NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT
BIOLOGICAL OPINION

Agency: U.S. Environmental Protection Agency

Activity Considered: National Pollutant Discharge Elimination System Permit for the Washington Aqueduct
F/NER/2008/03493

Conducted by: National Marine Fisheries Service
Northeast Region

Date Issued: Oct 10, 2008

Approved by: [signature]

This constitutes the National Marine Fisheries Service's (NMFS) biological opinion (Opinion) on the impacts of the Environmental Protection Agency's (EPA) issuance of a new National Pollutant Discharge Elimination System (NPDES) Permit for the Army Corps of Engineer's owned and operated Washington Aqueduct in the District of Columbia (DC) on threatened and endangered species in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). EPA is issuing the subject permit pursuant to permit requirements based on the Clean Water Act (33 USC § 1251 et seq.), hereinafter referred to as the CWA, and NPDES regulations (40 CFR Parts 122, 124, 125 and 133). Pursuant to an Act of Congress dated March 3, 1859 (11 Stat. 84), the Chief of Engineers, US Army Corps of Engineers, is responsible for the management and superintendence of the Washington Aqueduct. Ownership of the Aqueduct is under the administrative jurisdiction of the Department of the Army. The Aqueduct operates pursuant to the 1859 Congressional Order, a NPDES permit issued by EPA and a Federal Facilities Compliance Agreement (FFCA) entered into between the Army Corps of Engineers and the EPA.

This Opinion is based in part upon NMFS' independent evaluation of the following: information provided in the EPA's biological evaluation (BE), the Army Corps of Engineers (ACOE) report entitled Water Quality Studies in the Vicinity of the Washington Aqueduct (EA Engineering, Science, and Technology, Inc. 2001), previous Opinions issued by NMFS on the operations of the Aqueduct, and other sources of information. A complete administrative record of this consultation will be kept at the NMFS Northeast Regional Office. Formal consultation was initiated on June 6, 2008. Per a letter dated June 6, 2008 letter from EPA, the EPA is the lead Federal agency for purposes of the Section 7 consultation. A similar letter from the ACOE, also dated June 6, 2008, indicates it is their understanding that EPA will be the lead Federal agency for the purposes of the consultation.

BACKGROUND

Washington Aqueduct Facility

The Washington Aqueduct facility is owned and operated by the ACOE Baltimore District and has been supplying water since 1859. Currently, it provides water to three wholesale customers (the Customers) located in Virginia and the District of Columbia. The Customers provide potable water for approximately one million citizens. The facility produces an average of 180 million gallons of water per day at two treatment plants located in DC (the Dalecarlia and McMillan Water Treatment Plants).

Raw river water is obtained for both plants from the Great Falls Raw Water Intake or the Little Falls Pumping Station on the Potomac River (See map in Appendix A). Raw river water then flows through a 12-mile pipeline to the Dalecarlia Reservoir. While the water is in the reservoir, much of the sand and silt settles to the bottom. Approximately 51 percent of the solids are removed at this point in the process. Water at the top of the basins flows to large gravity filters, where the water flows down through filter media consisting of layers of small pieces of hard coal (anthracite), sand, and gravel placed in the bottom of deep, concrete-walled boxes. Filtered water passes through to a collecting system underneath. Chlorine is added to kill pathogenic microscopic life such as bacteria or viruses. Ammonia is then added. The chlorine and ammonia combine to form chloramine compounds. Orthophosphate is added to control corrosion in pipes, service lines, and household plumbing throughout the distribution system. It works by building up a thin film of insoluble material in lead, copper, and iron pipes and fixtures. This thin film acts a barrier to prevent leaching of metals into the water. Calcium hydroxide (lime) is also added to adjust the pH of the water to ensure optimal performance of the orthophosphate. Powdered activated carbon is occasionally used for taste and odor control. From the Dalecarlia Reservoir, water flows to the Dalecarlia and Georgetown basins.

