI 2004, 2012),

S_j = survival fraction from life stage *j* to *j*+1, and

j_{max} = the life stage immediately prior to adulthood.

The survival fractions were calculated from the instantaneous total mortality rate (*Z*) for each life stage by $S = \exp(-Z)$, $\exp(-(M+F))$ for fully recruited ages of exploited species, or $-\ln[(1-v)\exp(-M) + (v)\exp(-M+F)]$ for partially recruited ages of exploited species, where *M* is the instantaneous natural mortality rate, *F* is the instantaneous fishing mortality rate, and *v* is the fraction vulnerable to the fishery.

Table 3-33 presents the age of adult equivalence, maximum age, and age first partially or fully recruited to the fishery. These and other life-history parameters based on an equilibrium population are presented by life stage or age in Appendix F.

3.4.2.2 Production Foregone

The production foregone of forage species listed in Table 3-33 was estimated following standard methods established by EPA (2004) and EPRI (2004, 2012). Production foregone is the reduction in prey biomass available to predators due to, in this case, entrainment at NAPS, and includes the expected future growth prior to consumption by predators if the fish was not entrained or impinged. In this assessment, 100% of foregone production was conservatively assumed to be consumed by recreationally valuable predator species, in this case, an Age-2 Largemouth Bass. Specifically, the Rago (1984) model was used to estimate production foregone of a particular species due to fish entrained at any given life stage by integrating the instantaneous growth and mortality rates over the life stage *i* as follows:

$$P_i = \frac{G_i N_i W_i [\exp(G_i - Z_i) - 1]}{(G_i - Z_i)} \quad \text{(Equation 7)}$$

where P_i = production foregone (number of individuals) for age or life stage *i*,

G_i = instantaneous growth rate for individuals of age or life stage *i*,

Z_i = instantaneous total mortality rate for individuals of age or life stage *i*,

W_i = average weight of individuals at start of age or life stage *i*, and

N_i = number of individuals lost due to entrainment or impingement (assuming 100% mortality) of age or life stage *i*.

While Equation 7 estimates the production foregone for the entrained life stage *i*, the equation may also be used to estimate production foregone at a later life stage *j* instead of *i* by accounting N_i for mortality from stage *i* to *j*. Therefore, production foregone at any future life stage *j*, for a fish entrained or impinged at life stage *i* ($P_{i,j}$) is equal to:

$$P_{i,j} = \frac{G_j N_i S_{i,j} W_j [\exp(G_j - Z_j) - 1]}{(G_j - Z_j)} \quad \text{(Equation 8)}$$

where S_{ij} = proportion of individuals that survive from entrained *i* to later stage *j*, and by analogy to Equation 6 is calculated as:

$$S_{i,j} = S_{\text{adj},i} \prod_{j=i+1}^{j-1} S_j \quad \text{(Equation 9)}$$

Analogous to the adjustment to survival fraction for the entrained life stage to account for individuals entrained at any age within the life stage (i.e., median age-at-entrainment) rather than assuming individuals were entrained at the beginning of the stage, Equation 8 is similarly adjusted to account for a median life-stage length over which production can occur:

$$P_i = \frac{G_i N_i W_i [\exp\{(g_i - z_i)(d_i - \widehat{d_i})\} - 1]}{(G_i - Z_i)} \quad \text{(Equation 10)}$$

where P_i = production foregone for age or life stage *i*,

G_i = instantaneous growth rate for individuals of age or life stage *i*,

Z_i = instantaneous total mortality rate for individuals of age or life stage *i*,

d_i = duration (in days) of age or life stage *i* with $d_i/2$ equal to time interval between assumed median age-at-entrainment and end of the life stage,

$\widehat{d_i}$ = median age-at-death as $\widehat{d_i} = \left(\log_e 2 - \log_e(1 + e^{-z_i d_i})\right)/z_i$,

g_i = daily instantaneous growth rate for individuals of age or life stage *i* ($=G_i/d_i$),

z_i = daily instantaneous total mortality rate for individuals of age or life stage *i* (=Z_i/d_i),

W_i = average weight of individuals at start of age or life stage *i*, and

N_i = number of individuals lost due to entrainment (assuming 100% mortality) of age or life stage *i*.

The total production foregone (P_T) of all life stages entrained for a given species is then estimated by the adjusted Rago (1984) model as:

$$P_T = \sum_{i=t_{\min}}^{t_{\max}} \sum_{j=i}^{A_{\max}} P_{i,j} \qquad \text{(Equation 11)}$$

where $P_{i,j}$ = P_i for entrained stage (i.e., j=i) as calculated by Equation 11 otherwise by Equation 9 for later stages,

A_{max} = theoretical maximum age,

t_{min} = the earliest entrained life stage, and

t_{max} = the oldest entrained life stages (i.e., number of life stages entrained).

The Rago (1984) model for production foregone estimates the biomass production lost but does not include biomass lost at time of entrainment that is not consumed by predators. To correct for this bias, the entrained biomass lost (B_L), as calculated by Equation 12 below, was added to the total production foregone estimate from Equation 11.

$$B_L = N_i \widehat{W}_i \qquad \text{(Equation 12)}$$

where B_L = direct biomass lost (in pounds) of individuals at entrained stage *i*,

$\widehat{W}_i$ = median weight at stage *i* calculated as $W_i e^{g_i \hat{d}_i}$.

Herein, the adjusted total production foregone model estimate (P_F) is defined as

$$P_F = P_T + B_L \qquad \text{(Equation 13)}$$

To evaluate the reduction of economically valuable predators as a result of the foregone production that would be consumed, the P_F estimate for entrained forage species was then converted to predator biomass lost due to entrainment of forage species (B_P) by

$$B_P = (k)(P_F) \qquad \text{(Equation 14)}$$

where k = trophic transfer efficiency of 0.1 (EPA 2004, 2006; EPRI 2012).

3.4.2.3 Direct Equivalent Fishery Yield

Traditionally, the equivalent fishery yield model estimates the reduction in harvest due to removal of economically valuable species at early life stages, also referred to as harvest foregone. The equivalent yield model proposed by EPA (2004) and EPRI (2012) to evaluate entrainment impacts is an application of a biomass dynamic pool or yield-per-recruit model used in fisheries science (Ricker 1975, Jennings et al. 2001). In this assessment, "*equivalent fishery yield*" is defined as the number of individuals that would have been expected to die from recreational fishing, either by harvest or post-release mortality, had the taxon not been entrained at an earlier life stage. The model was modified by removal of the biomass term to estimate number of fish instead of biomass because this was the input needed for monetarizing the value of recreational fishery species based on U.S. dollars per fish. When the equivalent fishery yield estimate is expressed as numbers of fish among all ages recruited to the recreational fishery for purposes of economic valuation, the value per fish is assumed equal among all ages (i.e., sizes).

Similar to the concept of equivalent adult loss estimation previously described, which often is used to evaluate adverse environmental impacts to a population as a whole, equivalent number of individuals at each age in the fishery lost to entrainment at life stage *i* is multiplied by age-specific exploitation rate (i.e., harvest or catch rate), and then summed over the species' life span in the fishery. Specifically, EPA (2004) and EPRI (2012) present the Thompson-Bell equilibrium yield model which combines the exponential decay equation ($N_t = N_0 e^{-Zt}$, where N_t is number after t years, N_0 is the starting number of individuals, and Z is as previously defined and Baranov's catch equation (Catch = FA/Z, where A = 1-S, and F and S are as previously defined). Explicitly, equivalent fishery yield (Y, in numbers of fish) of a given species lost to the fishery due to entrainment was calculated as:

$$Y = \sum_{t=t_{\min}}^{t_{\max}} \sum_{t=R}^{A_{\max}} N_i S_{i,t} u_t \qquad \text{(Equation 15)}$$

where

N_i = number of individuals lost due to entrainment (assuming 100% mortality) of age or life stage i,

$S_{i,t}$ = fraction of fish expected to survive from entrained life stage i to age t beginning with t equal to age of entry to the fishery (R) and similarly calculated by Equation 5 for $S_{i,j}$,

u_t = exploitation rate (i.e., so-called harvest rate) at age t (=($F_t A_t / Z_t$),

F_t = instantaneous fishing mortality rate for individuals at age t,

Z_t = instantaneous total mortality rate for individuals at age t,

A_t = actual total mortality at age t calculated as 1-exp(-Z_t),

t_{min} = the earliest entrained life stage,

t_{max} = the oldest entrained life stages (i.e., number of life stages entrained), and

A_{max} = maximum age.

3.4.2.4 Indirect Equivalent Fishery Yield for Total Production Foregone

An indirect equivalent fishery yield was estimated for entrained forage species of fish. The predator biomass lost estimate from the adjusted production foregone model previously described was attributed to the iconic sport fish targeted by anglers in Lake Anna—Largemouth Bass. Largemouth Bass was selected because it was one of the most abundant predatory and highly targeted game fish in Lake Anna (Odenkirk 2016). Age 2 was selected because that was the age at first recruitment of Largemouth Bass to the recreational fishery. The forage biomass was assumed to be consumed by an Age-2 Largemouth Bass with a total length of 264 mm and total weight of 232 grams based on total length-total weight and age-total length relationships from Largemouth Bass data in Lake Anna provided by Virginia Department of Game and Inland Fisheries (VDGIF) (Figure 3-2). Despite that some forage species such as Gizzard Shad could reach sizes that effectively eliminate themselves from predation, this assessment assumes the biomass from these larger forage fish would contribute directly or indirectly to Largemouth Bass production and as a result may lead to an overestimate of forage benefits from entrainment reduction technologies. While Striped Bass is another high-valued predatory game fish in Lake Anna, Striped Bass was not selected as the representative predator in this assessment because the Striped Bass are stocked as sterile fingerlings by VGDIF and do not reproduce to support a self-sustaining population in Lake Anna, and the same monetary value is assigned to Striped Bass and Largemouth Bass by EPA.

The indirect equivalent fishery yield of Largemouth Bass (or 'generic' predator) as result of foregone production of forage species (Y_{PF}) adapted from Equation 15 as follows:

$$Y_{PF} = \sum_{t=R}^{A_{max}} \frac{B_P}{W_R} S_{R,t} u_t \qquad \text{(Equation 16)}$$

where W_R = average weight (232 g) of individuals at age of entry to the fishery (R),

$S_{R,A}$ = fraction of fish expected to survive from age of entry to the fishery (R) to age t as calculated by Equation 6 for $S_{i,j}$,

B_P is as defined in Equation 14, and

A_{max}, and u_t is as defined in Equation 15.

3.4.2.5 Natural Mortality Biomass Loss of Recreational Fishery Species

A fraction of recreationally important fishery species can also provide indirect benefit as prey biomass or as forage to scavengers or intermediary, especially before they mature and enter the fishery. This indirect benefit was estimated as the biomass from the natural mortalities of recreationally important fishery species that would have resulted if the early life stage had not been entrained. The biomass associated with natural mortality from the entrained stage i ($B_{M,i}$) and later stage j ($B_{M,j}$) for a particular recreational fishery species was assumed to serve as forage biomass by predation and was calculated as

$$B_{M,i} = N_i\left(1 - S_{adj,t}\right)\widehat{W}_t \qquad \text{(Equation 17)}$$

$$B_{M,j} = N_i S_{i,j}(1 - S_j)\widehat{W}_j \quad \text{(Equation 18)}$$

$$B_M = \sum_{j=i}^{A_{max}} B_{M,j} \quad \text{(Equation 19)}$$

where $B_{M,J}$ = $B_{M,I}$ for entrained stage (i.e., j=i) as calculated by Equation 17 otherwise by Equation 18 for later stages to and including the maximum age (A_{max}),

N_i = number of individuals lost due to entrainment (assuming 100% mortality) of age or life stage i,

$S_{adj,i}$ = survival fraction adjusted for mixed ages within the entrained life stage i as defined in Equation 6,

S_{ij} = proportion of individuals that survive from entrained stage i to later stage j as defined by Equation 9,

Sj = proportion of individuals that survive from stage j to next stage j+1, and $\widehat{W}_i$ and $\widehat{W}_j$ is the median weight at life stage i and j as defined in Equation 12.

The indirect benefit of a fraction of recreational fishery species serving as forage to a predator is quantified by converting the total biomass associated with natural mortalities of fishery species (from summation of the B_M estimates from each species) to predator biomass (B_P) by applying a 10% trophic transfer efficiency similar to Equation 14. The indirect equivalent fishery yield of Largemouth Bass from B_P associated with natural mortality biomass was estimated following Equation 16

3.4.2.6 Equivalent Number of Fish Caught

Benefit valuations of changes in entrainment using equivalent fishery yield (harvest foregone) models often assume that the equivalent biomass, or in this case number of fish harvested, would be harvested and thus do not account for catch-and-release practices. In Lake Anna where fishing tournaments regularly take place, catch-and-release practices are popular among anglers, particularly for Largemouth Bass with 99.7% of the catch being released based on a 2010 VDGIF creel survey (Odenkirk 2016). The equivalent fishery yield estimated here is really the equivalent number of fish that die from angling, as a result of harvest (landings) and catch-and-release mortality. To account appropriately for catch-and-release, the equivalent number of fish that would be caught by anglers (C) if entrainment were reduced at NAPS Units 1 and 2 combined was estimated by the following calculations:

$$Y = H + D_{CR} \quad \text{(Equation 20)}$$

where Y = total equivalent fishery yield estimate from Equations 11 and 12 summed,

H = equivalent number of fish harvested,

D_{CR} = equivalent number of deaths from catch and release.

H and D_{CR} can then be substituted with expressions of equivalent number caught based on the proportions of the catch harvested and released (P_H and P_{CR}) and catch-and-release mortality (F_{CR} expressed as a proportion). After substitution, Equation 20 becomes:

$$Y = P_H C + P_{CR} F_{CR} C \quad \text{(Equation 21a)}$$

$$C = Y/(P_H + P_{CR} F_{CR}) \quad \text{(Equation 21b)}$$

where P_H and P_{CR} were based on the proportions of the catch harvested and release from the 2010 VDGIF creel survey (Table 3-34) assuming these data are representative of the whole population for a typical year; and F_{CR} was based on percent catch-and-release mortality from the literature (Table 3-35).

3.4.3 Biological Benefits

3.4.3.1 Age-1 Equivalent and Equivalent Adult Estimates

The annual entrainment abundance was estimated to be equivalent to 83,338 Age-1 fish and 49,690 adult fish for a typical March through September season from cooling water withdrawal through the existing CWIS at NAPS Units 1 and 2 combined (Table 3-36). Installation and operation of 2 mm fine-mesh screens was expected to result in a further reduction in Age-1 equivalent and equivalent adult loss.

3.4.3.2 Production Foregone

Table 3-37 presents the total production foregone estimate from entrainment of forage species at the existing NAPS CWIS (1,236 kg) and with either seasonal flow reductions (1,147 kg) or 2 mm fine-mesh screens (938 kg).

3.4.3.3 Direct Recreational Fishery Benefits

Table 3-38 presents the annual entrainment abundance at NAPS and corresponding Age-1 equivalents, equivalent adults, equivalent recruits, and equivalent fishery deaths (i.e., direct equivalent fishery yield) for each of the fishery important species under existing CWIS operation and with one of two entrainment reduction measures. The equivalent number of fish harvested, equivalent number of catch-and-release encounters and deaths, and equivalent catch was estimated from the number of fishery species that would have died from fishing activities had the species and life stages not been entrained (Table 3-39).

The potential reductions in equivalent harvest, catch-and-release encounters, and catch from seasonal flow reductions or 2 mm fine-mesh screens are reported as negative differences relative to the respective estimates for the existing CWIS in Table 3-40. The largest reductions in equivalent catch lost from entrainment reduction were estimated for Channel Catfish larvae (-6,030 catch) and Largemouth Bass YOY (-3,941) with installation and operation of 2 mm fine-mesh screens.

3.4.3.4 Indirect Recreational Fishery Benefits from Total Production Foregone of Entrained Forage Species

The number of equivalent catch of Largemouth Bass resulting from total production foregone of forage species entrained at NAPS Units 1 and 2 combined was 395 for the existing CWIS, 367 with seasonal flow reductions, and 300 with 2 mm fine-mesh screens (Table 3-41). The potential entrainment reduction of forage species corresponded to potential indirect fishery benefits of a gain in equivalent catch of 28 Largemouth Bass for seasonal flow reductions and 95 Largemouth Bass for 2 mm fine-mesh screens.

3.4.3.5 Indirect Recreational Fishery Benefits from Natural Mortality Biomass Lost

The equivalent catch of Largemouth Bass from a 10% trophic transfer of biomass associated with the natural mortality of fishery important species that would have resulted if the early life stages had not been entrained by NAPS was 2,228 for the existing CWIS, 1,854 for seasonal flow reductions, and 581 for 2 mm fine-mesh screens (Table 3-42).

3.4.3.6 Changes in Stock Size or Harvest Levels

The total equivalent adult loss from annual entrainment at NAPS was estimated to be 49,690 equivalent adult fish (Table 3-36). Implementation of seasonal (May—June) flow reductions was estimated to potentially reduce entrainment abundance and thereby reducing equivalent adult loss by a total of 4,177 fish, where reductions in equivalent adult Largemouth Bass (1,905), Threadfin Shad (1,235) and Bluegill (464) comprised the majority of this potential reduction (Table 3-36). Installation and operation of 2 mm fine-mesh screens would result in a potential reduction in equivalent adult loss of 16,269 fish consisting mostly of Largemouth Bass (7,535), Threadfin Shad (3,485), Bluegill (2,463) and Gizzard Shad (1,735; Table 3-36).

Population size estimates of entrained species from fishery-independent stock assessments were unavailable to compare the Age-1 equivalent or equivalent adult loss from annual entrainment of the fishery species at NAPS, or estimate the incremental percent gain in stock size if entrainment reduction alternatives were implemented. Instead, the equivalent harvest (landings) and catch by recreational anglers from annual entrainment abundance at NAPS and the potential incremental changes in equivalent harvest and catch from implementing entrainment reduction technologies were compared to the most recent 2010 creel survey estimates for Lake Anna conducted by VDGIF. While population size estimates of Striped Bass and saugeye stocked in Lake Anna by VDGIF can be estimated from their stock enhancement program data, the potential indirect benefits of increased forage due to entrainment reduction technologies were accounted by modeling the trophic transfer to an equally valuable predator (Largemouth Bass). Changes in stock size of Striped Bass and saugeye are note expected as a result from increased forage (i.e., increased growth) from entrainment reduction technologies because these populations do not reproduce and are sustained only by stocking.

For example, the equivalent harvest of 22 Largemouth Bass estimated from annual entrainment at NAPS under the existing CWIS was about 18% of the harvest estimate from the 2010 creel survey (Table 3-43). The incremental entrainment reduction from seasonal flow reductions or operating 2 mm fine-mesh screens would result in a gain equivalent to 3.4% and 14.5% of the 2010 harvest estimate of Largemouth Bass, respectively. The potential harvest equivalent to the entrainment abundance of Channel Catfish and White Catfish collectively could be reduced from 2,241 catfish under the existing CWIS to 269 catfish with operation of 2 mm fine-mesh screen, a potential reduction of 140% of the 2010 catfish harvest levels (Table 3-43). The annual entrainment abundance of Largemouth Bass expressed as equivalent catch represented about 19.6% of the catch reported in the VDGIF 2010 creel survey (Table 3-44). Implementation of seasonal flow reductions or 2 mm fine-mesh screens would result in a gain equivalent to 3.8% and 15.1% of the 2010 creel survey estimate of angler catch. Annual entrainment of catfish (Channel and White Catfish combined) larvae under the existing CWIS, with seasonal flow reductions and with 2 mm fine-mesh screens would be equivalent to a potential catch of 7,544 fish, 7,544 fish, and 905 fish which is approximately 159.4%, 159.4%, and 19.1% of the 2010

creel survey estimate for catch, respectively. For the popular game fish, Black Crappie, the equivalent catch from annual entrainment at NAPS represented less than 0.1% of 2010 catch (18,930) estimated by the VDGIF creel survey.

3.4.4 Tables and Figures

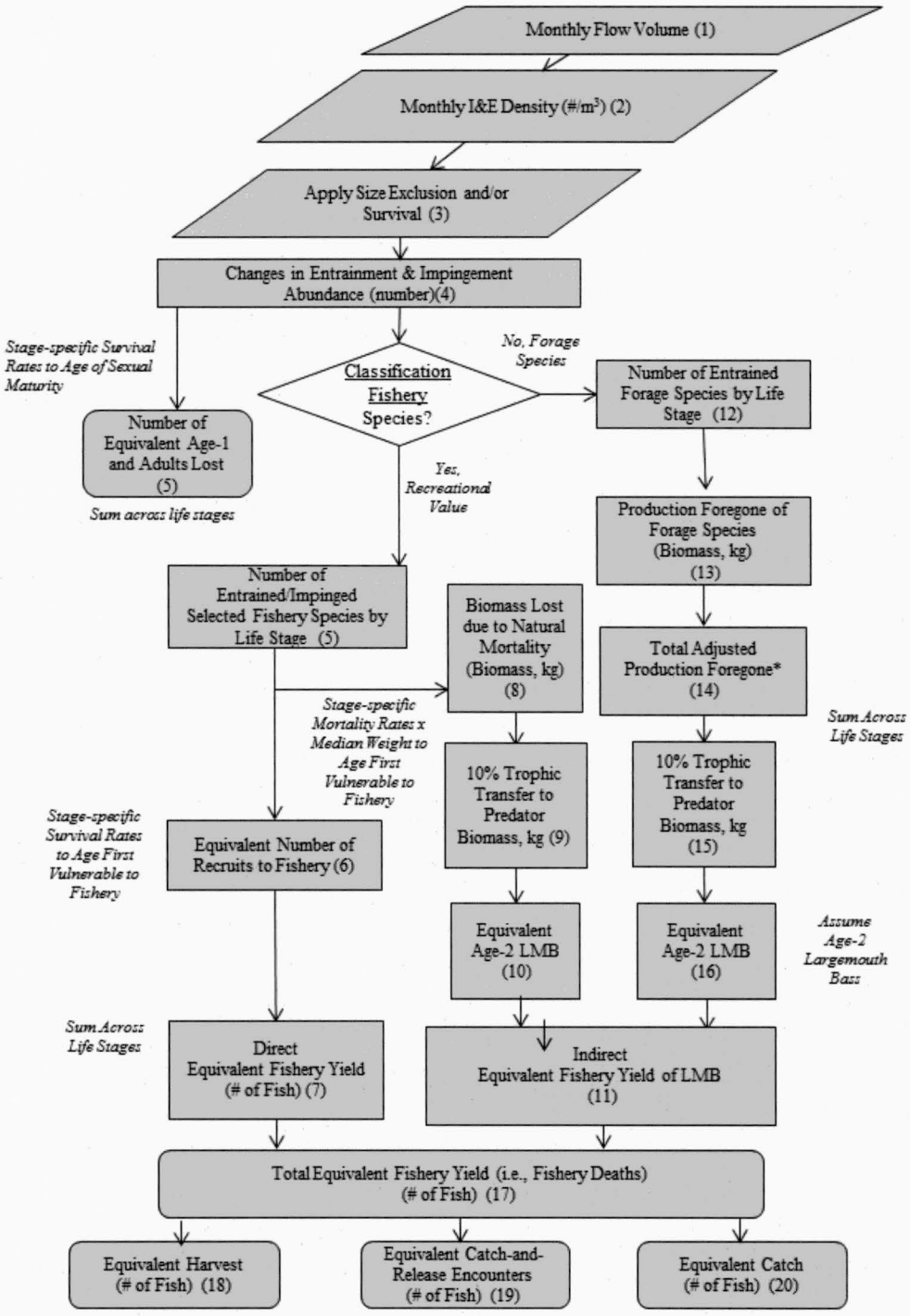


Figure 3-1: General approach used for evaluating the annual number of fish eggs or larvae entrained at NAPS's cooling water intake structures, expressed as equivalent adult loss, equivalent fishery yield, equivalent harvest, and equivalent catch.