A coagulant, aluminum sulfate (alum), is added to the water as it flows to the sedimentation basins. Coagulants aid in the removal of suspended particles by causing them to consolidate and settle. The water flows into sedimentation basins where the flocculated particles settle to the bottom. After about four hours, approximately 85 percent of the suspended material settles. There are four sedimentation basins located at Dalecarlia and two at Georgetown.

As part of the normal operation of the Aqueduct the sediment accumulated in the basins is periodically discharged back to the River through several outfalls. First, at both Dalecarlia and Georgetown, the liquid portion of the basins is decanted in a process that takes anywhere from four hours for the smallest basin to 12 hours for the largest basin. This decanting is then followed by a release of the solid portion of the discharge which consists of sediment, aluminum sulfate and organic material that was present in the raw water. Flushing the basins with hosed water assists the release of solids. At Dalecarlia, finished water is used, which may contain chlorine. Historically, in a year with average rainfall, each Dalecarlia basin was emptied of treated sediments four times per year, sediments from Georgetown Basin 2 were removed twice per year and sediments from Basin 1 were removed three times per year. This results in a total of approximately 15-20 discharges a year (see Table 1 in Appendix B for a list of all cleanings from 2003 to present).

History of NPDES Permits and Section 7 Consultation

The Clean Water Act (CWA) requires that all facilities that discharge pollutants from a point source into the waters of the United States obtain a NPDES permit. In accordance with the provisions of the CWA, EPA is the permitting authority responsible for issuing NPDES permits in the District of Columbia.

A permit was issued to the ACOE for the Aqueduct discharges in 1989. No ESA consultation was conducted on the issuance of this permit as, at that time, there was no evidence of endangered or threatened species listed by NMFS in the action area. Since 1989, concerns about the effect of the Aqueduct's sediment discharges on water quality, fish and other aquatic life have been debated. In 1993, the ACOE funded a study to investigate the potential adverse effects associated with the sediment discharges on a variety of test organisms. In 1993, Dynamac Corporation prepared a final report for this study and concluded that there were no adverse effects to the test organisms from any aspect of the sediment discharges. The results of this study have been questioned, however, due to concerns over the study design and data analysis. For example, the number of sampling sites and replicates were limited, and eggs and juveniles, which are often the most sensitive life stages, were not subjected to the tests. The 1989 permit was set to expire in 1994 but was administratively extended.

In 1995, Aqueduct engineers investigated alternatives to river disposal of the sediment. In early 1995, EPA prepared a draft NPDES permit for public comment, which included a land-based disposal method and effluent limitations. The Customers, local residents, and the ACOE expressed significant concerns over the conditions of this permit. The ACOE and the Customers were concerned that the proposed permit would require the Aqueduct to construct and operate an expensive residual solids recovery facility that was beyond their ability to finance. They also believed that the need for the solids recovery facility had not been demonstrated based upon the water quality study performed by Dynamac. These concerns were brought to the attention of the U.S. Congress and EPA was requested to delay the issuance of the permit, pending resolution of the Customer's concerns.

In 1996, the US Fish and Wildlife Service (FWS) began an Atlantic Sturgeon Reward Program in Maryland waters. This program provided monetary rewards to fishermen who reported the incidental capture of Atlantic sturgeon in their fishing gear. Upon capture of an Atlantic sturgeon in their fishing gear, fishermen were directed to hold the fish until it could be examined by a fisheries biologist. On May 17, 1996, one shortnose sturgeon (*Acipenser brevirostrum*) was unexpectedly captured and positively identified in the Potomac River. This was the first report of a shortnose sturgeon in the Potomac since 1899.