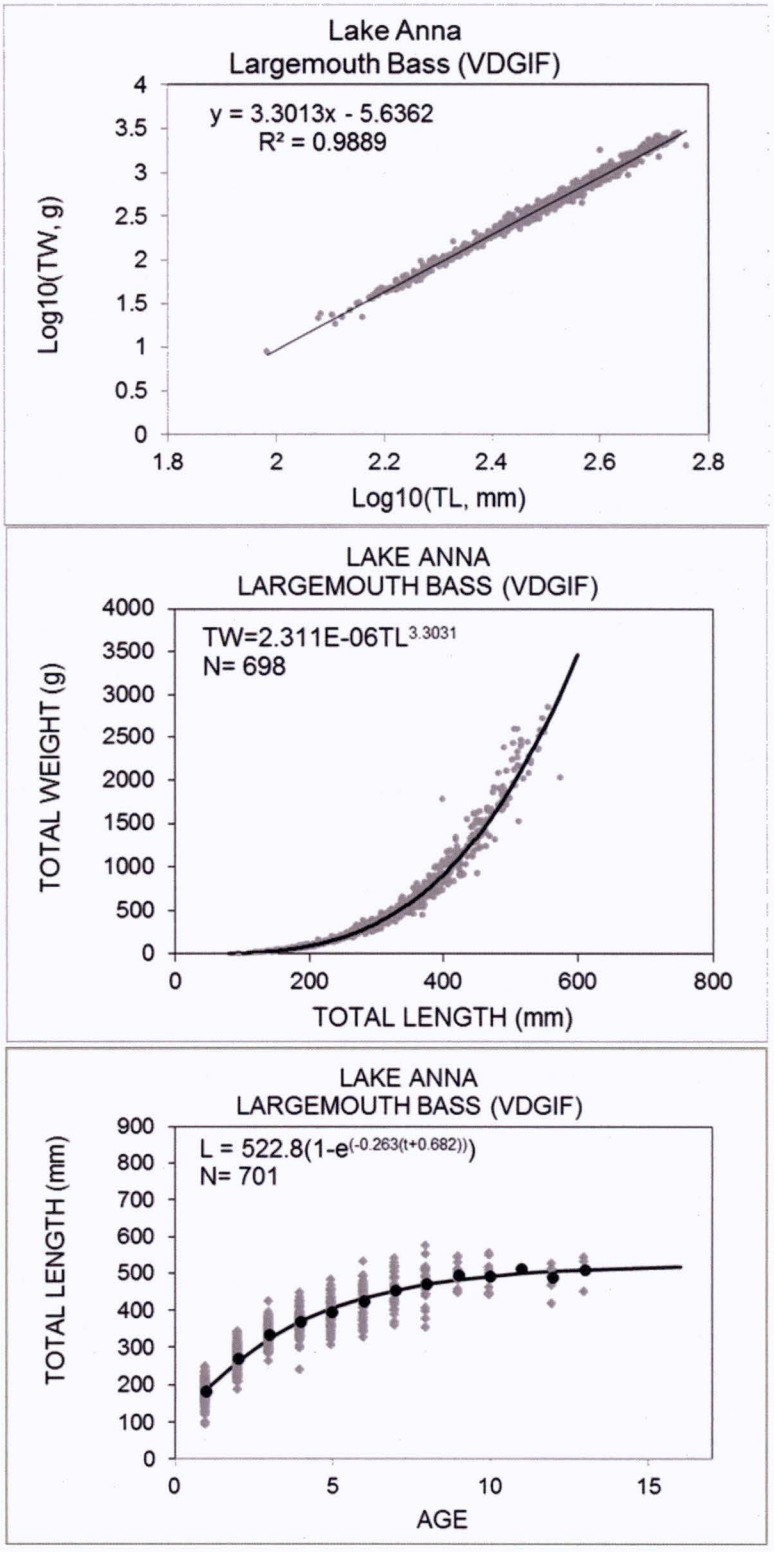


Figure 3-2: Log-linear and curvilinear total length-total weight relation (top and middle), and age-total length relation (bottom) for Largemouth Bass from data collected by Virginia Department of Game and Inland Fisheries (VDGIF) in Lake Anna (Odenkirk, J., VDGIF, pers. comm.).

Table 3-33. Species importance, economic value categories, and age of adult equivalence, maximum age, and age at first recruitment of species selected to model equivalent adult loss, equivalent fishery yield and production foregone as a result of annual entrainment at NAPS.

Taxon	Species Importance[a]	State Game Fish	Economic Value Category[b]	Age at Adulthood[c]	Age at First Recruitment[d]	Maximum Age[e]
Black Crappie	Fishery	Game	Panfish	2	2	11
Blueback Herring	Forage	Non-Game	Not Applicable	4	N/A	8
Bluegill	Fishery	Game	Panfish	2	2	7
Channel Catfish	Fishery	Non-Game	Panfish	3	1	10
Gizzard Shad	Forage	Non-Game	Not Applicable	1	N/A	7
Golden Shiner	Forage	Non-Game	Not Applicable	1	N/A	9
Largemouth Bass	Fishery	Game	Bass	2	2	17
Spottail Shiner	Forage	Non-Game	Not Applicable	1	N/A	4
Tesselated Darter	Forage	Non-Game	Not Applicable	1	N/A	4
Threadfin Shad	Forage	Non-Game	Not Applicable	1	N/A	2
White Catfish	Fishery	Non-Game	Panfish	3	1	10
White Perch	Fishery	Non-Game	Panfish	2	2	10
Yellow Perch	Fishery	Non-Game	Panfish	2	2	7

[a] EPA 2006.

[b] EPA 2014d.

[c] See life history tables for citations on age at first recruitment to the recreational fishery (i.e., age first susceptible to angling gear) for individual species in Appendix F.

[d] See life history tables for citations on age at first sexual maturity (i.e., earliest age of adulthood) for individual species in Appendix F.

[e] See life history tables for citations on maximum age in Appendix F.

Table 3-34. Number harvested, released and caught by selected species based on the 2010 creel survey results provided by Virginia Department of Game and Inland Fisheries (Odenkirk 2016).

Species	Number Harvested		Number Released		Number Caught	
	N	%	N	%	N	%
Black Crappie	8,085	42.7%	10,845	57.3%	18,930	100%
Bluegill[a]	14	0.3%	4,980	99.7%	4,994	100%
Channel and White Catfish[b]	1,407	29.7%	3,325	70.3%	4,732	100%
Largemouth Bass	117	0.3%	37,425	99.7%	37,543	100%
White Perch	0	0.0%	720	100.0%	720	100%
Yellow Perch[c]	73	12.0%	535	88%	608	100%

[a] Creel survey results for the "Sunfish" category were assumed representative of Bluegill
[b] Creel survey results for the "Catfish" category were assumed representative of Channel and White Catfish
[c] In absence of creel survey information specific to Yellow Perch in Lake Anna, percent harvest estimate (12%) from a creel survey (Bugas 2006) for Lake Claytor as a surrogate for Lake Anna

Table 3-35. Catch-and-release mortality estimates for recreationally important species entrained during April through September 2016 and March through September 2017 at NAPS.

Species	Percent Catch-and-Release Mortality	Source
Black Crappie	48%	Bartholomew and Bohnsack 2005
Bluegill	30%	Bartholomew and Bohnsack 2005
Channel Catfish	18%	Bartholomew and Bohnsack 2005
Largemouth Bass	18%	Allen et al. 2008
White Catfish	18%	Based on Channel Catfish
White Perch	27%	The average for Striped Bass, White Bass (*M. chrysops*), and Yellow Bass (*M. mississippiensis*) as a surrogate for White Perch (Bartholomew and Bohnsack 2005).
Yellow Perch	10.5%	Bartholomew and Bohnsack 2005

Table 3-36. Estimates of Age-1 equivalents (A1E) and equivalent adults (EA) of fish species entrained during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and the differences (Δ) with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

	Existing CWIS		Seasonal Flow Reduction				2 mm Fine-Mesh Screen			
Species	(A1E)	(EA)	(A1E)	(ΔA1E)	(EA)	(ΔEA)	(A1E)	(ΔA1E)	(EA)	(ΔEA)
Black Crappie	29	17	24	-5	14	-3	28	-1	16	-1
Blueback Herring	1,302	75	1,125	-177	65	-10	936	-366	54	-21
Bluegill	22,267	6,291	20,622	-1,645	5,827	-464	13,552	-8,715	3,828	-2,463
Channel Catfish	6,449	1,062	6,449	0	1,062	0	774	-5,675	127	-935
Gizzard Shad	3,539	3,539	3,324	-215	3,324	-215	1,804	-1,735	1,804	-1,735
Golden Shiner	2	2	2	0	2	0	2	0	2	0
Largemouth Bass	15,141	9,407	11,829	-3,312	7,501	-1,905	2,579	-12,562	1,871	-7,535
Spottail Shiner	546	546	449	-97	449	-97	546	0	546	0
Tessellated Darter	1,138	1,138	995	-143	995	-143	1,138	0	1,138	0
Threadfin Shad	24,107	24,107	22,872	-1,235	22,872	-1,235	20,622	-3,485	20,622	-3,485
White Catfish	651	107	651	0	107	0	78	-573	13	-94
White Perch	4,067	2,166	3,870	-197	2,061	-105	4,067	0	2,166	0
Yellow Perch	4,101	1,235	4,101	0	1,235	0	4,101	0	1,235	0
Total	83,338	49,690	76,312	-7,026	45,513	-4,177	50,226	-33,112	33,421	-16,269

Table 3-37. Total production foregone (kg) of forage species entrained entrained annually (Mar-Jun) at NAPS Units 1 and 2 combined, under the existing cooling water intake structure (CWIS), a proposed 21.875% seasonal (May—June) flow reduction and 2 mm fine-mesh screen based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Taxon	Life Stage	Existing CWIS	Seasonal Flow Reduction	2 mm Fine-Mesh Screen
Blueback Herring	Larvae	73.6	73.6	73.6
	YOY	88.8	69.3	48.7
	Total	162.3	142.9	122.2
Gizzard Shad	Eggs	1.0	0.8	1.0
	Larvae	198.0	163.7	197.3
	YOY	276.6	276.6	68.3
	Total	475.6	441.1	266.7
Golden Shiner	Larvae	1.0	1.0	1.0
	Total	1.0	1.0	1.0
Spottail Shiner	Larvae	4.4	3.6	4.4
	Total	4.4	3.6	4.4
Tessellated Darter	Larvae	5.4	4.8	5.4
	Total	5.4	4.8	5.4
Threadfin Shad	Larvae	527.1	494.0	523.4
	YOY	60.0	60.0	14.8
	Total	587.1	554.0	538.2
Total	Total	1,235.9	1,147.4	938.0

Table 3-38. Estimates of entrainment abundance, Age-1 equivalents, equivalent adult loss, equivalent recruits to the fishery, and equivalent fishery deaths apportioned to fishery species during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Technology	Entrainment Abundance	Number of Age-1 Equivalents	Number of Equivalent Adults	Equivalent Recruits	Equivalent Fishery Deaths
Black Crappie	Larvae	Existing CWIS	212,164	29	17	17	6
		Seasonal Flow Reduction	174,865	24	14	14	5
		2 mm Fine-Mesh Screen	209,056	28	16	16	6
	Total	Existing CWIS	212,164	29	17	17	6
		Seasonal Flow Reduction	174,865	24	14	14	5
		2 mm Fine-Mesh Screen	209,056	28	16	16	6
Bluegill	Larvae	Existing CWIS	13,462,099	18,095	5,112	5,112	1,064
		Seasonal Flow Reduction	12,238,415	16,450	4,648	4,648	967
		2 mm Fine-Mesh Screen	9,367,729	12,592	3,557	3,557	740
	YOY	Existing CWIS	275,286	4,172	1,179	1,179	245
		Seasonal Flow Reduction	275,286	4,172	1,179	1,179	245
		2 mm Fine-Mesh Screen	63,316	960	271	271	56
	Total	Existing CWIS	13,737,385	22,267	6,291	6,291	1,309
		Seasonal Flow Reduction	12,513,701	20,622	5,827	5,827	1,212
		2 mm Fine-Mesh Screen	9,431,045	13,552	3,828	3,828	796
Channel Catfish	Larvae	Existing CWIS	563,101	6,449	1,062	6,449	2,902
		Seasonal Flow Reduction	563,101	6,449	1,062	6,449	2,902
		2 mm Fine-Mesh Screen	67,572	774	127	774	348
	Total	Existing CWIS	563,101	6,449	1,062	6,449	2,902

(Continued)

Table 3-38. Continued.

Species	Life Stage	Technology	Entrainment Abundance	Number of Age-1 Equivalents	Number of Equivalent Adults	Equivalent Recruits	Equivalent Fishery Deaths
		Seasonal Flow Reduction	563,101	6,449	1,062	6,449	2,902
		2 mm Fine-Mesh Screen	67,572	774	127	774	348
Largemouth Bass	Larvae	Existing CWIS	54,892	72	31	31	4
		Seasonal Flow Reduction	42,884	57	24	24	3
		2 mm Fine-Mesh Screen	12,658	17	7	7	1
	YOY	Existing CWIS	727,504	15,069	6,376	6,376	863
		Seasonal Flow Reduction	568,362	11,772	4,982	4,982	674
		2 mm Fine-Mesh Screen	123,675	2,562	1,084	1,084	147
	Total	Existing CWIS	782,396	15,141	6,407	6,407	867
		Seasonal Flow Reduction	611,246	11,829	5,006	5,006	677
		2 mm Fine-Mesh Screen	136,333	2,579	1,091	1,091	148
White Catfish	Larvae	Existing CWIS	56,822	651	107	651	293
		Seasonal Flow Reduction	56,822	651	107	651	293
		2 mm Fine-Mesh Screen	6,819	78	13	78	35
	Total	Existing CWIS	56,822	651	107	651	293
		Seasonal Flow Reduction	56,822	651	107	651	293
		2 mm Fine-Mesh Screen	6,819	78	13	78	35
White Perch	Larvae	Existing CWIS	1,988,951	4,067	2,166	2,166	111
		Seasonal Flow Reduction	1,892,722	3,870	2,061	2,061	105
		2 mm Fine-Mesh Screen	1,988,951	4,067	2,166	2,166	111
	Total	Existing CWIS	1,988,951	4,067	2,166	2,166	111
		Seasonal Flow Reduction	1,892,722	3,870	2,061	2,061	105
		2 mm Fine-Mesh Screen	1,988,951	4,067	2,166	2,166	111

(Continued)

Table 3-38 Continued.

Species	Life Stage	Technology	Entrainment Abundance	Number of Age-1 Equivalents	Number of Equivalent Adults	Equivalent Recruits	Equivalent Fishery Deaths
Yellow Perch	Larvae	Existing CWIS	602,941	4,101	1,235	1,235	206
		Seasonal Flow Reduction	602,941	4,101	1,235	1,235	206
		2 mm Fine-Mesh Screen	602,941	4,101	1,235	1,235	206
	Total	Existing CWIS	602,941	4,101	1,235	1,235	206
		Seasonal Flow Reduction	602,941	4,101	1,235	1,235	206
		2 mm Fine-Mesh Screen	602,941	4,101	1,235	1,235	206

Table 3-39. Estimates of equivalent fishery deaths (equivalent fishery yield),equivalent number harvested, equivalent number caught and released, equivalent number released that die, and equivalent total catch apportioned to fishery species during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Technology	Equivalent Fishery Deaths	Equivalent Number Harvested	Equivalent Number of Catch-and-Release Encounters	Equivalent Number of Catch-and-Release Deaths	Equivalent Total Catch
Black Crappie	Larvae	Existing CWIS	6	4	5	2	9
		Seasonal Flow Reduction	5	3	4	2	7
		2 mm Fine-Mesh Screen	6	4	5	2	9
	Total	Existing CWIS	6	4	5	2	9
		Seasonal Flow Reduction	5	3	4	2	7
		2 mm Fine-Mesh Screen	6	4	5	2	9
Bluegill	Larvae	Existing CWIS	1,064	11	3,511	1,053	3,522
		Seasonal Flow Reduction	967	10	3,191	957	3,201
		2 mm Fine-Mesh Screen	740	7	2,443	733	2,450
	YOY	Existing CWIS	245	2	809	243	811
		Seasonal Flow Reduction	245	2	809	243	811
		2 mm Fine-Mesh Screen	56	1	184	55	185
	Total	Existing CWIS	1,309	13	4,320	1,296	4,333
		Seasonal Flow Reduction	1,212	12	4,000	1,200	4,012
		2 mm Fine-Mesh Screen	796	8	2,627	788	2,635
Channel Catfish	Larvae	Existing CWIS	2,902	2,035	4,817	867	6,852
		Seasonal Flow Reduction	2,902	2,035	4,817	867	6,852
		2 mm Fine-Mesh Screen	348	244	578	104	822
	Total	Existing CWIS	2,902	2,035	4,817	867	6,852

(Continued)

Table 3-39. Continued.

Species	Life Stage	Technology	Equivalent Fishery Deaths	Equivalent Number Harvested	Equivalent Number of Catch-and-Release Encounters	Equivalent Number of Catch-and-Release Deaths	Equivalent Total Catch
		Seasonal Flow Reduction	2,902	2,035	4,817	867	6,852
		2 mm Fine-Mesh Screen	348	244	578	104	822
Largemouth Bass	Larvae	Existing CWIS	4	0	22	4	22
		Seasonal Flow Reduction	3	0	16	3	16
		2 mm Fine-Mesh Screen	1	0	5	1	5
	YOY	Existing CWIS	863	14	4,716	849	4,730
		Seasonal Flow Reduction	674	11	3,683	663	3,694
		2 mm Fine-Mesh Screen	147	2	804	145	806
	Total	Existing CWIS	867	14	4,738	853	4,752
		Seasonal Flow Reduction	677	11	3,699	666	3,710
		2 mm Fine-Mesh Screen	148	2	809	146	811
White Catfish	Larvae	Existing CWIS	293	206	486	88	692
		Seasonal Flow Reduction	293	206	486	88	692
		2 mm Fine-Mesh Screen	35	25	58	11	83
	Total	Existing CWIS	293	206	486	88	692
		Seasonal Flow Reduction	293	206	486	88	692
		2 mm Fine-Mesh Screen	35	25	58	11	83
White Perch	Larvae	Existing CWIS	111	0	411	111	411
		Seasonal Flow Reduction	105	0	389	105	389
		2 mm Fine-Mesh Screen	111	0	411	111	411
	Total	Existing CWIS	111	0	411	111	411
		Seasonal Flow Reduction	105	0	389	105	389
		2 mm Fine-Mesh Screen	111	0	411	111	411
Yellow Perch	Larvae	Existing CWIS	206	116	854	90	970
		Seasonal Flow Reduction	206	116	854	90	970

(Continued)

Table 3-39 Continued.

Species	Life Stage	Technology	Equivalent Fishery Deaths	Equivalent Number Harvested	Equivalent Number of Catch-and-Release Encounters	Equivalent Number of Catch-and-Release Deaths	Equivalent Total Catch
		2 mm Fine-Mesh Screen	206	116	854	90	970
	Total	Existing CWIS	206	116	854	90	970
		Seasonal Flow Reduction	206	116	854	90	970
		2 mm Fine-Mesh Screen	206	116	854	90	970

Table 3-40. Estimates of equivalent number harvested (H), equivalent number catch-and-release encounters (CRE),and equivalent total catch (C) apportioned to fishery species during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined and comparison to estimates with a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen technologies based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species	Life Stage	Existing CWIS (H)	Existing CWIS (CRE)	Existing CWIS (C)	Seasonal Flow Reduction						2 mm Fine-Mesh Screen					
					H	ΔH	CRE	ΔCRE	C	ΔC	H	Δ H	CRE	Δ CRE	C	Δ C
Black Crappie	Larvae	4	5	9	3	-1	4	-1	7	-2	4	0	5	0	9	0
	Total	4	5	9	3	-1	4	-1	7	-2	4	0	5	0	9	0
Bluegill	Larvae	11	3,511	3,522	10	-1	3,191	-320	3,201	-321	7	-4	2,443	-1,068	2,450	-1,072
	YOY	2	809	811	2	0	809	0	811	0	1	-1	184	-625	185	-626
	Total	13	4,320	4,333	12	-1	4,000	-320	4,012	-321	8	-5	2,627	-1,693	2,635	-1,698
Channel Catfish	Larvae	2,035	4,817	6,852	2,035	0	4,817	0	6,852	0	244	-1,791	578	-4,239	822	-6,030
	Total	2,035	4,817	6,852	2,035	0	4,817	0	6,852	0	244	-1,791	578	-4,239	822	-6,030
Largemouth Bass	Larvae	0	22	22	0	0	16	-6	16	-6	0	0	5	-17	5	-17
	YOY	14	4,716	4,730	11	-3	3,683	-1,033	3,694	-1,036	2	-12	804	-3,912	806	-3,924
	Total	14	4,738	4,752	11	-3	3,699	-1,039	3,710	-1,042	2	-12	809	-3,929	811	-3,941
White Catfish	Larvae	206	486	692	206	0	486	0	692	0	25	-181	58	-428	83	-609
	Total	206	486	692	206	0	486	0	692	0	25	-181	58	-428	83	-609
White Perch	Larvae	0	411	411	0	0	389	-22	389	-22	0	0	411	0	411	0
	Total	0	411	411	0	0	389	-22	389	-22	0	0	411	0	411	0
Yellow Perch	Larvae	116	854	970	116	0	854	0	970	0	116	0	854	0	970	0
	Total	116	854	970	116	0	854	0	970	0	116	0	854	0	970	0

Table 3-41. Number of equivalent Age-2 Largemouth Bass (N), equivalent Age-2 Largemouth Bass harvested (H), equivalent number of Age-2 Largemouth Bass caught and released (CRE),equivalent Age-2 Largemouth Bass catch (C) supported by total production foregone (PF) of forage species entrained annually (Mar-Jun)at NAPS Units 1 and 2 combined, under the existing cooling water intake structure (CWIS), a proposed 21.875% seasonal (May–June) flow reduction and 2 mm fine-mesh screen based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Taxon	Life Stage	Existing CWIS				Seasonal Flow Reduction				2 mm Fine-Mesh Screen			
		N	H	CRE	C	N	H	CRE	C	N	H	CRE	C
Blueback Herring	Larvae	32	<1	23	24	32	<1	23	24	32	<1	23	24
	YOY	38	<1	28	28	30	<1	22	22	21	<1	16	16
	Total	70	<1	52	52	62	<1	46	46	53	<1	39	39
Gizzard Shad	Eggs	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Larvae	85	<1	63	63	71	<1	52	52	85	<1	63	63
	YOY	119	<1	88	88	119	<1	88	88	29	<1	22	22
	Total	205	<1	152	152	190	<1	141	141	115	<1	85	85
Golden Shiner	Larvae	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Total	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Spottail Shiner	Larvae	2	<1	1	1	2	<1	1	1	2	<1	1	1
	Total	2	<1	1	1	2	<1	1	1	2	<1	1	1
Tessellated Darter	Larvae	2	<1	2	2	2	<1	2	2	2	<1	2	2
	Total	2	<1	2	2	2	<1	2	2	2	<1	2	2
Threadfin Shad	Larvae	227	1	168	169	213	<1	158	158	226	1	167	167
	YOY	26	<1	19	19	26	<1	19	19	6	<1	5	5
	Total	253	1	187	188	239	1	177	177	232	1	172	172
Total[1]		533	1	394	395	495	1	366	367	404	1	299	300

[1]Sum of cell values may not be equal to total due to rounding

Table 3-42. Number of equivalent Age-2 Largemouth Bass (N), equivalent Age-2 Largemouth Bass harvested (H), equivalent number of Age-2 Largemouth Bass caught and released (CRE), equivalent Age-2 Largemouth Bass catch (C) from predation of the biomass accrued that would have resulted from natural mortality if recreationally important fishery species were not entrained annually (Mar-Jun) at NAPS Units 1 and 2 combined, under the existing cooling water intake structure (CWIS), a proposed 21.875% seasonal (May–June) flow reduction and 2 mm fine-mesh screen based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Taxon	Life Stage	Existing CWIS				Seasonal Flow Reduction				2 mm Fine-Mesh Screen			
		N	H	CRE	C	N	H	CRE	C	N	H	CRE	C
Black Crappie	Larvae	2	<1	2	2	2	<1	1	1	2	<1	2	2
	Total	2	<1	2	2	2	<1	1	1	2	<1	2	2
Bluegill	Larvae	332	1	246	246	302	1	223	224	231	1	171	172
	YOY	60	<1	44	44	60	<1	44	44	14	<1	10	10
	Total	392	1	290	291	362	1	268	269	245	1	181	182
Channel Catfish	Larvae	296	1	219	220	296	1	219	220	36	<1	26	26
	Total	296	1	219	220	296	1	219	220	36	<1	26	26
Largemouth Bass	Larvae	10	<1	8	8	8	<1	6	6	2	<1	2	2
	YOY	2,141	5	1,584	1,589	1,673	4	1,237	1,241	364	1	269	270
	Total	2,152	5	1,592	1,596	1,681	4	1,243	1,247	366	1	271	272
White Catfish	Larvae	30	<1	22	22	30	<1	22	22	4	<1	3	3
	Total	30	<1	22	22	30	<1	22	22	4	<1	3	3
White Perch	Larvae	63	<1	47	47	60	<1	45	45	63	<1	47	47
	Total	63	<1	47	47	60	<1	45	45	63	<1	47	47
Yellow Perch	Larvae	68	<1	50	50	68	<1	50	50	68	<1	50	50
	Total	68	<1	50	50	68	<1	50	50	68	<1	50	50
Total[1]	Total	3,003	7	2,221	2,228	2,499	6	1,848	1,854	784	2	580	581

[1]Sum of cell values may not be equal to total due to rounding

Table 3-43. Virginia Department of Game and Inland Fisheries (VDGIF) 2010 creel survey estimates of Lake Anna harvest (LAH) compared to estimates of equivalent number harvested (H) apportioned to fishery species entrained during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined with or without a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen, based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species (all life stages combined)	VDGIF 2010 Creel Survey Lake Anna Harvest[1] (LAH)	Existing CWIS				Seasonal Flow Reduction				2 mm Fine-Mesh Screen			
		H	%LAH	ΔH[2]	%LAH	H	%LAH	Δ H	%LAH	H	%LAH	Δ H	%LAH
Black Crappie	8,085	4	<0.1	0	0	3	<0.1	-1	-0.0	4	<0.1	0	0
Bluegill	14	13	92.9	0	0	12	85.7	-1	-7.1	8	57.1	-5	-35.7
Catfish[3]	1,407	2,241	159.3	0	0	2,241	159.3	0	0	269	19.1	-1,972	-140.2
Largemouth Bass	117	22	18.8	0	0	18	15.4	-4	-3.4	5	4.3	-17	-14.5
White Perch	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Perch	not available	116		0		116		0		116		0	

[1] 2010 creel survey results were provided by VDGIF (Odenkirk 2016).
[2] Delta = Difference in equivalent harvest relative to equivalent harvest under the existing CWIS
[3] Catfish includes Channel Catfish and White Catfish combined.

Table 3-44. Virginia Department of Game and Inland Fisheries (VDGIF) 2010 creel survey estimates of Lake Anna catch (LAC) compared to estimates of equivalent number caught (C) apportioned to fishery species entrained during a typical March through September season from cooling water withdrawn through the existing cooling water intake structure at NAPS Units 1 and 2 combined with or without a proposed 21.875% seasonal (May–June) flow reduction or 2 mm fine-mesh screen, based on 3-year (2015-2017) actual intake flow and monthly mean entrainable ichthyoplankton densities from pump samples collected during April through September 2016 (Year 1) and March through September 2017 (Year 2).

Species (all life stages combined)	VDGIF 2010 Creel Survey Lake Anna Harvest[1] (LAC)	Existing CWIS				Seasonal Flow Reduction				2 mm Fine-Mesh Screen			
		C	%LAC	ΔC[2]	%LAC	C	%LAC	ΔC	%LAC	C	%LAC	ΔC	%LAC
Black Crappie	18,930	9	<0.1	0	0	7	<0.1	-2	-0.0	9	<0.1	0	0
Bluegill	4,994	4,333	86.8	0	0	4,012	80.3	-321	-6.4	2,635	52.8	-1,698	-34.0
Catfish[3]	4,732	7,544	159.4	0	0	7,544	159.4	0	0	905	19.1	-6,639	-140.3
Largemouth Bass	37,543	7,375	19.6	0	0	5,931	15.8	-1,444	-3.8	1,692	4.5	-5,683	-15.1
White Perch	720	411	0	0	0	389	0	-22	0	411	0	0	0
Yellow Perch	not available	970		0		970		0		970		0	

[1] 2010 creel survey results were provided by VDGIF (Odenkirk 2016).
[2] Delta = Difference in equivalent catch relative to equivalent catch under the existing CWIS
[3] Catfish includes Channel Catfish and White Catfish combined.

3.5 Biological Basis of Non-Use Benefits

This section provides the biological information that is used below to develop an economic evaluation of the potential nonuse benefits at NAPS due to the NAPS Entrainment Technology Alternatives. In particular, the biological information consists of information on the possibility that threatened and endangered species are entrained at NAPS and on the significance of the entrainment to the long-term sustainability of other species.

3.5.1 Threatened and Endangered Species

Potential effects of cooling water withdrawal at NAPS were evaluated for species listed by federal and state agencies as threatened and endangered species under protection of the federal Endangered Species Act (ESA) and analogous state laws, and any potential non-use benefits if entrainment reduction alternatives were implemented. Information on the ESA, its influence under the Final §316(b) Rule, and threatened and endangered species potentially occurring within the NAPS project area is provided in the information submitted to address §122.21(r)(4)(vi). After review of the survey data and resource agency databases (USFWS 2005; Dominion 2009; NRC 2010; 2013; USFWS 2018a,b; VDGIF 2018), fish species protected under ESA were concluded not to be present in the NAPS project area.

The only ESA-listed aquatic organisms that may potentially occur in the NAPS project area were two invertebrates: the federally and state endangered Dwarf Wedgemussel (*Alasmodonta heterodon*) and state threatened Green Floater (*Lasmigona subviridis*). Based on the mussel surveys conducted in the early 1970s, 1991, 2004-2005 and 2008 as described in the information addressing §122.21(r)(4)(vi), these two species were not identified immediately downstream or upstream of Lake Anna and no threatened or endangered species are expected be in the project area or interact with the CWIS. Subsequent to addressing §122.21(r)(4)(vi), yellow lance (*Elliptio lanceolata*) became listed as a threatened mussel under the Endangered Species Act on April 2, 2018. While Lake Anna is within the geographic range of yellow lance, entrainment at NAPS is unlikely to cause direct and indirect impacts to yellow lance because it did not appear in USFWS's Information for Planning and Consultation (IPAC) resource list for the action area, was absent from a 2008 mussel survey (Dominion 2009), and is typically found in clean, moderately flowing medium-sized rivers and streams rather than in the vicinity of NAPS (USFWS 2019). Based on available information, the U.S. Fish and Wildlife Services (USFWS) stated in a 2005 letter of concurrence:

> *There are no federal or state-listed species that potentially occur within the action area, therefore were* [there] *will be no further discussion on species descriptions or potential impacts to listed-species.*

Recent information, as described in more detail in the information addressing §122.21(r)(4)(vi), continues to support USFWS's documented agreement in the conclusion that threatened and endangered aquatic species do not occur within the NAPS action area and that any threatened and endangered avian or mammalian species potentially occurring in the Lake Anna region would be limited to upland areas, there would be no non-use benefits associated with threatened and endangered species as a result of entrainment or impingement at NAPS.

3.5.2 Long-lasting or Irreversible Effects on Species Populations

The Age-1 equivalent and equivalent adult losses in recreationally important and forage species as a result of annual entrainment at NAPS have not caused an apparent adverse impact to populations or the recreational fishery in Lake Anna.

As an example, annual (March through September) entrainment abundance of Largemouth Bass was equivalent to 15,141 Age-1 fish and 9,407 adults (Table 3-36) but the Largemouth Bass population index, as measured by proportional stock density and relative stock density, does not show any trend from 2001 through 2015 that was consistent with a long-lasting, irreversible decline in the species abundance (Figure 3-3). Gillnet sampling by VDGIF provides a standardized catch per unit effort (CPUE) time series to examine recent (2001-2015) changes in abundance of species entrained at NAPS.

The CPUE for many fishery species are variable and sometimes cyclic (e.g., Bluegill), but no decreasing trends consistent with long-lasting, irreversible effects were present (Figure 3-4). Similarly, CPUE trends show no evidence of appreciable harm for forage species (Figure 3-5).

Based on monitoring by VDGIF, there is no evidence that operation of NAPS, and specifically entrainment, has resulted in long-lasting or irreversible effects on populations of species susceptible to entrainment in Lake Anna.

An approximate estimate for the abundance of fishery-vulnerable Largemouth Bass (Ages 2–17) in Lake Anna was made to put the mortalities associated with entrainment and the benefits of entrainment reduction technologies, and the fishery into context with the scale of the population size. The population was reconstructed based on age-specific annual rates of fishing and natural mortality (Appendix Table A-8), creel-survey estimates of harvest and live-release, and age composition of the catch (Odenkirk 2016, VDGIF, unpublished data). The overall fishery deaths in Lake Anna was taken as the estimated landings (117 fish) and 18% catch-and-release mortality of the live-releases (0.18 × 37,425 fish= 6,737 fish) that were expected to die following release and total fishery deaths of 6,854 fish (=6,737 fish + 117 fish). The overall number of Largemouth Bass that died from fishing was apportioned across recruited (vulnerable) ages (Ages 2–17) using the age distribution of samples taken from Lake Anna during 1999-2002. The age composition of the overall fishery mortalities for ages 14-17 was not available so these were extrapolated based on fishing mortality rates and expected numbers of fish surviving to these ages from younger age groups. The average number in the population of Largemouth Bass vulnerable to the fishery ($\bar{N}$) in Lake Anna was estimated using the equation:

$$\bar{N} = \sum_{a=2}^{17} C_a / F_a \qquad \text{(Equation 22)}$$

where: Ca = overall fishery deaths (harvest and post-release mortalities) at age a, and

Fa is the instantaneous fishing mortality during age a.

This relationship assumes constant fishing and natural mortality acting on the population throughout the year. Though the fishery might be seasonal in Virginia, the seasonality of natural mortality and age composition of the harvest and live-release is unknown. Given these data

constraints and assumptions, the estimated average population size for age 2-17 Largemouth Bass in Lake Anna was 178,000 fish.

The total (direct + indirect) equivalent number of Largemouth Bass deaths due to fishing had early life stages of fish not been entrained at NAPS was estimated to be 1,346 fish (0.8% of the population) for the existing CWIS, 1,082 fish (0.6% of the population) with season flow reductions and 309 fish (0.2% of the population) with 2 mm fine-mesh screens. it is estimated that the incremental benefits for seasonal flow reductions and 2 mm fine-mesh screens would be that 264 fewer fish (0.1% of the population) and 1,037 fewer fish (0.6% of the population) expected to die due to fishing, respectively, compared to the existing CWIS.

3.5.3 Tables and Figures

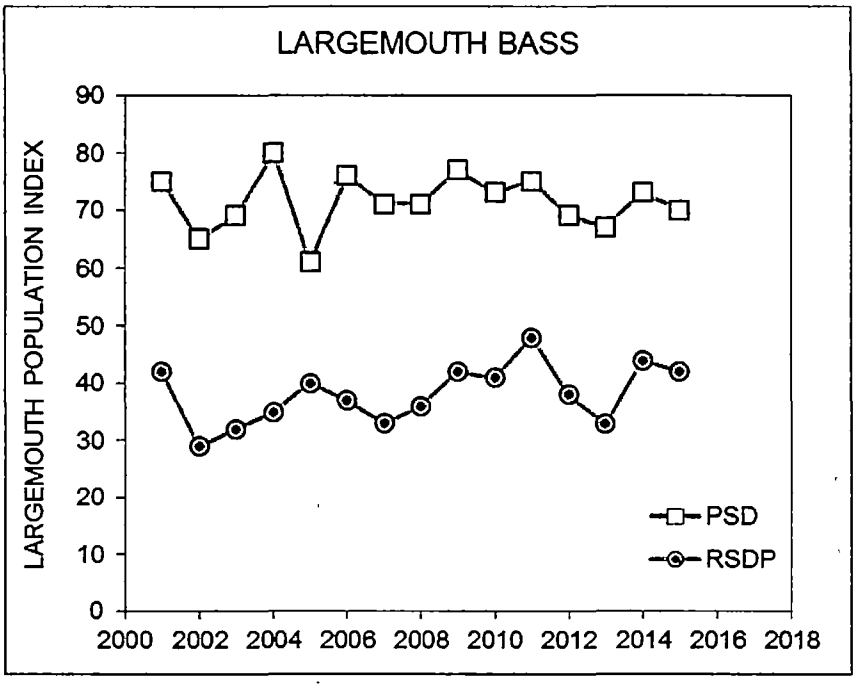


Figure 3-3. Proportional stock density (PSD) and relative stock density of preferred size fish (RSDP) as a population index for Largemouth Bass in Lake Anna (Odenkirk 2016).

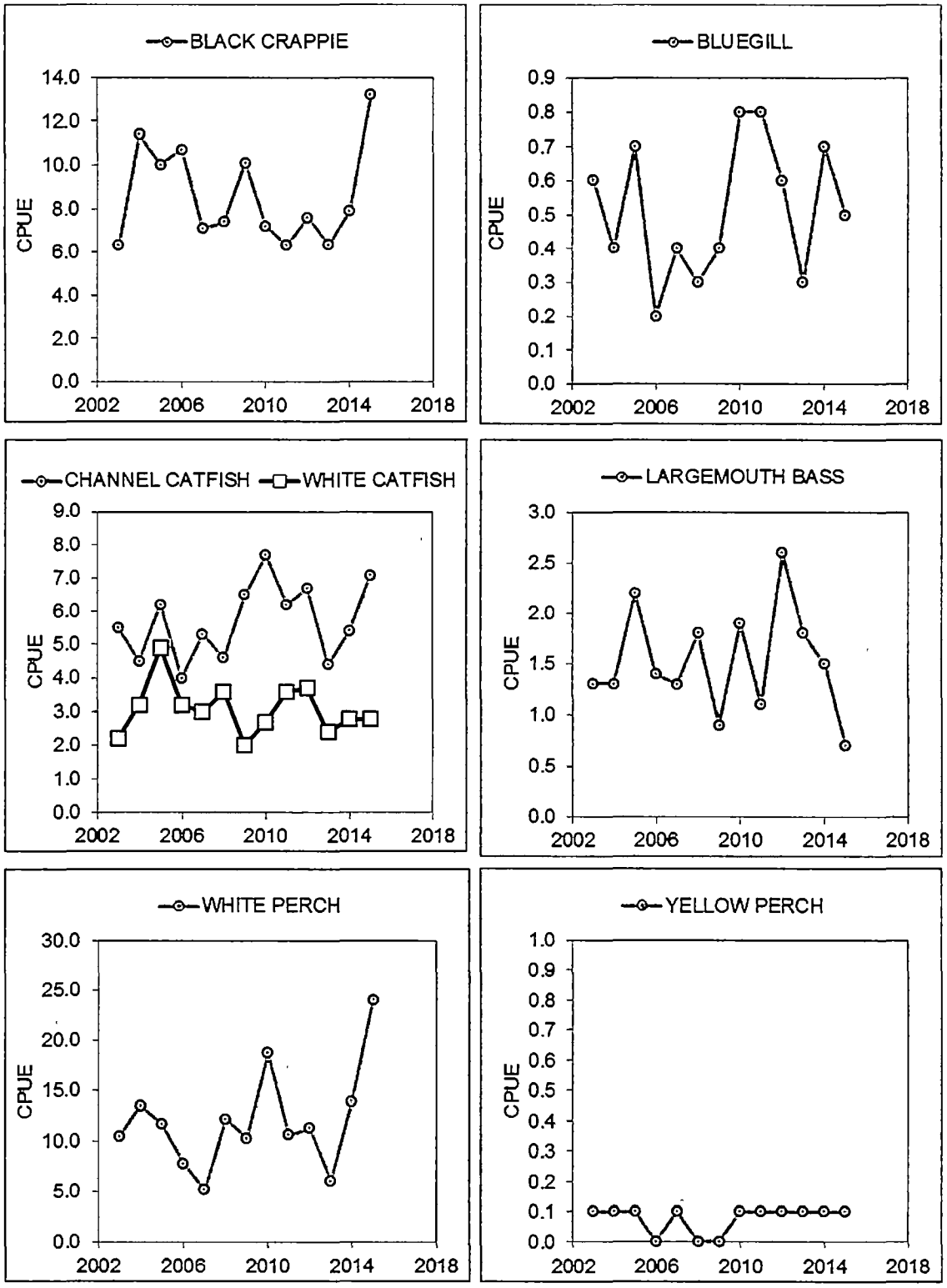


Figure 3-4. Time series of annual mean catch per unit effort (CPUE, number of fish per net night) of the fishery species entrained at NAPS based on VDGIF gillnet data from 2003 through 2015 (Odenkirk 2016).

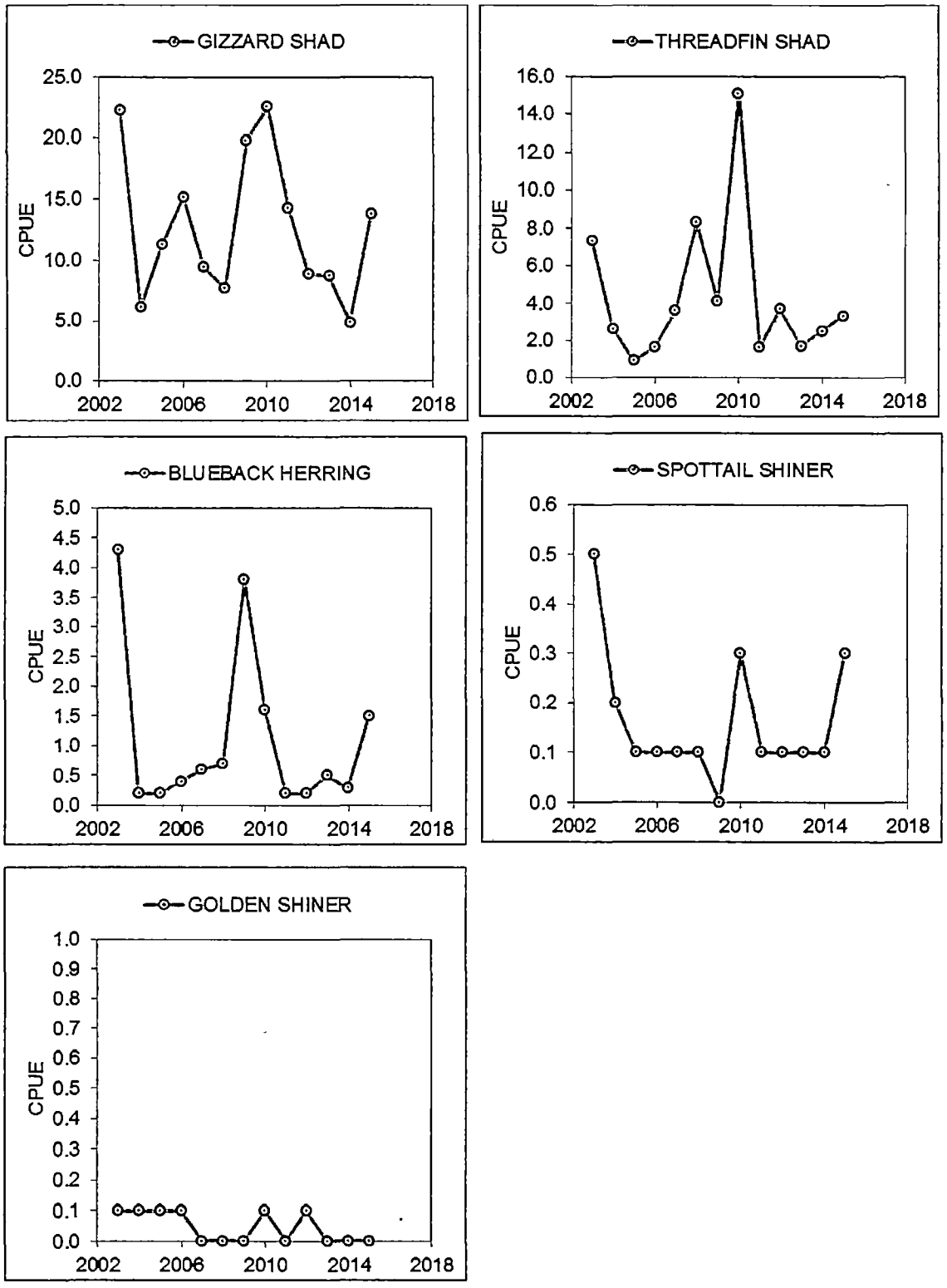


Figure 3-5. Time series of annual mean catch per unit effort (CPUE, number of fish per net night) of the forage species entrained at NAPS based on VDGIF gillnet data from 2003 through 2015 (Odenkirk 2016).

3.6 Social Benefits Valuation

This section includes information on the methodology and results of analysis of the social benefits of installing and operating two cooling water intake structure (CWIS) alternatives at NAPS. The two CWIS alternatives are: (1) seasonal flow reductions and (2) 2 mm fine-mesh screens. These options are being considered as alternatives for reducing entrainment mortality at NAPS.[14] We refer to these collectively as NAPS Entrainment Technology Alternatives. We first provide discussions of the overall social benefits methodology and components of benefits, the underlying data, and the baseline scenario. We then develop the estimates of social benefits.

3.6.1 Overview of Benefits Methodology

As noted in the Final §316(b) Rule social benefits represent the "increase in social welfare that results from taking an action," including "private benefits and those benefits not taken into consideration by private decision makers in the actions they chose to take" (EPA 2014a, p. 48432). We take the standard economic approach of using willingness-to-pay (WTP) to measure social benefits. This approach is consistent with the Final §316(b) Rule as well as with sound cost-benefit methodology (see, e.g., Boardman et al. 2011) and the approach set forth in the EPA *Guidelines* (EPA 2014b, Chapter 7).

3.6.1.1 Potential Components of Social Benefits

The EPA *Guidelines* provide a summary of the benefit categories relevant to an assessment of ecological improvements, which is the general category of benefits for this assessment. EPA uses these benefit categories as a framework to develop estimates of monetary benefits in the Final §316(b) Rule (see EPA 2014d, pp. 4-3 to 4-4). Economic textbooks provide similar frameworks for categorizing benefits related to ecological improvements.[15]

1. *Market Direct Use Benefits:* These benefits are related to goods directly used, and bought and sold in markets; for example, fish caught for eventual sale to consumers. (EPA 2014d, p.4-2)
2. *Nonmarket Direct Use Benefits:* These benefits consist of goods and services that have direct uses, but are not traded in the marketplace. Higher catch rates for recreational fishing provide a typical nonmarket direct use benefit. (EPA 2014d, p.4-2)
3. *Indirect Use Benefits:* These benefits occur through indirect or secondary effects on non-marketed and marketed goods (in primary and secondary markets). For example, an increase in the number of forage fish can increase the population of harvested species. Reducing entrainment of forage species thus can result in indirect welfare gains for commercial and recreational fishers. (EPA 2014d, p.4-2)
4. *Non-use Benefits:* These benefits occur when individuals value improved environmental quality without any past, present, or anticipated future use of the resources in question. (EPA 2014d, p.4-2)

[14] Pursuant to 40 CFR 122.21(r)(11)(i), the benefits valuation study must take into account gains to impingement due to the entrainment technologies if such data are available. We understand that there are no data on potential impingement benefits from the entrainment technologies.

[15] See, e.g. Kolstad (2011, pp. 138-140), Boardman et al. (2011, Chapters 4 and 9), and Freeman (2003, Chapters 5 and 13).

Figure 3-6, adapted from the 2000 EPA *Guidelines* (EPA 2000) for assessing ecological benefits, provides a useful way of organizing and visualizing these potential benefit categories.[16] The figure divides the ecological benefits into two major categories: "use" benefits and "non-use" benefits. Use benefits consist of gains to those who use the additional resources provided by the various alternatives (e.g., commercial fishing), while non-use benefits consist of potential gains to those who do not expect any potential use gains (e.g. those who might value the bequest of changes to future generations). Use benefits can be further subdivided into three subcategories—market benefits, nonmarket, and indirect benefits—resulting in a total of four potentially relevant general ecological benefits categories as reflected in Figure 3-6.

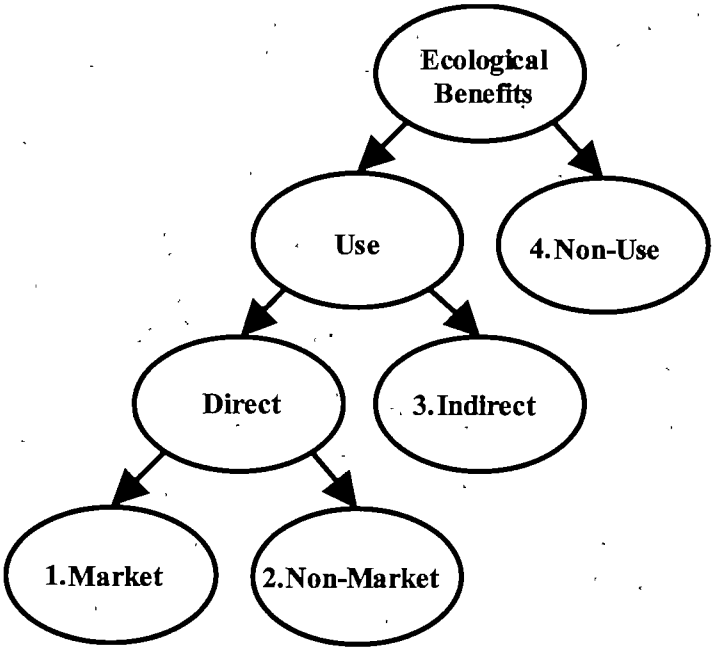


Figure 3-6. Summary of Benefit Classification Scheme from EPA 2000 Guidelines

Source: EPA (2000, p. 70); see also EPA (2014b, p. 7-9).

Our assessment of social benefits from the NAPS Entrainment Technology Alternatives considers each of these categories. We develop monetized benefits for the first three categories and provide a qualitative evaluation of non-use benefits.

3.6.1.2 Discounting of Social Benefits

Social benefits are discounted at social discount rates. We use social discount rates of 3 and 7 percent, as recommended in the Final §316(b) Rule (EPA 2014a, p. 48367).[17] We develop estimates of the net present value for benefits of the NAPS Entrainment Technology Alternatives.

[16] The 2014 *Guidelines* provide a similar categorization but do not include this figure. See EPA (2014b, p. 7-15).

[17] The explicit recommendation in the Final §316(b) Rule is for social cost analyses. Since to be comparable, social costs and social benefits should be calculated using the same discount rate, these two discount rates are appropriate for social benefits as well.

(To be consistent with the Final §316(b) Rule terminology, we refer to the discounted values as "net present values.") The benefits are calculated as of January 1, 2020 over the period from January 1, 2020 to December 31, 2043, reflecting the 20-year useful life of the 2 mm fine-mesh screens, were they to become operational at the end of 2023 (Section 2.4.4).

3.6.1.3 Biological Benefits Information

We rely upon biological benefits information developed by Normandeau (Section 3.4), which includes detailed estimates of changes in recreational fishery catch in Lake Anna due to the NAPS Entrainment Technology Alternatives. Normandeau concluded that there was no commercial fishery in Lake Anna and thus there are no commercial benefits (Section 3.4.1.1). Recreational biological benefits are developed from estimates of the direct and indirect benefits to the recreational fishery from reductions in entrainment. The biological benefits consist of estimates of additional recreational catch, which are calculated from estimates of additional recreational harvest (i.e., catch and keep) and estimates of recreational catch rates, i.e., the average number of fish caught per fish harvested (Section 3.4.1.1). Because Normandeau developed biological information for all entrained species, it is not necessary to adjust estimates to account for omitted species.

Biological benefits for each of the two NAPS Entrainment Technology Alternatives are based on the difference between (a) recreational catch losses (by species) with the alternative in place and (b) catch losses in the baseline scenario, as discussed below.

3.6.1.4 Baseline Scenario

The social costs (Section 2.5.1), compliance costs (Section 2.5.2), and social benefits estimates are measured relative to a Baseline Scenario that reflects the future circumstances if neither of the two entrainment technologies were implemented. In the absence of the installation of new entrainment controls, the study assumes that the entrainment losses with the current configuration would continue in the future. The current system in place at NAPS thus represents the Baseline Scenario for purposes of developing the economic analysis of the NAPS Entrainment Technology Alternatives.

3.6.2 Biological Fish Benefits

This section provides Normandeau's estimates of the additional recreational fish catch due to the NAPS Entrainment Technology Alternatives. As noted above, forage fish that are not directly caught, and therefore have no direct monetary value, still contribute indirectly to potential use benefits of alternatives by providing additional forage for predator species. Non-harvested game fish also contribute indirectly to the additional forage available to game fish. Table 3-45 provides a list of species classified as either fishery fish (i.e., possessing some catch value to anglers) or forage fish. Seven of the species are marked as fishery species.

Table 3-45. Species Categorization: Fishery or Forage

Species	Category
Black Crappie	Fishery
Blueback Herring	Forage
Bluegill	Fishery
Channel Catfish	Fishery
Gizzard Shad	Forage
Golden Shiner	Forage
Largemouth Bass	Fishery
Spottail Shiner	Forage
Tessellated Darter	Forage
Threadfin Shad	Forage
White Catfish	Fishery
White Perch	Fishery
Yellow Perch	Fishery

Note: Largemouth Bass was used as the equivalent predator to consume entrained forage species.
Source: Table 3-33.

3.6.2.1 Commercial Fishing Biological Benefits

As noted above, there is no commercial fishery in Lake Anna and thus there are no commercial biological commercial benefits associated with the NAPS Entrainment Technology Alternatives (Section 3.4.1.1). Note that this result is consistent with EPA's analyses of benefits for the Inland region. EPA does not estimate benefits from commercial fishing harvests for the Inland region in their 2014 benefits analysis for the Final §316(b) Rule (EPA 2014d, Chapter 6 Commercial Fishing Benefits). EPA's decision to exclude commercial benefits for the Inland Region is based upon "negligible commercial fishing harvest in this region" (EPA 2014d, p. 6-11).

3.6.2.2 Recreational Fishing Biological Benefits

Recreational benefits are represented by the increase in the number of fish potentially caught by recreational anglers (i.e., fish harvested, as well as those caught and released) due to the NAPS Entrainment Technology Alternatives. Table 3-46 provides the direct recreational fishing biological benefits (presented in additional recreational catch) due to each technology for the seven species that generate direct benefits.

Table 3-46. Direct Biological Recreational Benefits Due to NAPS Entrainment Technology Alternatives, by Species (Number of fish)

	Black Crappie	Bluegill	Channel Catfish	Largemouth Bass	White Catfish	White Perch	Yellow Perch
Seasonal Flow Reductions							
Harvest	1	1	0	3	0	0	0
Catch and Release	1	320	0	1,039	0	22	0
Total Catch	2	321	0	1,042	0	22	0
Fine Mesh Screens							
Harvest	0	5	1,791	12	181	0	0
Catch and Release	0	1,693	4,239	3,929	428	0	0
Total Catch	0	1,698	6,030	3,941	609	0	0

Source: Table 3-40.

3.6.2.3 Forage Biological Benefits

Table 3-47 provides the average annual additional largemouth bass catch for both alternatives due to indirect effects.

Because of the trophic (e.g. foraging) relationships in aquatic fish communities, species without direct recreational value provide forage value to species with recreational use value. Changes to forage species populations lead to changes in the biomass available in the ecosystem to predator species (indirect forage benefits). For this analysis, Normandeau developed estimates of the indirect changes in recreational species due to changes in forage species by translating changes in the forage species into increases in an equivalent predator, assumed to be an Age -2 largemouth bass. Note that Normandeau's estimates also include the indirect benefits associated with non-harvested portions of fishery species, as these fish would also provide potential indirect use benefits by providing additional forage for predators.

Table 3-47. Indirect Biological Benefits Due to NAPS Entrainment Technology Alternatives (Number of Fish)

	Largemouth Bass
Seasonal Flow Reductions	
Harvest	1
Catch and Release	401
Total Catch	402
Fine Mesh Screens	
Harvest	5
Catch and Release	1,737
Total Catch	1,742

Note: Indirect biological benefits include benefits related to forage species. Largemouth Bass was used as the equivalent predator to target forage species.

Source: Table 3-41 and Table 3-42.

3.6.3 Monetized Use Benefits

This section considers the monetary benefits to fishers from implementation of the NAPS Entrainment Technology Alternatives, using the biological information discussed in the previous section and dollar values described below.

3.6.3.1 Monetized Commercial Benefits

As explained above, there is no commercial fishery in Lake Anna and thus there are no commercial benefits from the NAPS Entrainment Technology Alternatives.

3.6.3.2 Monetized Recreational Benefits

3.6.3.2.1 Monetary Values of Recreational Catch

We use the benefit transfer methodology to value the additional recreational catch due to the NAPS Entrainment Technology Alternatives. Benefit transfer is the "process of applying values estimated in previous studies to new policy cases" (EPA 2014b, p. 7-3). As the basis for recreational catch values, we use results from a detailed meta-analysis study developed by EPA that provides dollar values for marginal recreational value per fish by region and species (EPA 2006, Chapter A5). This study develops a statistical model that combines results from numerous recreational fishing studies to provide a means of estimating the marginal value per fish of additional catch for species as a function of catch rates and other variables. Note that the EPA meta-analysis is based on underlying studies that estimate the value of additional recreational fish catch (i.e., catch-and-keep fish—or harvest—as well as catch-and-release fish), and does not develop separate estimates for harvested fish and catch-and-release fish. The meta-analysis is described in EPA's benefits analysis for the Final §316(b) Rule (EPA 2014d, Chapter 7 Recreational Fishing Benefits). It is our professional opinion that use of the detailed values from this study (via benefit transfer based upon the different types of fish and location) is superior to developing original estimates for North Anna because: (a) benefit transfer provides substantial time and cost savings compared to developing an original study that would estimate values specific to North Anna fishers; and (b) the detailed region- and species-specific values in the EPA meta-analysis study provide estimates likely to be similar in magnitude and reliability to those from an original study. (See EPA *Guidelines for Preparing Economic Analyses* for discussion of the benefit transfer approach and when it is appropriate (EPA 2014b, p. 7-45).)

As noted, EPA's meta-analysis provides values for different species groups and regions. We used the species groups for the Inland region that correspond to the fishery species modeled by Normandeau (Table 3-33). Table 3-48 shows the recreational values per fish for the species groups relevant to this study, measured in dollars per additional fish caught.

Table 3-48. Recreational Catch Values by Species (2018$)

Species	EPA Species Group	Recreational Catch Value ($/Fish)
Black Crappie	Panfish	$1.23
Bluegill	Panfish	$1.23
Channel Catfish	Panfish	$1.23
Largemouth Bass	Bass	$10.48
White Catfish	Panfish	$1.23
White Perch	Panfish	$1.23
Yellow Perch	Panfish	$1.23

Note: Dollar year conversions based on inflation information from BEA.
Source: US EPA (2014d, p. I-23); NERA calculations as explained in text.

3.6.3.2.2 Annual Recreational Fishing Benefits Estimates

We calculate the annual recreational benefits of the NAPS Entrainment Technology Alternatives for each species group as the product of the estimated increases in recreational catch (i.e., harvest plus catch and release) and the recreational value per fish. Table 3-49 provides our estimates of annual recreational benefits.

Table 3-49. Annual Recreational Fishing Benefits (2018$)

	Black Crappie	Bluegill	Channel Catfish	Largemouth Bass	White Catfish	White Perch	Yellow Perch	Total
Seasonal Flow Reductions								
Harvest	$1	$1	$0	$44	$0	$0	$0	$47
Catch and Release	$1	$395	$0	$15,098	$0	$27	$0	$15,521
Total Catch	$2	$396	$0	$15,142	$0	$27	$0	$15,567
Fine Mesh Screens								
Harvest	$0	$6	$2,210	$181	$223	$0	$0	$2,620
Catch and Release	$0	$2,089	$5,230	$59,389	$528	$0	$0	$67,236
Total Catch	$0	$2,095	$7,440	$59,569	$751	$0	$0	$69,856

Note: Values account for direct benefits as well as benefits due to forage (i.e. indirect benefits). Values may not sum to totals due to rounding.
Source: NERA calculations as explained in text.

Since the EPA meta-analysis and underlying individual studies are based on additional recreational catch—and do not provide separate values for catch and keep (harvest) and catch and release—we apply the marginal catch value to recreational benefits from both harvested fish and catch and release fish. Note that there may be a difference in the value that recreational anglers derive from a caught-and-released fish as opposed to a harvested fish. However, we are not aware of reliable information on relative values that would allow us to account for differences

in the value of caught versus kept fish for fish species at North Anna.[18] Thus, we do not adjust values to reflect differences between catch that is caught and released and catch that is kept.

3.6.3.2.3 Present Value Recreational Fishing Benefits Estimate

Table 3-50 provides our estimates of the net present values of recreational benefits for the two NAPS Entrainment Technology Alternatives over the period from 2020 to 2043. The net present value of recreational benefits for the seasonal flow reductions are about $269,000 using a 3 percent discount rate and $186,000 using a 7 percent discount rate. The net present values of recreational benefits for 2 mm fine-mesh screens are about $960,000 using a 3 percent discount rate and $605,000 using a 7 percent discount rate.

Table 3-50. Net Present Value of Total Recreational Benefits, 2020 – 2043 (2018$)

	Discount Rate	
Technology	3%	7%
Seasonal Flow Reductions	$268,560	$186,261
Fine Mesh Screens	$960,460	$604,933

Note: All dollar values are real 2018 dollars. Present values are calculated as of January 1, 2020 for benefits accrued from 2020 to 2043. Benefits are assumed to accrue monthly, at the start of each month.

Source: NERA calculations as explained in text

3.6.4 Evaluation of Indirect Benefits

This section considers the two indirect categories of social benefits:

- Market indirect use benefits; and
- Non-market indirect use benefits.

For the reasons discussed in the subsequent sections, we conclude that apart from forage-related indirect use benefits for recreational fish (which are included in our estimates of recreational fishing benefits), no other indirect category is likely to account for benefits that are significant relative to the monetary benefits we estimate.

3.6.4.1 Market Indirect Use Benefits

Market indirect use benefits are benefits that occur through indirect (or secondary) effects on marketed goods. The following are the specific items listed in EPA's summary of market indirect use benefits in its benefits analysis for the Final 316(b) Rule:

1. Increases in commercially valuable species due to an increase in the number of forage fish.
2. Increases in equipment sales, rental, and repair.

[18] A recent study (Carter and Liese 2012) addressed this issue for several marine species along the Southeast coast. The study found that gamefish kept were valued at about 3.3 times those that were caught and released. This single study is not necessarily representative of values in other situations, and it does not seem appropriate to use it to modify the values for the inland fishery in Lake Anna.

3. Increases in bait and tackle sales.
4. Increases in consumer market choices.
5. Increases in choices in restaurant meals.
6. Increases in property values near the water.
7. Increases in ecotourism (charter trips, festivals, and other organized activities with fees such as river walks). (EPA 2014d, p. 4-3)

As explained in Section 3.6.2.1, since there is no commercial fishery on Lake Anna, there would be no commercial fishing benefits associated with the NAPS Entrainment Technology Alternatives. Accordingly, there are no indirect benefits to commercially valuable species from increases in forage fish species due to the NAPS Entrainment Technology Alternatives. Because no commercial fish are affected, there are no indirect benefits related to consumer market choices or increases in choices in restaurant meals (although such gains would not likely be relevant even if there was a commercial fishery).

The other market indirect use benefits in this list are best categorized as potential secondary markets impacts from the additional recreational catch, i.e., impacts on other markets due to the increase in catch by recreational fishermen. Many markets in theory could be affected—increases in fishing could increase the demand for fishing boats and equipment, which in turn could increase the demand for aluminum, which could increase the demand for electricity. The question for a social benefits study is the following: is it necessary to evaluate these market effects to develop estimates of social benefits?

The economic literature indicates that these secondary market effects can be ignored (for purposes of estimating social benefits) as long as market prices in the affected markets do not change (see, e.g., Kolstad 2011, p. 117). As noted in textbooks on this issue, the market for fishing equipment is assumed to be a constant cost sector, i.e., the long-run cost of production does not change as the quantity produced changes (Kolstad 2011, p. 118). Under the assumption of constant costs, there will be no effect on prices of recreational fishing equipment due to changes in recreational fishing on Lake Anna. Thus, secondary effects of changes in recreational fishing on other markets (e.g., fishing equipment) would not lead to additional social benefits (i.e., consumer and producer surplus). It is worth noting that EPA in their benefits evaluation for the Final 316(b) Rule also does not develop estimates of these secondary market effects, noting data constraints and lack of information on the relationship between changes in catch and these various secondary impacts (EPA 2014d, p. 4-3).

3.6.4.2 Non-market Indirect Use Benefits

Non-market indirect use benefits are benefits that occur through indirect or secondary effects on non-marketed goods. The following are the specific items listed in EPA's summary of non-market indirect goods in its benefits study for the Final 316(b) Rule:

1. Increase in recreationally valuable species due to an increase in the number of forage fish.
2. Increase in value of boating, scuba diving, and near-water recreational experiences due to enjoying/observing fish while boating, scuba diving, hiking or picnicking, and watching aquatic birds fish or catch aquatic invertebrates.
3. Increase in boating, scuba diving and near-water recreational participation. (EPA 2014d, p. 4-4)

The first category of "indirect non-market use benefits"—benefits due to increases in the number of forage fish—are included in the monetary values. Consistent with EPA's benefit assessment in the Final 316(b) Rule, we do not develop estimates of changes in trip value or recreational participation due to improved boating or birdwatching opportunities (EPA 2014d, p. 4-4). As EPA concludes in the context of the national regulation, and based on Normandeau's assessment of potential gains to mammals, birds, and other organisms and aquatic habitats provided in Section 3.8, we conclude that these benefits would be negligible at Lake Anna. Even if those engaged in other recreation on North Anna (e.g., boating) valued seeing fish, the changes in fish populations due to the alternatives is negligible. As noted below in Section 3.6.5.5 (see Table 3-51), for example, largemouth bass mortality from entrainment at NAPS is very small in comparison to the total fishery population (i.e., less than 0.8 percent of the total Lake Anna largemouth bass population). Since entrainment mortality provides an upper bound on the potential biological gains, it seems inconceivable that such a small change in the fish population in Lake Anna could have any significant effects on the value people derive from boating, bird watching or other "indirect non-market use benefits."

3.6.4.3 Conclusions Regarding Indirect Benefits

In summary, we do not expect the relatively small increases in fish populations and catch from NAPS Entrainment Technology Alternatives to lead to any significant indirect market or non-market benefits. We conclude that omitting any such benefits from the monetized social benefits estimates is unlikely to significantly affect the overall results and conclusions of the study.

3.6.5 Evaluation of Non-Use Benefits

This section provides background on non-use benefits and our evaluation of potential non-use benefits for the entrainment technology alternatives at NAPS.

3.6.5.1 Background on Non-Use Benefits

Non-use benefits may arise if people value the change in an ecological resource apart from the prospect of using the resource or enjoying the option to use it in the future. EPA's 2014 *Guidelines for Preparing Economic Analysis*, for example, note that there are various possible types of non-use values for an individual.

1. Bequest value, in which the individual places a value on the availability of a resource to future generations;
2. Existence value, in which the individual values the mere knowledge of the existence of a good or resource; and
3. Paternalistic altruism, in which the individual places a value on others' enjoyment of the resource (EPA 2014b, p. xiv).

The 2014 *Guidelines* note that environmental policies may have non-use benefits from improvements to "relevant species populations, communities, or ecosystems" (EPA 2014b, p. 7-9). In terms of improvements to relevant species populations, for instance, people may attach non-use benefits to preserving an endangered species (EPA 2014b, p. 7-18).

With respect to the 316(b) regulations, EPA describes non-use benefits as including the value that individuals place on knowing that increased fish protection would enable a species to exist or an aquatic ecosystem to be healthy (EPA 2014a, p. 48350, EPA 2014b, p. 4-7).

3.6.5.2 Overview of Assessment of Potential Non-Use Benefits from NAPS Entrainment Technology Alternatives

In accordance with economic principles and the guidance of EPA's 2014 Final §316(b) Rule, our assessment of non-use benefits from NAPS Entrainment Technology Alternatives proceeds in the following four steps: (1) determine whether existing information is available to provide a monetary estimate of the non-use benefits due to reduced entrainment at NAPS, either directly or through benefits transfer; (2) if no existing information is available, use guidance from the economic literature to determine whether non-use benefits are likely to be significant; (3) given the results of the economic assessment, determine whether it would be appropriate to develop an independent study of non-use benefits; and (4) if no study is available or warranted to provide a monetary valuation, provide a non-monetary evaluation (qualitative or quantitative) of non-use benefits. The results of these steps allow us to provide conclusions regarding non-use benefits from NAPS Entrainment Technology Alternatives.

3.6.5.3 Assessment of Existing Information

EPA indicated in the Final §316(b) Rule that non-use benefits should be monetized if suitable results exist from a direct study or a study that could be used as the basis for benefit transfer. We were unable to identify an existing study of non-use benefits related to NAPS has been performed.

We thus focused on determining if there were existing studies that could be used as the basis for benefit transfer.

As a threshold matter, benefit transfer analysis is only a valid approach when a prior study has evaluated a comparable commodity, where comparability includes the nature of the environmental changes (in this case, potential increases in various fish populations) and the location of the change (in this case, Lake Anna). EPA has noted this element of the benefits transfer approach, cautioning that "the less similar are the commodities valued in the existing ecological benefit studies ...the less valid will be the transfer of the resulting value estimate or function (EPA 2014b, p. 7-19). In its Guidelines for Preparing Economic Analyses, EPA states:

> Study cases potentially suitable for use in benefit transfer should be similar to the policy case in their: (1) definition of the environmental commodity being valued (include scale and presence of substitutes); (2) baseline and extent of environmental changes; and (3) characteristics of affected populations. Analysts should avoid using benefit transfer in cases where the policy or study case is focused on a "good" with unique attributes or where the magnitude of the change or improvement across the two cases differs substantially (EPA 2014b, p. 7-46).

Therefore, we performed a literature review of potential studies that might be used as the basis for benefit transfer. Consistent with the EPA recommendation to "develop an explicit set of selection criteria to evaluate each of the potentially relevant studies for quality and applicability to the policy case," NERA used the following two criteria for an appropriate non-use benefit study to be used as the basis of benefit transfer (EPA 2014b, p. 7-45):

1. The non-use study pertains to a comparable commodity and environmental change (potential increases in fish populations that are similar to those relevant at NAPS); and
2. The non-use study pertains to a comparable site (i.e., the site is sufficiently similar to Lake Anna).

We conducted a systematic review of existing literature to identify a study (or studies) that could serve as a valid basis for benefit transfer. This review relied on electronic databases included in Google and Google Scholar, and included the following search terms: "non-use benefit valuation," "bequest value," "existence value," "altruistic value," "non-market value," "stated preference survey," "contingent valuation," and "willingness-to-pay." In terms of geographic criteria, we searched for studies pertaining to similar lakes in Virginia and surrounding states. We did not uncover any non-use study that provided an acceptable basis for benefits transfer. We thus conclude that no studies are appropriate to use as the basis for benefits transfer to develop non-use values for NAPS Entrainment Technology Alternatives.

3.6.5.4 Economic Criteria for Likely Significance

The economics literature on non-use valuation provides some guidance on situations in which non-use values are likely to be significant. We use this literature to structure a qualitative assessment of the likely significance of non-use benefits due to the installation of alternative technologies at NAPS.

In his text on measuring environmental and resource values, Freeman (2003) reviews the literature on non-use values, considering the situations in which non-use values are likely to be important:

> Another important question is, when are non-use values likely to be important? The long literature on non-use values emphasizes the *uniqueness or specialness of the resource in question* and the *irreversibility of loss or injury*. For example, economists have suggested that there are important non-use values in preserving the Grand Canyon in its natural state and in preventing the global or local extinction of species and the destruction of unique ecological communities. In contrast, resources such as ordinary streams and lakes or a subpopulation of a widely dispersed wildlife species are not likely to generate significant non-use values because of the availability of close substitutes. Moreover, the literature does not suggest that non-use values are likely to be important where recovery from an injury is quick and complete, either through natural processes or restoration (Freeman 2003, pp. 156-157, emphasis added).

Thus, Freeman's (2003) review of this literature suggests two operative criteria for evaluating whether non-use value for fish protection is likely to be important:

1. The resource effect is unique, in contrast to effects on a widely dispersed wildlife species; and
2. the loss would be irreversible or subject to a long recovery period.

Freeman (2003) recognizes that there is no generally accepted method of determining whether a resource is sufficiently unique or a resource change is of sufficient duration to generate important non-use values (p. 157). But he suggests that unless the two criteria mentioned above are met, non-use values are unlikely to be important. Freeman (2003) also notes that stated preference methods should be used cautiously, as it is extremely difficult to perform such studies well (p. 183).

3.6.5.5 Implications for Potential Significance of Non-use Benefits at NAPS

The Freeman criteria described above are used to evaluate the potential significance of non-use benefits from the installation of the alternative technologies at NAPS. We consider the two factors (uniqueness and irreversibility) in terms of the changes in threatened and endangered (T&E) species and other species.

Threatened and Endangered Species

Normandeau provides a discussion of potential T&E species at NAPS (see Section 3.5.1). Normandeau did not identify any fish species relevant to the NAPS geographic region that have been identified at the federal and/or Virginia state level as T&E or of special concern.

The only aquatic organisms listed under the protection of the federal Endangered Species Act (ESA) or analogous state laws that could potentially occur in NAPS are two invertebrates: the federally and state endangered Dwarf Wedgemussel (*Alasmodonta heterodon*) and state threatened Green Floater (*Lasmigona subviridis*). However, based on the 1972-1972, 1991, 2004-2005, and 2008 mussel surveys described in the information addressing §122.21(r)(4)(vi), these species were not identified as occurring within the NAPS action area. USFWS supported this determination, stating: "there are no federal or state-listed species that potentially occur within the action area, therefore were [there] will be no further discussion on species descriptions or potential impacts to listed-species" (USFWS 2005).

Subsequent to addressing §122.21(r)(4)(vi), yellow lance (*Elliptio lanceolata*) became listed as a threatened mussel under the Endangered Species Act on April 2, 2018. As discussed in Section 3.5.1, we conclude that entrainment at NAPS is unlikely to cause direct and/or indirect impats to yellow lance.

Thus, the biological information provided by Normandeau (see Section 3.5.1) indicates that the installation of entrainment technology alternatives at NAPS would not lead to protection of a unique resource, based upon impacts on T&E species. If there were no such effects, there would be no effect on long-term sustainability of T&E species. Thus, by Freeman's (2003) criteria, non-use benefits of NAPS Entrainment Technology Alternatives would not likely be significant as judged by impacts on T&E species.

Other Species

Normandeau also assessed the potential effects of NAPS entrainment on the viability of other species (i.e., those other than T&E) and we rely upon these assessments (See Section 3.5.2). Normandeau reports two types of historical information: (a) population stock density for largemouth bass at NAPS over time; and (b) standardized catch per unit effort ("CPUE") for fishery fish and forage fish based on gillnet sampling performed by VDGIF. Based on review of this information, Normandeau concludes that "there is no evidence that operation of NAPS, and specifically entrainment, has resulted in long-lasting or irreversible effects on populations susceptible to entrainment on Lake Anna; therefore, entrainment reduction technologies would have little to no significance to preventing irreversible harm to those species" (Section 3.5.2).

In addition, Normandeau developed estimates of the gross largemouth bass entrainment mortality under each CWIS alternative in comparison to the estimated total Lake Anna largemouth bass population (178,000 fish). As Table 3-51 shows, the total baseline CWIS entrainment mortality is small as a percentage of the total fishery population (0.8%). Table 3-52 provides information on

the potential reductions in fishing mortality for largemouth bass due to the two NAPS Entrainment Technology Alternatives in comparison to the total estimated largemouth bass fishery population. The reduced deaths were 264 fish for seasonal flow reductions and 1,037 for the 2 mm fine-mesh screens; relative to the average population of 178,000 largemouth bass, these values represent only about 0.1% and 0.6%, respectively. These small percentages provide further evidence the entrainment technologies would not have any noticeable effect on the NAPS recreational fishery, and thus that non-use benefits from the entrainment technologies are not likely to be significant.

Table 3-51. Gross Largemouth Bass Entrainment Mortality as Percentage of Lake Anna Largemouth Bass Population

Species	LMB Mortality from Entrainment	Lake Anna LMB Population	Mortality / Population (%)
Baseline CWIS	1,346	178,000	0.8%
Seasonal Flow Reductions	1,082	178,000	0.6%
2 mm Fine-Mesh Screens	309	178,000	0.2%

Note: Values include both direct and indirect entrainment mortality. "LMB" is an abbreviation for Largemouth Bass.

Source: Section 3.5.2

Table 3-52. Largemouth Bass Entrainment Mortality Benefits as Percentage of Lake Anna Largemouth Bass Population

Species	LMB Mortality from Entrainment	Lake Anna LMB Population	Mortality / Population (%)
Seasonal Flow Reductions	264	178,000	0.1%
2 mm Fine-Mesh Screens	1,037	178,000	0.6%

Note: All values are relative to the baseline CWIS entrainment mortality. Values include both direct and indirect entrainment mortality. "LMB" is an abbreviation for Largemouth Bass.

Source: Section 3.5.2

These results and conclusions indicate that the benefits of entrainment technology alternatives at NAPS would not constitute a "unique" resource, as described by Freeman (2003), based upon the criteria of impacts on non-T&E species. Instead, the potential gains would be to a "subpopulation of a widely dispersed wildlife species," which Freeman notes would not be likely to generate significant non-use values. Moreover, if impacts would cease at the point at which NAPS would discontinue operation, then any adverse effects of NAPS would be reversible.

In summary, the biological benefits at NAPS would not constitute unique resources and, indeed, would not prevent irreversible damage. Thus, by Freeman's (2003) criteria, non-use benefits of alternative technologies at NAPS would not likely be significant as judged by impacts on non-T&E species.

Appropriateness of Developing a Stated Preference Study to Monetize Non-Use Benefits

In principle, a well-designed stated preference study could be used to measure the potential non-use benefits associated with reduced entrainment at NAPS. As noted in EPA (2014b) *Guidelines*,

however, obtaining reliable results from a stated preference study is very difficult. Indeed, we are not aware of any instance in which non-use benefits have been estimated for changes in entrainment in the context of a site-specific 316(b) benefits valuation study.

Accounting for the substantial costs and difficulty of developing a site-specific assessment of non-use benefits, as well as the conclusion that non-use benefits are not likely to be significant in this situation, we conclude that it is not appropriate to develop a stated preference study to assess non-use benefits from NAPS Entrainment Technology Alternatives. This conclusion is consistent with EPA *Guidelines* (2014b, e.g., See C.7).

3.6.5.6 Conclusions Regarding Non-Use Benefits from NAPS Entrainment Technology Alternatives

Based upon the available relevant biological information, the absence of an existing study of non-use values directly related to entrainment at NAPS, the absence of a study that could be used appropriately as the basis for benefit transfer, and the overall cost and difficulty of developing an independent study of non-use benefits, we conclude that it is appropriate to provide a non-monetary evaluation of potential non-use benefits from NAPS Entrainment Technology Alternatives. Based on the economic criteria outlined above and the biological information and conclusions related to T&E species and non-T&E species provided above, we conclude that the non-use benefits are not likely to be significant.

3.6.6 Total Monetized Benefits

Table 3-53 provides net present values of the benefits of each alternative over the study period as of January 1, 2020, using annual discount rates of 3 percent and 7 percent. Values are presented in 2018 dollars. As Table 3-53 reports, the net present value of recreational benefits for the seasonal flow reductions are about $269,000 using a 3 percent discount rate and $186,000 using a 7 percent discount rate. The equivalent net present values of recreational benefits for 2 mm fine-mesh screens are about $960,000 using a 3 percent discount rate and $605,000 using a 7 percent discount rate.

Table 3-53. Net Present Value of Total Monetized Social Benefit, 2020 – 2043 (2018$)

	Discount Rate	
Technology	**3%**	**7%**
Seasonal Flow Reductions	$268,560	$186,261
Fine Mesh Screens	$960,460	$604,933

Note: All dollar values are in 2018 dollars. Present values are calculated as of January 1, 2020 for benefits accrued from 2020 to 2043. Benefits are assumed to accrue monthly, at the start of each month.

Source: NERA calculations as explained in text

3.7 Prior Mitigation Efforts

Creation of artificial reefs and several stocking programs were mitigation efforts to enhance the recreational fishery in Lake Anna that were made prior to October 14, 2014, and were described in response to §122.21(r)(4) and §122.21(r)(5).

Artificial structures placed in Lake Anna would be expected to provide two principal fishery benefits: (1) attract fish and thereby increase catch rates or angling success, and (2) increase production (recruitment) to the fishery by providing relief from predation pressure and potentially improved foraging success. The contribution of nearby artificial reefs to productivity of game fish in Lake Anna are reflected in the entrainment abundance data, and the incremental entrainment reduction from the NAPS Entrainment Technology Alternatives associated with artificial reefs are already included in this assessment of indirect and direct fisheries benefits. While many species found in Lake Anna may have origins from stocking during the 1970s, the stocking of hatchery-reared Striped Bass and saugeye (Sauger x Walleye hybrid) have enhanced recreational fishing. Surveys conducted by VDGIF indicate the abundance and size structure of stocked Striped Bass support a strong recreational fishery and local marina sponsored fishing tournaments (Odenkirk 2016).

The potential direct benefits to saugeye and Striped Bass due to entrainment reduction technologies were not quantified in this assessment because (1) saugeye and Striped Bass were not entrained, (2) saugeye and Striped Bass are not a self-sustaining population in Lake Anna because the hatchery-reared juveniles are sterile and are not able to reproduce, and (3) indirect forage benefit to saugeye and Striped Bass would be equal to the benefit to Largemouth Bass given the equal monetary value assigned to these two game species by EPA. While an increase in forage species from entrainment reduction would not contribute to increased reproductive success of these stocked sterile species, improved growth that may result was accounted for in this evaluation by the trophic transfer to Largemouth Bass. As a result, the potential indirect benefits associated with these important game species if these alternatives were implemented to reduce entrainment of forage species were quantified.

3.8 Other Benefits

For the technology alternatives investigated in this report, no other significant benefits from the NAPS Entrainment Technology Alternatives are expected to accrue to the environment and local communities, including but not limited to improvements for mammals, birds, and other organisms and aquatic habitats. Implementation and operation of fine mesh screens or seasonal flow reductions may result in a reduction in entrainment abundance and incremental increase fish species but are not likely to result in a biologically meaningful impact to mammals, birds, other organisms, and aquatic habitats with exception of potentially increasing available forage for bald eagle, osprey, herons, cormorants and other fish-eating birds. While the link between food supply and survival and breeding success of fish-eating bird populations is well established, EPA (2004) concluded that impingement and entrainment by cooling water intake structures have not resulted large-scale die offs or reproductive failures and assert any potential impacts would be subtle.

In summary, and as discussed in Section 3.5.1, we do not expect the relatively small increases in fish populations from the NAPS Entrainment Technology Alternatives to lead to any significant indirect benefits due to improvements for mammals, birds, and other organisms and aquatic habitats. We conclude that omitting any such benefits from the monetized social benefits estimates is unlikely to significantly affect the overall results and conclusions of the study.

3.9 Summary

This section has presented estimates of the net present values of social benefits due to the NAPS Entrainment Technology Alternatives consistent with the requirement of Section 122.21(r)(11). The dollar benefits are based upon estimates of the potential increased recreational catch due to implementation of the technologies, including direct and indirect (forage) gains. Note that there is no commercial fishery in Lake Anna and thus the entrainment reduction alternatives at NAPS would have no benefits to commercial fishers. Potential non-use benefits due to the NAPS Entrainment Technology Alternatives were assessed qualitatively; based on relevant biological information, it was concluded that non-use benefits are not likely to be significant at NAPS. Similarly, we concluded that other potential indirect market and non-market effects are unlikely to be significant (beyond the indirect benefits related to forage fish).

Table 3-53 provides a summary of the social benefit results. The net present value total monetized social benefits for the seasonal flow reductions are about $269,000 using a 3 percent discount rate and $186,000 using a 7 percent discount rate for benefits accrued from 2020 to 2043. The equivalent net present values of total monetized social benefits for 2 mm fine-mesh screens are about $960,000 using a 3 percent discount rate and $605,000 using a 7 percent discount rate.

3.10 References

List of literature cited includes references from Appendix F.

Allen, M.S., C.J. Walters, and R. Myers. 2008. Temporal trends in Largemouth Bass mortality, with fishery implications. North American Journal of Fisheries Management 28: 418-427

Altman, P.L. and D.S. Dittmer. 1962. Growth, including reproduction and morphological development. Federation of American Societies for Experimental Biology Washington, D.C., 1962. xiv + 608 pp. Illus.

Atkinson, T., S. Desrosiers, T. Townsend, and T.P. Simon. 2015. Length-weight relationships of the Emerald Shiner (*Notropis atherinoides* - Rafinesque, 1818) in the Western Basin of Lake Erie. Ohio J Sci 114(2): 27-35.

Barnthouse, L.W. 2005. Parameter development for equivalent adult and production foregone models. EPRI report 1008832 (draft).

Bartholomew, A. and J.A. Bohnsack. 2005. A review of catch-and-release angling mortality with implications for no-take reserves. Reviews in Fish Biology and Fisheries 15: 129-154

Beamesderfer, R.C. and J.A. North. 1995. Growth, natural mortality, and predicted response to fishing for Largemouth Bass and Smallmouth Bass populations in North America. North American Journal of Fisheries Management 15:688-704.

Boardman, A., D. Greenberg, A. Vining, and D. Weimer. 2011. Cost-Benefit Analysis: Concepts and Practice, 4th Edition. Prentice-Hall.

Brown, S.J. and M.J. Maceina. 2002. The influence of disparate levels of submersed aquatic vegetation on Largemouth Bass population characteristics in a Georgia reservoir. Journal of Aquatic Plant Management 40: 28-35

Bugas, Jr., P.E. 2006. Angler Survey, Lake Moomaw, Alleghany and Bath Counties, VA April – October 2006. Virginia Department of Game and Inland Fisheries

(https://www.dgif.virginia.gov/wp-content/uploads/Lake-Moomaw-2006-Angler-Survey-Rpt.pdf)

Carlander, K.D. 1969. Handbook of freshwater fishery biology, volume 1. The Iowa State University Press, Ames. Iowa. 752 p.

Carter, David W., and Christopher Liese. 2012. The economic value of catching and keeping or releasing saltwater sport fish in the Southeast USA. North American Journal of Fisheries Management 32.4 (2012): 613-625.

Crawford, S. and M.S. Allen. 2006. Fishing and natural mortality of Bluegills and Redear Sunfish at Lake Panasoffkee, Florida: implications for size limits. North American Journal of Fisheries Management, 26(1):42-51. DOI: 10.1577/M04-109.1

Dahlburg, M.D. 1979. A review of survival rates of fish eggs and larvae in relation to impact assessments. Marine Fisheries Review (March):1-12.

DiCenzo, V.J. and D.A. Garren. 2001. Trophy Largemouth Bass abundance and harveset in a central Viriginia impoundment: implications for restrictive slot limits. Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies 55: 194-207.

Dominion Energy, Inc. (Dominion). 2009. A Survey for the Discovery of Freshwater Mussel Populations in Lake Anna, Louisa County and Hanover County, Virginia.

EPRI (Electric Power Research Institute). 2004. Extrapolating impingement and entrainment losses to equivalent adults and production foregone. EPRI Report 1008471.

EPRI (Electric Power Research Institute). 2012. Fish Life History Parameter Values for Equivalent Adult and Production Foregone Models: Comprehensive Update. EPRI, Palo Alto, CA: 2012. 1023103.

EPRI (Electric Power Research Institute). 2013. Engineering and Biological Assessment of Fine Mesh Fish Protection-Modified Traveling Water Screens. 3002001104 Technical Update. EPRI, Palo Alto, California.

ESEERCO (Empire State Electric Energy Research Corporation). 1981. Laboratory Evaluation of Fine-Mesh Screening for the Protection of Fish Larvae at Intakes. EP 8-6. Prepared by Alden Research Laboratory and Stone & Webster Engineering Corporation.

Freeman, A. Myrick III. 2003. *The Measurement of Environmental and Resource Values: Theory and Methods*. Second Edition. Washington, D.C.: Resources for the Future.

Froese, R. and D. Pauly. Editors. 2018.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2018)

Fuchs, Evertt H. 1966. Life History of the Emerald Shiner in Lewis and Clark Lake, South Dakota.Theses and Dissertations. South Dakota State University. Paper 91.

Gilbert, C.R. 1992. Southern tessellated darter, *Etheostoma olmstedi maculaticeps*. Pp. 88-92. In: C.R. Gilbert, ed., Rare and Endangered Biota of Florida. Vol. II. Fishes. University Press of Florida, Gainesville.

Goodyear, C.P. 1978. Entrainment Impact Estimates using the Equivalent Adult Approach. U.S. Fish and Wildlife Service, Biological Services Program. FWS/OBS-78/65.

HDR (HDR Engineering, Inc.). 2018. 2016-2017 Entrainment Characterization Study. Draft Final. Prepared for Dominion Energy, Inc. February 26, 2018.

Hoenig, J. M.1983. Empirical use of longevity data to estimate mortality rates. Fishery Bulletin 82:898–903.

Höök, T.O., E.S. Rutherford, D.M. Mason, and G.S. Carter. 2007. Hatch dates, growth, survival, and overwinter mortality of age-0 alewives in Lake Michigan: implications for habitat-specific recruitment success. Transactions of the American Fisheries Society, 136(5):1298-1312, DOI: 10.1577/T06-194.1

Horst, T.J. 1975. The assessment of impact due to entrainment of ichthyoplankton. Pages 107-118 in S.B. Saila, ed. Fisheries and energy production: a symposium. D.C. Heath, Lexington MA.

Hugg, D.O. 1996. MAPFISH georeferenced mapping database. Freshwater and estuarine fishes of North America. Life Science Software. Dennis O. and Steven Hugg, 1278 Turkey Point Road, Edgewater, Maryland, USA.

Jackson, Z. J., M. C. Quist, and J. G. Larscheid. 2008. Growth standards for nine North American fish species. Fisheries Management and Ecology 15:107-118.

Jansen, W. 1996. Plasticity in maturity and fecundity of yellow perch, *Perca flavescens* (Mitchill): comparisons of stunted and normal-growing populations. Annales Zoologici Fennici 33: 403-415.

Jenkins, R.E. and N.M. Burhead. 1994. Freshwater Fishes of Virginia. American Fisheries Society, Bethesda, Maryland. 1067 Pages

Jennings, S., M. J. Kaiser, and J. D. Reynolds. 2001. Marine Fisheries Ecology. Blackwell Publishing, Malden, MA.

Kolstad, Charles D. 2011. Environmental Economics, 2nd Edition. Oxford University Press.

Kuhl, G. H. and K. N. Mueller. 1988. Prairie Island Nuclear Generating Plant Environmental Monitoring Program 1988 Annual Report Fine-mesh Vertical Traveling Screens Impingement Survival Study. Northern States Power Company.

Layzer, J.B. and R.J. Reed. 1978. Age and Growth of the Tessellated Darter, *Etheostoma olmstedi*, in Massachusetts. The American Midland Naturalist 100,(2):459-462.

Lazur, A.M. and F.A. Chapman. 1996. Golden Shiner Culture: A Reference Profile. University of Florida, Cooperative Extension Service. FA-34. June 1996.

Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. Journal of Fish Biology 49:627-647.

Michaletz, P.H. 2012. Gizzard shad population dynamics in eutrophic Missouri reservoirs with emphasis on environmental influences on their growth, Golden Shiner. Journal of Freshwater Ecology, 27:2, 185-197, DOI: 10.1080/02705060.2011.650898.

Mosel, K.J., D.A. Isermann, and J.F. Hansen. 2015. Evaluation of daily creel and minimum length limits for Black Crappie and Yellow Perch in Wisconsin. North American Journal of Fisheries Management, 35(1):1-13. DOI: 10.1080/02755947.2014.963752

Normandeau (Normandeau Associates Inc.) 1995. Roseton Generating Station 1994 Evaluation of Post Impingement Survival and Impingement Abundance. Draft March 1995. Prepared for Central Hudson gas & Electric Corporation, Poughkeepsie, New York

Normandeau. 2018. *Biological Benefit Evaluation of Entrainment Reducing Technologies at North Anna Power Station.* June.

Odenkirk, J. 2016. Lake Anna Fisheries Management Report. Federal Aid Project-F111R. March 2016. https://www.dgif.virginia.gov/wp-content/uploads/Lake-Anna-Popular-Report-2016.pdf

Panek, F.M. and C.R. Cofield. 1978. Fecundity of Bluegill and Warmouth from a South Carolina Blackwater Lake. The Progressive Fish-Culturist 40(2):67-68.

Partridge, D.G. and D.R. DeVries. 1999. Regulation of growth and mortality in larval Bluegills: implications for juvenile recruitment. Transactions of the American Fisheries Society, 128(4):625-638.

Rago, P.J., 1984. Production forgone: an alternative method for assessing the consequences of fish entrainment and impingement losses at power plants and other water intakes. Ecological Modelling, 24(1), pp.79-111.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of Fisheries Research Board of Canada 91. 382 Pages

Rohde, F.C., R.G. Arndt, J.W. Foltz, and J.M. Quattro. 2009. Freshwater fishes of South Carolina. University of South Carolina Press, South Carolina.

Saila, S.B., E.Lorda, J.D. Miller, R.Sher, and W.H. Howell 1997. Equivalent adult estimates for losses of fish eggs, larvae and juveniles at Seabrook Station with use of fuzzy logic to represent parametric uncertainty. North American Journal of Fisheries Management. 17: 811-825.

Slipke, J. W., A. D. Martin, J. Pitlo, Jr., and M. J. Maceina. 2002. Use of the spawning potential ratio for the upper Mississippi River channel catfish fishery. North American Journal of Fisheries Management 224:1295–1300.

Steeby, J and J. Avery. 2005. Channel catfish broodfish and hatchery management. Southern Regional Aquaculture Center Publication 1803. January 2005, 8p.

Stuber, R.J., G. Gebhart, and O. E. Maughan. 1982. Habitat suitability index models: Largemouth bass. U.S. Dept. Int. Fish Wildl. Service FWS/OBS-82/10.16. 32 pp.

Taft, E. P., T. J. Horst, and J. K. Downing. 1981. Biological Evaluation of a Fine-Mesh Traveling Screen for Protecting Organisms. In: Workshop on Advanced Intake Technology, San Diego, California, April 22–24, 1981.

Tsai, C. 1972. Life history of the eastern johnny darter, *Etheostoma olmstedi* Storer, in cold tailwater and sewage-polluted water. Transactions of the American Fisheries Society 101(1): 80-88.

Tsai, C., and G. R. Gibson, Jr. 1971. Fecundity of yellow perch, *Perca flavescens* Mitchill, in the Patuxent River, Maryland. Chesapeake Science 12:270-284.

U.S. Bureau of Economic Analysis (BEA). 2018. *National Data Table Browser.* Table 1.1.9. Implicit Price Deflators for Gross Domestic Product. https://www.bea.gov/ (Accessed May 20, 2018)

U.S. Environmental Protection Agency (EPA). 2004. *Regional analysis document for the final Section 316(b) phase II existing facilities rule.* February. http://www.epa.gov/sites/production/files/2015-04/documents/cooling-water_phase-2_regional-benefits_2004.pdf.

U.S. Environmental Protection Agency (EPA). 2006. *Regional Benefits Analysis for the Final Section 316(b) Phase III Existing Facilities Rule.* June. https://www.epa.gov/sites/production/files/2015-04/documents/cooling-water_phase-3_regional-benefits_2006.pdf

U.S. Environmental Protection Agency (EPA). 2011. *Environmental and Economic Benefits Analysis for Proposed Section 316(b) Existing Facilities Rule*. Washington, DC: EPA, March 28.

U S. Environmental Protection Agency (EPA). 2014a. *National Pollutant Discharge Elimination System—Final Regulations To Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities.* Federal Register, Volume 79, No. 158. August 15.

U.S. Environmental Protection Agency (EPA). 2014b. *Guidelines for Preparing Economic Analyses (Guidelines)*. Washington, DC: EPA, May.

U.S. Environmental Protection Agency (EPA). 2014c. *Economic Analysis for the Final Section 316(b) Existing Facilities Rule*. Washington, DC: May.

U.S. Environmental Protection Agency (EPA). 2014d. *Benefits Analysis for the Final Section 316(b) Existing Facilities Rule*. U.S. Environmental Protection Agency, Office of Water. May

U.S. Fish and Wildlife Service (USFWS). 2005. Letter of concurrence from Mr. John Wolflin, USFWS, to Mr. Pao-Tsin Kuo, Nuclear Regulatory Commission, that ESP Activities would not impact Dwarf Wedgemussel, May 20, 2005. Wilson, K.L., B.G. Matthias, A.B. Barbour, R.N. M. Ahrens, T. Tuten, and M.S. Allen. 2015. Combining samples from multiple gears helps to avoid fishy growth curves. North American Journal of Fisheries Management, 35(6):1121-1131, DOI:10.1080/02755947.2015.1079573

U.S. Fish and Wildlife Service (USFWS). 2018a. Candidate Species, Section 4 of the Endangered Species Act. Accessed on June 7, 2018 at: https://www.fws.gov/endangered/esa-library/pdf/candidate_species.pdf.

U.S. Fish and Wildlife Service (USFWS). 2018b. IPAC Trust Resource Report [for the area surrounding North Anna Power Station in Louisa and Spotsylvania counties, Virginia]. Accessed June 7, 2018. https://ecos.fws.gov/ipac/

U.S. Fish and Wildlife Service (USFWS). 2019. Yellow Lance. Accessed January 15, 2019 at https://www.fws.gov/southeast/wildlife/mussels/yellow-lance/, accessed 15 January 2019.

U.S. Nuclear Regulatory Commission (NRC). 2010. Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3.

U.S. Nuclear Regulatory Commission (NRC). 2013. Draft Supplemental Information to the Biological Assessment North Anna Power Station Combined License Application. Docket No. 52-017. September 2013.

Virginia Department of Game and Inland Fisheries (VDGIF). 2018. Virginia Wildlife and Information Service Search Report [for an area surrounding North Anna Power Station]. Accessed April 12, 2018. https://vafwis.dgif.virginia.gov/fwis/?Menu=Home

4 Non-Water Quality Environmental And Other Impacts Study (40 CFR § 122.21 (r)(12))

4.1 § 122.21 (r)(12) Requirements:

This section addresses the following §122.21(r)(12) application requirements for facilities with cooling water intake structures. §122.21(r)(12) of the Final §316(b) Rule requires submittal of a Non-Water Quality Environmental and Other Impacts consistent with the following requirements:

> *"For an existing facility that withdraws greater than 125 MGD AIF, submit a detailed facility-specific discussion of the changes in non-water quality environmental and other impacts attributed to each technology and operational measure considered in § 122.21 (r)(10), including both impacts increased and impacts decreased. The study must include the following:*
>
> *(i) Estimates of changes to energy consumption, including but not limited to auxiliary power consumption and turbine backpressure energy penalty;*
>
> *(ii) Estimates of air pollutant emissions and of the human health and environmental impacts associated with such emissions;*
>
> *(iii) Estimates of changes in noise;*
>
> *(iv) A discussion of impacts to safety, including documentation of the potential for plumes, icing, and availability of emergency cooling water;*
>
> *(v) A discussion of facility reliability, including but not limited to facility availability, production of steam, impacts to production based on process unit heating or cooling, and reliability due to cooling water availability;*
>
> *(vi) Significant changes in consumption of water, including a facility-specific comparison of the evaporative losses of both once-through cooling and closed- cycle recirculating systems, and documentation of impacts attributable to changes in water consumption; and*
>
> *(vii) A discussion of all reasonable attempts to mitigate each of these factors."*

4.2 Flow Reductions via Flow Modifications

Flow reductions achieved through planned spring refueling outages and seasonal flow modifications would combine to reduce flow and proportionally reduce entrainment.

NAPS's planned spring outages, typically occurring in mid-March to early April, align with the beginning of higher seasonal entrainment. Reducing the amount of cooling water volume withdrawn during outages results in a proportional reduction in impingement and entrainment.

Entrainment density is highest from May to July with a peak in July; therefore, entrainment reduction may be significant if intake flow can be reduced during this time. The percentage of flow reduction that is allowable during these months depends upon Lake Anna water temperature and the design and operating margin of the condensers at NAPS. Seasonal flow reductions at NAPS could be implemented by throttling and/or securing individual CW pumps during portions of the peak entrainment season, thus reducing the total volume of water withdrawn from Lake Anna.

The resulting reduction in entrainment would be proportional to the reduction in cooling water withdrawn.

The construction-related activities, and operational effects resulting from flow reductions were considered to assess the potential for environmental impacts. The impacts to aquatic ecology resulting from entrainment and impingement and impacts to water quality from water withdrawals and discharges are not addressed in this section, however, this discussion does address the impacts of water consumption.

4.2.1 Construction-related Impacts

Refueling outages already occur at NAPS, so this TOM is already implemented and no additional construction or modification is required. Refueling outages for each unit occur in the spring once every three years.

The implementation of seasonal flow reductions by taking individual CW pumps offline can be achieved with no new construction or modifications. Individual CW pumps could be removed from service during portions of the entrainment season in the same way that pumps are currently secured for routine maintenance.

Because flow reductions require no new construction or modification, the implementation of these technologies would not result in construction-related impacts. Therefore, their implementation would not result in construction-related air or noise impacts, loss of terrestrial habitat, or impacts to historic sites.

4.2.2 Operational-related Impacts

Since spring refueling outages at NAPS already align with higher entrainment times and no changes to the planned refueling outages are being proposed, there are no operational impacts associated with the planned spring outages.

However, the implementation of seasonal flow reductions by removing and/or throttling pumps during the months of May and June has the potential for incremental environmental impacts. While implementation of seasonal flow reductions would not result in air emissions, water consumption, or visual impacts, flow reductions would reduce generating capacity. Details are discussed in the following sections.

4.2.2.1 Air Quality and Atmospheric Impacts

Securing and throttling electrical pumps during May and June would nominally reduce parasitic power demand and reduced run time could also reduce maintenance frequency. Nominal reduction in electricity demand and maintenance would likewise reduce any associated air emissions during the times of year the pumps were offline or throttled. Therefore, no negative impacts to air quality are anticipated, and implementation of this technology is not expected to pose a regulatory concern.

4.2.2.2 Noise

The practice of achieving flow reductions by securing and/or throttling CW pumps during the months of May and June would serve to reduce the existing level of noise at the intake during those months. Because no additional equipment or modifications are required for the

implementation of this technology, the potential net impact to the existing noise level as a result of implementing the seasonal flow reductions technology would be a slight decrease during those months. The noise impact from operation of the plant as a whole with the exception of boiler blowdown was characterized as not perceptible to offsite receptors (Reference 4.4.1). The slight reduction in noise levels for these two months would not change that assessment.

4.2.2.3 Water Consumption and Wastewater Discharge Impacts

The current cooling system at NAPS draws water from Lake Anna into the intake tunnels and discharges heated water into the WHTF via the discharge canal. Generally, the same amount of water is withdrawn from and discharged to the lake.

The implementation of the seasonal flow reductions technology would not alter the existing configuration of how NAPS draws water from Lake Anna and discharges it back to the lake via the discharge canal. Instead, the seasonal flow reductions technology would only serve to reduce the amount of water that is withdrawn and passed through the existing cooling system. Since the existing cooling system discharges all of the water that is withdrawn, there are no water consumption impacts associated with the implementation of seasonal flow reductions.

The flow modifications would not introduce new chemicals or pollutants into the discharge. Reduced cooling water flow would result in an incremental increase in the temperature of the water discharged to the WHTF in the immediate vicinity of the station. However, there would also be a reduction in total discharge flow, consistent with the reduction in cooling water flow. The results of the PEPSE model runs were evaluated to verify that the thermal discharge limit in the station's existing VPDES permit (a British thermal unit (Btu)/hour limit) is not anticipated to be exceeded.

4.2.2.4 Visual Impacts

Flow reduction technologies would not result in the addition or modification of equipment or structures and therefore, would not alter the appearance of NAPS. Operation of these technologies would not result in impacts to the Lake Anna viewshed.

4.2.2.5 Energy Consumption and Net Reduction in Energy Output

Implementing seasonal flow reductions at NAPS via securing or throttling CW pumps during the months of May and June would decrease generating capacity of the plant. Reduced thermal efficiency (i.e. operational losses) due to decreased CW flow rates through the condensers would result in a reduced gross generating capacity. Although removing CW pumps from service or throttling pumps would reduce the total electricity demand and parasitic losses of the plant, the operational losses are significantly larger than the reduction in parasitic losses, resulting in a net generation loss.

Various combinations of securing and throttling pumps were considered for optimizing entrainment reduction while minimizing reductions to net power production. As discussed in Section 2.3.3.1, It was determined that an entrainment reduction of approximately 10% could be achieved by throttling three pumps for Unit 1 (81.25% flow operation) and securing one pump for Unit 2 (75% flow operation) during the months of May and June. Flow reductions would be constrained by condenser operating limits such as backpressure and hot well temperature limits.

Typically, flow reductions are most readily achievable in the winter and spring, when water temperatures tend to be cooler. Achievable flow reductions and the resulting power generation losses will vary with river temperature. Using river temperatures from 2011-2016, the combined net reduction in generating capacity for both units is an estimated average of 13.7 MWe for the month of May and 23.6 MWe for the month of June for the combination of throttling three pumps at Unit 1 and securing one pump at Unit 2 (Section 2.3.3.1). Assuming a utilization factor of 91.7% (average five-year capacity factor from the values presented in the §122.21(r)(8) Operational Status report), these operational losses result in a total loss of electricity supplied to the grid of 9,347 MWhr during May and 15,582 MWhr during June (Section 2.3.3.9).

Dominion's planning to meet the power demand of its customer base includes the continued operation of NAPS at current operating capacity (Reference 4.4.3). Therefore, these operational losses would have to be replaced in the electrical supply grid by alternative sources of power to continue to meet power supply demand. Dominion considers a variety of power supply source alternatives in its annual planning (Reference 4.4.3).

4.3 Fine-Mesh Screens

The construction-related activities, and operational effects and emissions of retrofitting NAPS with 2 mm fine-mesh screens were considered to assess the potential environmental impacts. The impacts to aquatic ecology resulting from entrainment and impingement and impacts to water quality are not addressed in this section, however, this discussion does address the impacts of water consumption and discharges.

Implementation of this TOM, fully described in Section 2.4.2, includes construction of an expanded intake structure, relocation of four circulating water (CW) pumps, new CW tunnels to connect the new intake structures to the existing CW tunnels, modifications to the existing intake structure walls to allow two through-flow traveling screens to provide flow to a single circulating water pump, installation of concrete retaining walls directly in front of the existing intake structure, and the installation of a fish handling return system (FHRS).

4.3.1 Construction-related Impacts

Implementation of the fine-mesh screen technology would involve dredging and demolition/construction in the existing intake bay, construction of structures along the shoreline, and onshore ground disturbance to install new tunnels to tie into the existing CW tunnels. The construction duration is estimated at 15 months. The construction activities would disturb the intake bay bottom and require onshore ground disturbance, which has the potential to impact terrestrial and aquatic communities and impact water quality.

Dredging and construction will require a joint permit(s) issued by the United States Army Corps of Engineers (USACE), Virginia Marine Resources Commission (VMRC), and the Virginia Department of Environmental Quality (VDEQ) for dredging, in water construction, and shoreline/onshore work. The USACE would be a CWA Section 404 permit (e.g., Individual Permit or under Nationwide Permit) and the VDEQ's Virginia Water Protection Permit Program serves as Virginia's Section 401 certification program for federal CWA Section 404 permits. As part of the permit application process, a project description and project plans would be placed on public

notice and open to public comment. Consultation with state and federal fish and wildlife agencies would likely be required under the USACE permitting process.

In addition, other environmental permitting would be required. For instance, any ground disturbance of one or more acres requires a construction stormwater permit under the VDEQ Construction General Permit Number VAR10, which grants authorization to discharge under the Virginia Stormwater Management Program and the Virginia Stormwater Management Act. The construction stormwater permit specifies best management practices (BMPs) to reduce erosion caused by stormwater runoff, thereby minimizing the risk of pollution from soil erosion and sediment, and potentially from other pollutants that the stormwater may contact, minimizing impacts to adjacent aquatic habitat.

A site plan review would be required by Louisa County to ensure that the proposed development would comply with County Codes and Ordinances. This process would include a site plan review by the County, zoning and building permits, and a land disturbance permit. Land disturbance permits are required when greater than 10,000 square feet (0.23 acres) of land would be disturbed. In addition, because the project footprint is within the 100-year floodplain, Louisa County would require approval of the project by the County floodplain administrator. See Section 2.4.3.6 for additional discussion of required permits.

Much of the construction activities would be in-water work which provides little or no opportunity to generate fugitive dust. For ground disturbance activities with the potential to generate fugitive dust, control measures such as wetting work areas and roads and covering soil piles would be implemented to minimize fugitive dust. Some additional vehicle-related air emissions can be expected from workforce personal vehicles and project construction vehicles and equipment. Also, there may be some emission sources on temporary offshore platforms or barges. Construction supplies and inshore fine screen intake and piping-related equipment deliveries would also contribute to vehicle emissions in the early phases of construction. Using control measures, any air quality impacts would be small, localized, and temporary.

Construction-related noise impacts would include the operation of vehicles, earthmoving equipment, and other equipment such as generators and compressors used in the construction of the facility. These noises would be intermittent and last for the duration of construction activities. Lake Anna residents may be temporarily impacted by noise resulting from construction. While the distance of most residents from the proposed construction areas will help attenuate the noise impacts to these sites, there are few barriers to noise to lakeside residents between the construction site and these locations. Other sensitive receptors such as persons in schools, churches, and parks would be a greater distance away from the noise and likewise would not be impacted by construction noise. Construction activities would be conducted in compliance with any local noise regulation. Wildlife may disperse to adjacent habitats because of noise associated with construction activities. Significant noise impacts are not anticipated.

Construction activities would be restricted to previously developed land and open water habitat. Therefore, no impacts to upland terrestrial habitat would result from construction activities. Compliance with the required federal, state, and local permits and associated conditions and BMPs will minimize impacts to aquatic communities and minimize impacts to surface water quality from runoff and construction activities. In addition, the permitting process would consider the potential to impact protected species. Given the absence of protected species in Lake Anna as

indicated by previous surveys, and compliance with permit conditions as well as the temporary nature of construction activities, impacts to ecological communities would be small and impacts to protected species are not expected.

Construction would occur on previously developed land; however, the discovery of unknown potentially hazardous substances or materials is possible. Should potentially hazardous materials or substances be identified during construction, appropriate measures for protecting the environment and workers would be implemented which may include a work stoppage and/or remediation activities.

No impacts to cultural resources are anticipated because construction would occur on previously developed land. However, given the number of historic and cultural resources located in immediate vicinity of the NAPS site, inadvertent discovery of cultural sites or artifacts is possible. Should such event occur, appropriate measures such as ceasing construction activities in the immediate area and contacting the appropriate agencies (e.g., Virginia State Historic Preservation Office) would be implemented.

4.3.2 Operational-related Impacts

Once operational, implementation of fine-mesh screens would not result in significant air emissions, water consumption, or visual impacts. However, fine-mesh screens would reduce net electricity output by consuming energy for its operation. Details are discussed in the following sections.

4.3.2.1 Air Quality and Atmospheric Impacts

The pumps and motors involved in this TOM are electrical, so the air emissions associated with their operation would be those from power generation and maintenance activities. Existing CW pumps and motors are being relocated for use in the new intake structures; therefore, there would be no net increase in emissions due to the operation of those pumps. The air emissions associated with the operation of the new dual-flow traveling water screen motors and screenwash pumps would be incremental to existing emissions. The electrical power source would be NAPS which as a nuclear power plant has minimal air emissions and likewise air emissions due to periodic maintenance on the pumps and motors would be minimal. These minimal incremental additions in air emissions are not anticipated to be noticeable; therefore, no negative impacts to air quality are anticipated, and implementation of this technology is not expected to pose a regulatory concern.

4.3.2.2 Noise

Noise from an intake structure generally consists of sounds created by the motors, the speed reduction or power transmission units, and various pumps (circulating water, screenwash, service water). Because existing CW pumps and motors are being relocated for use in the new intake structures, there would be no net increase in noise due to the operation of these pumps. The operation of the new dual-flow traveling water screen motors and screenwash pumps would produce noise that would be incremental to existing level of noise at the intake structure. Noise would also be generated by the operation of the screenwash nozzles, although this noise would be contained to within the intake structure (at the surface of the traveling water screens) and would be somewhat minimized. However, the incremental increase in noise due to the operation

of the equipment in the new intake structures is not expected to be of significant concern to the surrounding population or environment due to the location of the equipment, which is very near to the rest of the plant's buildings and equipment. The noise impact from operation of the plant as a whole with the exception of boiler blowdown was characterized as not perceptible to offsite receptors (Reference 4.4.1).

4.3.2.3 Water Consumption and Discharge Impacts

The current cooling system at NAPS draws cool water from Lake Anna into the CW system and discharges heated water into the WHTF via the discharge canal. Generally, the same amount of water is withdrawn and discharged to the lake.

The retrofitting of NAPS with fine-mesh traveling water screens would not alter the existing configuration of how NAPS draws water from Lake Anna and discharges to the WHTF or increase the capacity of the station to withdraw water from Lake Anna. Instead, implementation of fine-mesh screens would only serve to expand the footprint of the intake structure through which cooling water is withdrawn. Since the cooling system and the new FHRS discharge all of the water that is withdrawn, there are no water consumption impacts associated with the implementation of fine-mesh screens.

All discharges would be returned to Lake Anna, either in the vicinity of the station and existing CWIS or downstream of the station via the WHTF. Discharge flow from the screenwash sprays would either fall into the screenwell, upstream of the CW pumps, or be returned to Lake Anna via the FHRS. Discharge from the cooling system would flow through the discharge canal to the WHTF.

No change to thermal discharge to the WHTF is anticipated because the configuration of the intake and discharge system will not be fundamentally different from current operations.

4.3.2.4 Visual Impacts

As described in Section 2.4.2.2, each of the new intake structures would be 109 feet long and approximately as tall as the existing intake structure. The new intake structures would be constructed alongside of the existing intake structure on the shoreline. The new intake structures would be surrounded by Dominion property, and would be somewhat concealed from view from across the lake by a peninsula housing the main parking lot for the station. Therefore, retrofitting NAPS with fine-mesh screens would not create significant visual impacts for the surrounding areas. The final detailed design would minimize any visual impacts, to the extent practical.

4.3.2.5 Impacts on Availability of Emergency Cooling Water

Emergency cooling water must be available in the event of an emergency or accident for proper plant cooling, avoiding unplanned radiological emissions and their subsequent environmental impacts. NAPS's service water reservoir is the primary source for emergency cooling water. Sufficient service water is available in the Service Water Reservoir a minimum of 30 days operation without makeup. Makeup water would be available from the North Anna Reservoir via the auxiliary service water pumps. (Reference 4.4.2, Section 9.2) Implementation of fine-mesh screens would not alter this emergency cooling water configuration and therefore would not impact the availability of emergency cooling water.

4.3.2.6 Energy Consumption and Net Reduction in Energy Output

Retrofitting NAPS with fine-mesh screens would decrease net generating capacity of the station due to parasitic losses resulting from the operation of the new dual-flow traveling water screens, screenwash pumps, and trash rake system. Parasitic losses are defined as power consumption necessary to operate the plant, which therefore reduce the net generating capacity of the plant. As discussed in Section 2.4.3.10, an additional 316 kW of parasitic losses is estimated as a result of new equipment required to operate the new fine-mesh screens. Assuming a utilization factor of 91.7%, the parasitic losses would result in 2,538 MWhr of losses annually. Dominion's planning to meet the power demand of its customer base includes the continued operation of NAPS at current operating capacity (Reference 4.4.3). Therefore, these operational losses would have to be replaced in the electrical supply grid by alternative sources of power to continue to meet power supply demand. Dominion considers a variety of power supply source alternatives in its annual planning (Reference 4.4.3).

4.4 References

4.4.1 Generic Environmental Impact Statement for License Renewal of Nuclear Plant Supplement 7 regarding North Anna Power Station, Units 1 and 2. NUREG-1437, Supplement 7. November 2002.

4.4.2 North Anna Power Station Updated Final Safety Analysis Report, Revision 53.03

4.4.3 Virginia Electric and Power Company's Report of Its Integrated Resource Plan, May 1, 2018

Enclosure 4
Attachment 3

LETTER FROM J. SCHNEIDER TO K. ROLLER, DATED SEPTEMBER 16, 2020, RE: OPERATING LICENSE RENEWAL RESPONSE TO REQUEST REGARDING SECTION 401 CERTIFICATION

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

P O. Box 1105, Richmond, Virginia 23218
(800) 592-5482
www.deq.virginia.gov

Matthew J Strickler
Secretary of Natural Resources

David K. Paylor
Director
(804) 698-4000

September 16, 2020

Mr. Ken Roller
Manager, Environmental
Dominion Energy Environmental Services
120 Tredegar Street
Richmond, VA 23219

RE: North Anna Power Station, Operating License Renewal Response to request regarding Section 401 Certification

Dear Mr. Roller:

Thank you for contacting us regarding the relicensing of the North Anna Power Station and requesting correspondence regarding Clean Water Act §401 certification. The Virginia Department of Environmental Quality (DEQ) has reviewed your request.

The State Corporation Commission (SCC) granted a license to Virginia Electric and Power Company in 1969 to construct the Lake Anna Dam for the purpose of impounding the waters of the North Anna River. That license also required a minimum instantaneous water release of 40 cubic feet per second (cfs) from the lake at the Lake Anna dam. The same release rate was required in a February 11, 1972, 21b Certificate and an August 29, 1973, 401 Certificate both issued by the State Water Control Board. In 2000, the Virginia General Assembly amended the State Water Control Law to require the maintenance of the lake level to protect both upstream (lake) and downstream beneficial uses. With the issuance of the VPDES permit in 2001 that incorporated new release schedules developed as a result of the Lake Level Contingency Plan legislation, both the previous 21b and 401 certificate were revoked. The new release schedules have been maintained with each reissuance of the VPDES permit and are in the current VPDES permit.

VWP permit 10-2001, issued on April 9, 2012, incorporated the Lake Level Contingency Plan release schedule from the facility's VPDES permit based upon existing Units 1 and 2, along with necessary

modifications and additions to account for the water withdrawal associated with the proposed Unit 3. As a result of the issuance of the Part III VWP permit (10-2001), two active permits are in place with Lake Level Contingency Plan requirements. In accordance with Part I.A.1 of the VWP permit (10-2001), "The VPDES permit shall govern releases from the Lake Anna Dam until such time as the permittee has notified DEQ of its intent to implement a permanent increase of three inches in the normal target pool elevation of Lake Anna to support Unit 3 and implements the increase, as provided in Part I.I.1". As of the date of this letter, Dominion has not notified DEQ of its intent to implement a permanent increase of three inches. Therefore, the Lake Level Contingency Plan requirements found within the 2014 VPDES reissuance continue to govern flow releases from the Lake Anna Dam.

Pursuant to § 62.1-44.15:20 D. of the Code of Virginia, "[i]ssuance of a Virginia Water Protection Permit shall constitute the certification required under § 401 of the Clean Water Act" except for certain natural gas transmission pipeline projects. Therefore, the VWP permit issued to North Anna Power Station, VWP permit 10-2001, which includes the incorporated Lake Level Contingency Plan release schedule from the facility's VPDES permit based upon existing Units 1 and 2, along with necessary modifications and additions to account for the water withdrawal associated with the proposed Unit 3, is the commonwealth's § 401 Certification for the North Anna Power Station. If you have any questions please contact me at 804-698-4099 or Scott Kudlas at 804-698-4456.

Sincerely,

Jutta Schneider

Jutta Schneider, Director
Water Planning Division

Cc: Jeffery Steers, DEQ
Melanie Davenport, DEQ
Tom Faha, DEQ
Scott Kudlas, DEQ
DWR

Enclosure 5

AIR TOPICAL AREA DOCUMENTS

Attachment 1 - Letter from C. Forbes to D. Heacock, dated July 1, 2002, re: Permit to Operate Auxiliary Boilers and Emergency Generators

Attachment 2 - Letter from J. Wilkinson to J. Jenkins, dated June 13, 2019, re: Amendment to State Operating Permit

Enclosure 5
Attachment 1

LETTER FROM C. FORBES TO D. HEACOCK, DATED JULY 1, 2002,
RE: PERMIT TO OPERATE AUXILIARY BOILERS
AND EMERGENCY GENERATORS

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

C Taylor
cc: D. Heacock
R. Wood

FSO-278-02

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

806 Westwood Office Park
Fredericksburg, Virginia 22401
(540) 899-4600 Fax (540) 899-4647
www.deq.state.va.us

Robert G. Burnley
Director

Gregory L. Clayton
Regional Director

July 1, 2002

Mr. D. A. Heacock
Site Vice President
North Anna Nuclear Power Station
Virginia Electric and Power Company
5000 Dominion Boulevard
Glen Allen, Virginia 23060

Dear Mr. Heacock:

Attached is a permit to operate two auxiliary boilers and five emergency generators in accordance with the provisions of the Commonwealth of Virginia State Air Pollution Control Board's (Board's) Regulations for the Control and Abatement of Air Pollution. The attached permit supersedes your permits dated May 18, 1983, June 18, 1998, and October 20, 1993, as amended August 1, 1994, and November 30, 1998.

This permit contains legally enforceable conditions. Failure to comply may result in a Notice of Violation and civil penalty. Please read all permit conditions carefully.

In the course of evaluating the application to operate two auxiliary boilers and five emergency generators and arriving at a final decision to approve the project, the Department of Environmental Quality (DEQ) deemed the application complete on April 16, 2002. Written public comments were solicited by placing a newspaper advertisement in the *The Central Virginian* on May 23, 2002. The required comment period, provided by 9 VAC 5-80-1020 A expired on June 24, 2002.

This approval to operate two auxiliary boilers and five emergency generators shall not relieve Virginia Electric and Power Company of the responsibility to comply with all other local, state, and federal permit requirements.

The Board's Regulations as contained in Title 9 of the Virginia Administrative Code 5-170-200 provides that you may request a formal hearing from this case decision by filing a petition with the Board within thirty days after this case decision notice was mailed or delivered to you. 9 VAC 5-170-180 provides that you may request direct consideration of the decision by

the Board if the Director of the DEQ made the decision. Please consult the relevant regulations for additional requirements for such requests.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have thirty days from the date of service of this decision (the date you actually received this decision or the date on which it was mailed to you, whichever occurred first), within which to initiate an appeal of this decision by filing a Notice of Appeal with:

Robert G. Burnley, Director
Department of Environmental Quality
P. O. Box 10009
Richmond, VA 23240-0009

In the event that this decision is served on you by mail, three days are added to the period in which to file an appeal. Please refer to Part Two A of the Rules of the Supreme Court of Virginia for information on the required content of the Notice of Appeal and for additional requirements governing appeals from decisions of administrative agencies.

If you have any questions concerning this permit or any other air pollution issue please feel free to contact the regional office at (703) 583-3847 or Mr. Dahlgren Vaughan at (540) 899-4508.

Sincerely,

Charles D. Forbes
Regional Permit Manager

CDF/THD/ADV/02103SOP

Attachments: State Operating Permit

Cc: Director, OAPP (electronic file submission)
Manager, Data Analysis (electronic file submission)
Chief, Air Enforcement Branch (3AP12). U. S. EPA, Region III

FSO-103-02

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

806 Westwood Office Park
Fredericksburg, Virginia 22401
(540) 899-4600 Fax (540) 899-4647
www.deq.state.va.us

Robert G. Burnley
Director

Gregory L. Clayton
Regional Director

STATIONARY SOURCE PERMIT TO OPERATE

This permit supersedes your permits dated May 18, 1983; June 18, 1998; and October 20, 1993, as amended August 1, 1994, and November 30, 1998.

In compliance with the Federal Clean Air Act and the Commonwealth of Virginia Regulations for the Control and Abatement of Air Pollution,

Virginia Electric and Power Company
North Anna Power Station
5000 Dominion Boulevard
Glen Allen, Virginia 23060
Registration No.: 40726
AIRS ID No.: 51-109-0025

is authorized to operate a

Nuclear Powered Electric Generation Station

located at

North end of Route 400, Louisa County, Virginia

in accordance with the Conditions of this permit.

Approved on 7/1/02

Robert G. Burnley
Director, Department of Environmental Quality

Permit consists of 8 pages.
Permit Conditions 1 to 24.

PERMIT CONDITIONS - the regulatory reference or authority for each condition is listed in parentheses ( ) after each condition.

APPLICATION

1. Except as specified in this permit, the permitted facility is to be operated as represented in the permit application dated February 13, 2002, including amendment information dated March 7, 2002, and as represented in the permit application dated August 30, 1993, as amended May 2, 1994, and September 28, 1998. Any changes in the permit application specifications or any existing facilities which alter the impact of the facility on air quality may require a permit. Failure to obtain such a permit prior to construction may result in enforcement action.
   (9 VAC 5-80-830 and 9 VAC 5-80-10D)

PROCESS REQUIREMENTS

2. **Equipment List** - Equipment to be operated at this facility consists of:

   - Two Riley auxiliary boilers (Emission Units ES-1 and ES-2), rated at 90.7 million Btu/hour each;

   - One Caterpillar 3600 Series Blackout diesel engine/generator (Emission Unit ES-3) rated at 36.6 million Btu/hour;

   - Four Fairbanks Morse, Inc. emergency diesel engines/generators (Emission Units ES-4 through ES-7), rated at 35.1 million BTU/hour each.

   Equipment List – Insignificant equipment to be operated at this facility consists of:

   - Security emergency generator (Emission Unit ES-8) rated at 235 HP;
   - Diesel generator for dam (Emission Unit ES-9) rated at 235 HP;
   - Fire pump emergency diesel generator (Emission Unit ES-10) rated at 360 HP;
   - Fire pump emergency diesel generator (Emission Unit ES-11) rated at 360 HP;
   - Spent fuel storage emergency generator (Emission Unit ES-12) rated at 81 Kw or 136 Hp.

3. **Monitoring Devices** - The boilers and generator engines shall be equipped as follows:

   - Two Riley auxiliary boilers (Emission Units ES-1 and ES-2), shall be equipped to measure the total hours of engine operation on a monthly basis.

   - One Caterpillar 3600 Series Blackout diesel engine/generator (Emission Unit ES-3) shall be equipped to measure the total hours of engine operation on a monthly basis.

- Four Fairbanks Morse, Inc. emergency diesel engines/generators (Emission Units ES-4 through ES-7) shall be equipped to measure the total hours of engine operation on a monthly basis.

Each monitoring device shall be installed, maintained, calibrated and operated in accordance with approved procedures which shall include, as a minimum, the manufacturer's written requirements or recommendations. Each monitoring device shall be provided with adequate access for inspection and shall be operational when the boiler or engine is operating.
(9 VAC 5-80-850)

4. **Monitoring Device Observation** - The devices used to determine 1) the boiler (Emission Units ES-1 and ES-2) hours of operation, 2) the blackout diesel engine/generator (Emission Unit ES-3) hours of operation, and 3) the four emergency diesel engines/generators (Emission Unit ES-4 through ES-7) hours of operation shall be observed and the measurement shall be recorded by the permittee at the conclusion of each month. The recorded data shall be maintained on site for a minimum of five years.
(9 VAC 5-80-850)

OPERATING/EMISSION LIMITATIONS

5. **Operating Hours** - The two auxiliary boilers (Emission Units ES-1 and ES-2), combined, shall not operate more than 500 hours per year, calculated monthly as the sum of each consecutive 12 month period.
(9 VAC 5-80-850)

6. **Operating Hours** - The blackout diesel engine/generator (Emission Units ES-3) shall not operate more than 500 hours per year, calculated monthly as the sum of each consecutive 12 month period.
(9 VAC 5-80-10 H)

7. **Operating Hours** - The four emergency diesel engines/generators (Emission Units ES-4 through ES-7), combined, shall not operate more than 1000 hours per year, calculated monthly as the sum of each consecutive 12 month period.
(9 VAC 5-80-850)

8. **Fuel** - The approved fuel for the two auxiliary boilers (Emission Units ES-1 and ES-2) and the four emergency diesel engines/generators (Emission Units ES-4 through ES-7) is Number 2 distillate oil, also known as diesel fuel oil. The approved fuel for the blackout diesel engine/generator (Emission Unit ES-3) is Number 2 distillate oil, also known as diesel fuel oil. A change in the fuel may require a permit to modify and operate.
(9 VAC 5-80-850 and 9 VAC 5-80-10)

9. **Fuel** - The distillate oil shall meet the specifications of ASTM D396 for numbers 1 or 2 fuel oil. The maximum sulfur content of the distillate oil fuel burned by the auxiliary boilers (Emission Units ES-1 and ES-2) and the four emergency diesel engines/generators (Emission Units ES-4 through ES-7) shall be no more than 0.2 percent per shipment. The maximum

sulfur content of the distillate oil fuel burned by the blackout diesel engine/generator (Emission Unit ES-3) shall be no more than 0.5 percent per shipment.
(9 VAC 5-80-850 and 9 VAC 5-80-10)

10. **Fuel Certification** - The permittee shall obtain a certification from the fuel supplier with each shipment of distillate oil. Each fuel supplier certification shall include the following:

    a. The name of the fuel supplier;

    b. The date on which the distillate oil was received;

    c. A statement that the distillate oil complies with the American Society for Testing and Materials specifications for numbers 1 or 2 fuel oil;

    d. The volume of oil delivered in the shipment; and

    e. The sulfur content of the distillate oil.

    (9 VAC 5-80-850 and 9 VAC 5-50-260)

11. **Emission Limits** - Emissions from the operation of two auxiliary boilers (Emission Units ES-1 and ES-2) shall not exceed the limits specified below:

	Per Boiler	Two Boiler Total
Sulfur Dioxide	18.4 lbs/hr/boiler 0.203 lbs/MMBtu/boiler	4.6 tons/yr
Nitrogen Oxides (as NO_2)	13.0 lbs/hr/boiler 0.143 lbs/MMBtu/boiler	3.2 tons/yr

    Exceedance of the operating limits shall be considered credible evidence of the exceedance of emission limits.
    (9 VAC 5-80-850)

12. **Emission Limits** - Emissions from the operation of the blackout diesel engine/generator (Emission Unit ES-3) shall not exceed the limits specified below:

PM-10	1.8 lbs/hr	1.0 tons/yr
Sulfur Dioxide	18.5 lbs/hr	4.6 tons/yr
Nitrogen Oxides (as NO_2)	157.2 lbs/hr	39.3 tons/yr
Carbon Monoxide	29.9 lbs/hr	10.4 tons/yr

Volatile Organic Compounds (9 VAC 5-50-260)	6.7 lbs/hr	1.7 tons/yr

13. **Emission Limits** - Emissions from the operation of four emergency diesel engines/generators (Emission Units ES-4 through ES-7) shall not exceed the limits specified below:

	Per Engine	Four Engine Total
Nitrogen Oxides (as NO_2)	112.4 lbs/hr/engine 3.2 lbs/MMBtu/engine	56.2 tons/yr

Exceedance of the operating limits shall be considered credible evidence of the exceedance of emission limits.
(9 VAC 5-80-850)

14. **Visible Emission Limit** - Visible emissions from each boiler and each of four emergency engine/generators (Emission Units ES-1, ES-2, and ES-4 through ES-7) shall not exceed 20 percent opacity except during one six-minute period in any one hour in which visible emissions shall not exceed 30 percent opacity as determined by the EPA Method 9 (reference 40 CFR 60, Appendix A). Visible emissions from the blackout emergency engine/generator (Emission Unit ES-3) shall not exceed 20 percent opacity except during one six-minute period in any one hour in which visible emissions shall not exceed 30 percent opacity as determined by the EPA Method 9 (reference 40 CFR 60, Appendix A). This condition applies at all times except during startup, shutdown, and malfunction.
(9 VAC 5-80-850 and 9 VAC 5-50-80)

RECORDS

15. **On Site Records** - The permittee shall maintain records of emission data and operating parameters as necessary to demonstrate compliance with this permit. The content and format of such records shall be arranged with the DEQ, Fredericksburg Office. These records shall include, but are not limited to:

    a. Total annual hours of operation of the two auxiliary boilers (Emission Units ES-1 and ES-2), calculated monthly as the sum of each consecutive 12 month period.

    b. Total annual hours of operation of the blackout diesel engine/generator (Emission Unit ES-3), calculated monthly as the sum of each consecutive 12 month period.

    c. Total annual hours of operation of the four emergency diesel engines/generators (Emission Units ES-4 through ES-7), calculated monthly as the sum of each consecutive 12 month period.

d. All fuel supplier certifications.

e. Scheduled and unscheduled maintenance.

f. Results of all stack tests, visible emission evaluations and performance evaluations.

These records shall be available for inspection by the DEQ and shall be current for the most recent five years.
(9 VAC 5-80-900)

16. **Testing/Monitoring Ports** - The permitted facility shall be constructed so as to allow for emissions testing upon reasonable notice at any time, using appropriate methods. Test ports shall be provided when requested in accordance with the applicable performance specification (reference 40 CFR Part 60, Appendix B).
(9 VAC 5-80-930)

GENERAL CONDITIONS

17. **Right of Entry** - The permittee shall allow authorized local, state, and federal representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises on which the facility is located or in which any records are required to be kept under the terms and conditions of this permit;

b. To have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit or the State Air Pollution Control Board's Regulations;

c. To inspect at reasonable times any facility, equipment, or process subject to the terms and conditions of this permit or the State Air Pollution Control Board's Regulations; and

d. To sample or test at reasonable times.

For purposes of this condition, the time for inspection shall be deemed reasonable during regular business hours or whenever the facility is in operation. Nothing contained herein shall make an inspection time unreasonable during an emergency.
(9 VAC 5-170-130)

18. **Notification for Facility or Control Equipment Malfunction** - The permittee shall furnish notification to the DEQ, Fredericksburg Office of malfunctions of the affected facility or related air pollution control equipment that may cause excess emissions for more than one hour, by facsimile transmission, telephone or telegraph. Such notification shall be made as soon as practicable but not later than four daytime business hours of the malfunction. The permittee shall provide a written statement giving all pertinent facts, including the estimated duration of the breakdown, within 14 days of the occurrence. When the condition causing

the failure or malfunction has been corrected and the equipment is again in operation, the permittee shall notify the DEQ, Fredericksburg Office in writing.
(9 VAC 5-20-180 C)

19. **Violation of Ambient Air Quality Standard** - The permittee shall, upon request of the DEQ, reduce the level of operation or shut down a facility, as necessary to avoid violating any primary ambient air quality standard and shall not return to normal operation until such time as the ambient air quality standard will not be violated.
(9 VAC 5-20-180 I)

20. **Maintenance/Operating Procedures** - The permittee shall take the following measures in order to minimize the duration and frequency of excess emissions:

    a. Develop a maintenance schedule and maintain records of all scheduled and non-scheduled maintenance.

    b. Maintain an inventory of spare parts.

    c. Have available written operating procedures for equipment. These procedures shall be based on the manufacturer's recommendations, at a minimum.

    d. Train operators in the proper operation of all such equipment and familiarize the operators with the written operating procedures. The permittee shall maintain records of the training provided including the names of trainees, the date of training and the nature of the training.

    Records of maintenance and training shall be maintained on site for a period of five years and shall be made available to DEQ personnel upon request.
    (9 VAC 5-50-20 E)

21. **Permit Suspension/Revocation** - This permit may be suspended or revoked if the permittee:

    a. Knowingly makes material misstatements in the application for this permit or any amendments to it;

    b. Fails to comply with the terms or conditions of this permit;

    c. Fails to comply with any emission standards applicable to the equipment listed in Condition 2;

    d. Causes emissions from this facility which result in violations of, or interferes with the attainment and maintenance of, any ambient air quality standard;

    e. Fails to operate this facility in conformance with any applicable control strategy, including any emission standards or emission limitations, in the State Implementation Plan in effect on the date that the application for this permit is submitted;

f. Fails to comply with the applicable provisions of 9 VAC 5-80-10, and Article 8 and Article 9 of 9 VAC 5 Chapter 80.

(9 VAC 5-80-1010 and 9 VAC 5-80-10 K)

22. **Change of Ownership** - In the case of a transfer of ownership of a stationary source, the new owner shall abide by any current permit issued to the previous owner. The new owner shall notify the DEQ, Fredericksburg Office of the change of ownership within 30 days of the transfer.
(9 VAC 5-80-940 and 9 VAC 5-80-10 O)

23. **Registration/Update** – Annually the permittee will be required to provide information to the DEQ or the Board, which will be used to maintain the currency of the stationary source emission database. The information requested may include, but is not limited to process and production data; changes in control equipment; and operating schedules. Such requests for information from the DEQ will either be in writing or by personal contact. The availability of information submitted to the DEQ or the Board will be governed by applicable provisions of the Freedom of Information Act, §§ 2.1-340 through 2.1-348 of the Code of Virginia, § 10.1-1314 (addressing information provided to the Board) of the Code of Virginia, and 9 VAC 5-170-60 of the State Air Pollution Control Board Regulations. Information provided to federal officials is subject to appropriate federal law and regulations governing confidentiality of such information.
(9 VAC 5-80-900 and 9 VAC 5-170-160)

24. **Permit Copy** - The permittee shall keep a copy of this permit on the premises of the facility to which it applies.
(9 VAC 5-80-860 D and 9 VAC 5-170-160)

Enclosure 5
Attachment 2

LETTER FROM J. WILKINSON TO J. JENKINS, DATED JUNE 13, 2019, RE: AMENDMENT TO STATE OPERATING PERMIT

Virginia Electric and Power Company
(Dominion Energy Virginia)
North Anna Power Station Units 1 and 2

COMMONWEALTH of VIRGINIA

Matthew J. Strickler
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
NORTHERN REGIONAL OFFICE
13901 Crown Court, Woodbridge, Virginia 22193-1453
(703) 583-3800
www.deq.virginia.gov

David K. Paylor
Director

Thomas A. Faha
Regional Director

June 13, 2019

Mr. James Jenkins
Director, Nuclear Safety and Licensing
Virginia Electric and Power Company
5000 Dominion Blvd.
Glen Allen, VA 23060

Location: Louisa County
Registration No.: 40726

Dear Mr. Jenkins:

Attached is a minor amendment to your State Operating Permit dated July 1, 2002, to operate diesel fuel burning equipment at Dominion's North Anna Power Station (Louisa County), in accordance with the provisions of the Virginia State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution. The purpose of this permit amendment is to remove the two (2) auxiliary boilers (Ref. No. ES-1 and ES-2) from the state operating permit as Dominion requested in the permit application dated March 21, 2014, and to limit the hours of operation from the facility's Station Blackout Generator (ES-3) as Dominion requested in the permit application dated February 4, 2019.

Effective the date of this permit, Dominion shall cease operations of the two (2) Riley auxiliary boilers. No future operations of such boilers at Dominion's North Anna Power Station shall occur until the owner has obtained a permit pursuant to 9 VAC 5 Chapter 80. Any use of the boilers at this site subsequent to the date of this letter shall be considered equivalent to construction and operation of a new emissions unit and will subject Dominion to the requirement to obtain a permit pursuant to applicable provisions of 9 VAC 5 Chapter 80 in the Regulations. This amended permit document supersedes your permit document dated July 1, 2002.

The Department of Environmental Quality (DEQ) deemed the application complete on March 31, 2014 and March 12, 2019, and has determined that the applications meet the requirements of 9 VAC 5-80-980 A for a minor amendment to a state operating program permit.

This permit contains legally enforceable conditions. Failure to comply may result in a Notice of Violation and/or civil charges. Please read all permit conditions carefully.

This permit approval to modify and operate shall not relieve Virginia Electric and Power Company of the responsibility to comply with all other local, state, and federal permit regulations.

Please note that the diesel engine generator sets at the facility may be affected facilities under 40 CFR Part 63, National Emission Standards for Hazardous Air Pollutants for Source Categories (MACT) Subpart ZZZZ (Stationary Reciprocating Internal Combustion Engines). As the owner/operator of the potentially affected units, DEQ advises you to review the MACT to ensure compliance with applicable emission standards, operational limitations, and the monitoring, notification, reporting and recordkeeping requirements. Applicable notifications shall be sent to EPA, Region III. The MACT may be found at **www.ecfr.gov**.

The Board's Regulations as contained in Title 9 of the Virginia Administrative Code 5-170-200 provide that you may request a formal hearing from this case decision by filing a petition with the Board within 30 days after this case decision notice was mailed or delivered to you. Please consult the relevant regulations for additional requirements for such requests.

As provided by Rule 2A:2 of the Supreme Court of Virginia, you have 30 days from the date you actually received this permit or the date on which it was mailed to you, whichever occurred first, within which to initiate an appeal of this decision by filing a Notice of Appeal with:

David K. Paylor, Director
Department of Environmental Quality
P.O. Box 1105
Richmond, VA 23218

If this permit was delivered to you by mail, three days are added to the thirty-day period in which to file an appeal. Please refer to Part Two A of the Rules of the Supreme Court of Virginia for information on the required content of the Notice of Appeal and for additional requirements governing appeals from decisions of administrative agencies.

If you have any questions concerning this permit, please contact Mr. K. Dean Gossett at (703) 583-3926.

Sincerely,

Justin A. Wilkinson
Regional Air Permit Manager

TAF/JAW/KDG/2019-juneSOP

Attachment: Permit

cc: DEQ NRO Regional Air Compliance Manager (pdf copy via email)

COMMONWEALTH of VIRGINIA

Matthew J. Strickler
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
NORTHERN REGIONAL OFFICE
13901 Crown Court, Woodbridge, Virginia 22193-1453
(703) 583-3800
www.deq.virginia.gov

David K. Paylor
Director

Thomas A. Faha
Regional Director

STATIONARY SOURCE PERMIT TO OPERATE

This permit document supersedes your permit dated July 1, 2002.

In compliance with the Federal Clean Air Act and the Commonwealth of Virginia Regulations for the Control and Abatement of Air Pollution,

Virginia Electric and Power Company
5000 Dominion Blvd
Glen Allen, VA 23060
Registration No.: 40726
AFS ID No.: 51-109-00025

Is authorized to operate

diesel fuel burning equipment

located at

Dominion's North Anna Power Station
End of State Route 700
Louisa, Virginia
(Louisa County)

In accordance with the Conditions of this permit.

Approved on July 1, 2002
Amended on June 13, 2019

Thomas A. Faha
Regional Director

Permit consists of 8 pages.
Permit Conditions 1 to 20.

INTRODUCTION

This permit approval is based on and combines permit terms and conditions in accordance with 9VAC5-80-820 B and 9VAC5-80-1255 from the following permit approvals and the respective permit applications:

Permit Program: Approval/Amendment Date	Application Signature Date	Application Supplemental Information Date
Minor New Source Review (mNSR) Permit: May 18, 1983	February 28, 1983	
mNSR Permit: October 20, 1993	August 30, 1993	
Amended mNSR Permit: August 1, 1994	May 2, 1994	
Exclusionary General Permit (EGP): June 18, 1998	April 30, 1998	
Amended mNSR: November 30, 1998	September 28, 1998	
State Operating Permit (SOP): July 1, 2002	April 8, 2002	
SOP Minor Amendment: June 13, 2019	March 13, 2014 February 4, 2019	March 12, 2019

Any changes in the permit application specifications or any existing facilities which alter the impact of the facility on air quality may require a permit. Failure to obtain such a permit prior to construction may result in enforcement action. In addition, this facility may be subject to additional applicable requirements not listed in this permit.

Words or terms used in this permit shall have meanings as provided in 9VAC5-10-20 of the State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution. The regulatory reference or authority for each condition and the most recent effective date (if different from the date of this combined permit) for a term or condition is listed in parentheses () after each condition.

Annual requirements to fulfill legal obligations to maintain current stationary source emissions data will necessitate a prompt response by the permittee to requests by the DEQ or the Board for information to include, as appropriate: process and production data; changes in control equipment; and operating schedules. Such requests for information from the DEQ will either be in writing or by personal contact.

The availability of information submitted to the DEQ or the Board will be governed by applicable provisions of the Freedom of Information Act, §§ 2.2-3700 through 2.2-3714 of the Code of Virginia, § 10.1-1314 (addressing information provided to the Board) of the Code of Virginia, and 9VAC5-170-60 of the State Air Pollution Control Board Regulations. Information provided to federal officials is subject to appropriate federal law and regulations governing confidentiality of such information.

Equipment at this facility subject to SOP conditions consists of the following:			
Reference No.	**Equipment Description**	**Rated Capacity**	**Delegated Federal Requirements**
ES-3	One (1) diesel fuel fired Caterpillar model 3600 Series Blackout emergency generator set	3,400 kW 4,640 bhp	-
ES-4 Through ES-7	Four (4) diesel fuel fired Fairbanks Morse, Inc. emergency generator sets	3,000 kW 3,600 bhp (each unit)	-

Unpermitted Equipment at this facility consists of the following:			
Reference No.	**Equipment Description**	**Rated Capacity**	**Delegated Federal Requirements**
ES-8	One (1) Security emergency generator set	235 bhp	-
ES-9	One (1) diesel fuel fired emergency generator set for dam	235 bhp	-
ES-10	One (1) diesel fuel fired emergency fire pump generator set	360 bhp	-
ES-11	One (1) diesel fuel fired emergency fire pump generator set	360 bhp	-
ES-12	One (1) spent fuel storage emergency generator set	81 kW 136 bhp	-

Specifications included in the above tables are for informational purposes only and do not form Enforceable terms or conditions of the permit.

PROCESS REQUIREMENTS

1. **Monitoring Devices** – The emergency generator sets shall be equipped as follows:

   - One (1) diesel fuel fired Caterpillar 3600 Series Blackout generator set (Emission Unit ES-3) shall be equipped to measure the total hours of engine operation on a monthly basis.

   - Four (4) diesel fuel fired Fairbanks Morse, Inc. generator sets (Emission Units ES-4 through ES-7) shall be equipped to measure the total hours of engine operation on a monthly basis.

   Each monitoring device shall be installed, maintained, calibrated and operated in accordance with approved procedures which shall include, as a minimum, the manufacturer's written requirements or recommendations. Each monitoring device shall be

provided with adequate access for inspection and shall be operational when the engine is operating.
(9 VAC 5-80-850)

2. **Monitoring Device Observation** – The devices used to determine the Blackout diesel generator set (Emission Unit ES-3) hours of operation and the four Fairbanks Morse, Inc. generator sets (Emission Unit ES-4 through ES-7) hours of operation shall be observed and the measurement shall be recorded by the permittee at the conclusion of each month. The recorded data shall be maintained on site for a minimum of five years.
(9 VAC 5-80-850)

OPERATING/EMISSION LIMITATIONS

3. **Operating Hours** – The Blackout diesel generator set (Emission Unit ES-3) shall not operate more than 350 hours per year, calculated monthly as the sum of each consecutive 12 month period.
(9 VAC 5-80-850)

4. **Operating Hours** – The four diesel generator sets (Emission Units ES-4 through ES-7), combined, shall not operate more than a combined 1000 hours per year, calculated monthly as the sum of each consecutive 12 month period.
(9 VAC 5-80-850)

5. **Fuel** – The approved fuel for the Blackout diesel generator (Emission Unit ES-3) and the four diesel generator sets (Emission Units ES-4 through ES-7) is Number 2 distillate oil, also known as diesel fuel oil. A change in the fuel may require a permit to modify and operate.
(9 VAC 5-80-850)

6. **Fuel** – The distillate oil shall meet the specifications of ASTM D396 for numbers 1 or 2 fuel oil. The maximum sulfur content of the distillate oil fuel burned by the four emergency diesel engines/generators (Emission Units ES-4 through ES-7) shall be no more than 0.2 percent per shipment. The maximum sulfur content of the distillate oil fuel burned by the blackout diesel engine/generator (Emission Unit ES-3) shall be no more than 0.5 percent per shipment.
(9 VAC 5-80-850)

7. **Fuel Certification** – The permittee shall obtain a certification from the fuel supplier with each shipment of distillate oil. Each fuel supplier certification shall include the following:

   a. The name of the fuel supplier;

   b. The date on which the distillate oil was received;

   c. A statement that the distillate oil complies with the American Society for Testing and Materials specifications for numbers 1 or 2 fuel oil;

   d. The volume of oil delivered in the shipment; and

e. The sulfur content of the distillate oil.

(9 VAC 5-80-850 and 9 VAC 5-50-260)

8. **Emission Limits** – Emissions from the operation of the Blackout diesel generator set (Emission Unit ES-3) shall not exceed the limits specified below:

PM_{10}	1.8 lbs/hr	0.32 tons/yr
Sulfur Dioxide	18.5 lbs/hr	3.24 tons/yr
Nitrogen Oxides (as NO_2)	157.2 lbs/hr	27.51 tons/yr
Carbon Monoxide	29.9 lbs/hr	5.23 tons/yr
Volatile Organic Compounds	6.7 lbs/hr	1.17 tons/yr

(9 VAC 5-80-850 and 9 VAC 5-50-260)

9. **Emission Limits** – Emissions from the operation of the four emergency diesel engines/generators (Emission Units ES-4 through ES-7) shall not exceed the limits specified below:

	Per Engine	Four Engines (Total)
Nitrogen Oxides (as NO2)	112.4 lbs/hr 3.2 lbs/MMBtu	56.2 tons/yr

(9 VAC 5-80-850)

10. **Visible Emission Limit** – Visible emissions from the Blackout diesel generator set (Emission Unit ES-3) and each of the four emergency diesel generator sets (Emission Units ES-4 through ES-7) shall not exceed 20 percent opacity during one 6-minute period in any one hour in which visible emissions shall not exceed 30 percent opacity as determined by EPA Method 9 (reference 40 CFR 60, Appendix A). This condition applies at all times except during startup, shutdown and malfunction.
(9 VAC 5-80-850 and 9 VAC 5-50-80)

RECORDS

11. **On Site Records** – The permittee shall maintain records of emission data and operating parameters as necessary to demonstrate compliance with this permit. The content and format of such records shall be arranged with DEQ's Northern Regional Office.

These records shall include, but are not limited to:

a. Total annual hours of operation of the Blackout diesel engine/generator (Emission Unit ES-3), calculated monthly as the sum of each consecutive 12 month period.

b. Total annual hours of operation of the four emergency diesel engines/generators (Emission Units ES-4 through ES-7), calculated monthly as the sum of each consecutive

12 month period.

c. All fuel supplier certifications.

d. Scheduled and unscheduled maintenance.

e. Results of all stack tests, visible emission evaluations and performance evaluations.

These records shall be available for inspection by the DEQ and shall be current for the most recent five years.
(9 VAC 5-80-900)

GENERAL CONDITIONS

12. **Testing/Monitoring Ports** – The permitted facility shall be constructed so as to allow for emissions testing upon reasonable notice at any time, using appropriate methods. Test ports shall be provided when requested in accordance with the applicable performance specification (reference 40 CFR Part 60, Appendix B).
(9 VAC 5-80-930)

13. **Right of Entry** – The permittee shall allow authorized local, state, and federal representatives, upon the presentation of credentials:

    a. To enter upon the permittee's premises on which the facility is located or in which any records are required to be kept under the terms and conditions of this permit;

    b. To have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit or the State Air Pollution Control Board Regulations;

    c. To inspect at reasonable times any facility, equipment, or process subject to the terms and conditions of this permit or the State Air Pollution Control Board Regulations; and

    d. To sample or test at reasonable times.

    For purposes of this condition, the time for inspection shall be deemed reasonable during regular business hours or whenever the facility is in operation. Nothing contained herein shall make an inspection time unreasonable during an emergency.
    (9 VAC 5-170-130)

14. **Notification for Facility or Control Equipment Malfunction** – The permittee shall furnish notification to DEQ's Northern Regional Office of malfunctions of the affected facility or related air pollution control equipment that may cause excess emissions for more than one hour, by facsimile transmission, telephone or telegraph. Such notification shall be made as soon as practicable but no later than four daytime business hours after the malfunction is discovered. The permittee shall provide a written statement giving all pertinent facts, including the estimated duration of the breakdown, within two weeks of discovery of the malfunction. When the condition causing the failure or malfunction has been corrected and

the equipment is again in operation, the permittee shall notify the DEQ's Northern Regional Office.
(9 VAC 5-20-180 C)

15. **Violation of Ambient Air Quality Standard** – The permittee shall, upon request of the DEQ, reduce the level of operation or shut down a facility, as necessary to avoid violating any primary ambient air quality standard and shall not return to normal operation until such time as the ambient air quality standard will not be violated.
(9 VAC 5-20-180 I)

16. **Maintenance/Operating Procedures** – The permittee shall take the following measures in order to minimize the duration and frequency of excess emissions:

    a. Develop a maintenance schedule and maintain records of all scheduled and non-scheduled maintenance.

    b. Maintain an inventory of spare parts.

    c. Have available written operating procedures for equipment. These procedures shall be based on the manufacturer's recommendations, at a minimum.

    d. Train operators in the proper operation of all such equipment and familiarize the operators with the written operating procedures, prior to their first operation of such equipment. The permittee shall maintain records of the training provided including the names of trainees, the date of training and the nature of the training.

    Records of maintenance and training shall be maintained on site for a period of five years and shall be made available to DEQ personnel upon request.
    (9 VAC 5-50-20 E)

17. **Permit Suspension/Revocation** – This permit may be suspended or revoked if the permittee:

    a. Knowingly makes material misstatements in the permit application or any amendments to it;

    b. Fails to comply with the conditions of this permit;

    c. Fails to comply with any emission standards applicable to a permitted emissions unit;

    d. Causes emissions from the stationary source which result in violations of, or interfere with the attainment and maintenance of, any ambient air quality standard; or

    e. Fails to operate in conformance with any applicable control strategy, including any emission standards or emissions limitations, in the State Implementation Plan in effect at the time an application for this permit is submitted.

    (9 VAC 5-80-1210 G)

18. **Change of Ownership** – In the case of a transfer of ownership of a stationary source, the new owner shall abide by any current permit issued to the previous owner. The new owner shall notify DEQ's Northern Regional Office of the change of ownership within 30 days of the transfer.
(9 VAC 5-80-940 and 9 VAC 5-80-1240)

19. **Registration/Update** – Annually, the permittee will be required to provide information to the DEQ or the Board, which will be used to maintain the currency of the stationary source emission database. The information requested may include, but is not limited to process and production data; changes in control equipment; and operating schedules. Such requests for information from the DEQ will either be in writing or by personal contact. The availability of information submitted to the DEQ or the Board will be governed by applicable provisions of the Freedom of Information Act, §§ 2.1-340 through 2.1-348 of the Code of Virginia, §10.1-1314 (addressing information provided to the Board) of the Code of Virginia, and 9 VAC 5-170-60 of the State Air Pollution Control Board Regulations. Information provided to federal officials is subject to appropriate federal law and regulations governing confidentiality of such information.
(9 VAC 5-80-900 and 9 VAC 5-170-160)

20. **Permit Copy** – The permittee shall keep a copy of this permit on the premises of the facility to which it applies.
(9 VAC 5-80-860 D and 9 VAC 5-170-160)