In 1997, the ACOE, EPA, and the Customers agreed to undertake a three-year water quality study to determine the effects of the Aqueduct's discharges on habitat, water quality, and living resources, including shortnose sturgeon. The EPA determined that a new NPDES permit could not be issued until the study of the effects of the discharges was completed. Through an Interagency Agreement, EPA created and funded a panel of fisheries biologists from the FWS, NMFS, Maryland Department of Natural Resources (MD DNR), DC Fish and Wildlife, and the Interstate Commission on the Potomac River Basin. This panel was convened in 1998 to recommend short-term measures to minimize impacts to migratory fish from sediment discharges at the Washington Aqueduct. The result of this meeting was a report issued in March 1999 describing the potential impacts of the discharges and providing recommendations on measures to minimize those impacts. In this report, it was stated that due to the potential for discharges to affect shortnose sturgeon in the Potomac River, NMFS would be recommending that EPA initiate Section 7 consultation on the issuance of any new NPDES permit for the Aqueduct.

In spring 2001, EPA and NMFS entered into informal Section 7 consultation. At this time, a total of four shortnose sturgeon had been reported in the Potomac River via the FWS Reward Program and an additional 42 shortnose sturgeon had been reported elsewhere in the Chesapeake Bay and its tributaries.

In October 2001, EA Engineering, Science, and Technology, Inc. published a final report entitled *Water Quality Studies in the Vicinity of the Washington Aqueduct.* The EPA used this report to develop a BE to assess the impacts of the discharges on shortnose sturgeon. In the BE, EPA concluded that the issuance of the NPDES permit for the Washington Aqueduct was not likely to adversely affect shortnose sturgeon. This determination was based on EPA's assessment that the scientific studies performed to date had shown that the conditions of the draft permit were sufficient to protect aquatic species present in the action area and their habitat. It was also EPA's contention that the issuance of the draft permit was the first step in an overall plan to significantly reduce or eliminate Aqueduct discharges from the Potomac River.

The 2001 draft permit proposed to prohibit discharges annually from February 15 through June 15 (i.e., "the spring spawning season") in order to protect anadromous species. The ACOE indicated that, in the past, the spring was typically the time when discharges occurred most frequently due to the high river flows. As such, the ACOE indicated that conditions could necessitate discharges during the prohibited spring spawning season, which would involve invoking the bypass provision in the permit. Upon review of the BE, and based on the assumption that shortnose sturgeon were likely present and spawning in the vicinity of the Aqueduct outfalls during the spring, NMFS determined that this action may adversely affect shortnose sturgeon, particularly eggs and larvae. Therefore, in a conference call on May 29, 2002, NMFS recommended that EPA initiate formal consultation.

In a letter to NMFS dated June 13, 2002, EPA requested the initiation of formal consultation on the issuance of a NPDES permit for the Washington Aqueduct discharges. In a separate letter to NMFS, also dated June 13, 2002, EPA indicated that as there were multiple Federal agencies involved in the project, EPA would continue to be the lead Federal agency for the purposes of the consultation. On July 9, 2002, NMFS concurred with the need for formal consultation and informed EPA that the date of the June 13, 2002 letter would serve as the commencement of the formal consultation process. Formal consultation culminated in the issuance of an Opinion on November 5, 2002. The Opinion concluded that issuance of the March 2002 draft permit may adversely affect shortnose sturgeon eggs and larvae but was not likely to jeopardize the continued existence of shortnose sturgeon.

On December 18, 2002, EPA issued a revised draft permit for public comment. The revised draft permit included tighter controls on the discharge of the residual solids and incorporated some of the Reasonable and Prudent Measures (and Terms and Conditions) of the Incidental Take Statement that accompanied the November 5, 2002 Opinion. The revised draft permit included effluent limits for total suspended solids (TSS), total aluminum concentrations, and chlorine.

In a letter dated January 7, 2003, NMFS provided comments to EPA on the revised draft permit and revised BE and requested additional information. NMFS stated that this information was necessary in order to make a determination on whether to recommend that Section 7 consultation be reinitiated or that the existing Opinion be amended to reflect the changes in the permit

On February 24, 2003, EPA also supplied NMFS with a draft of a proposed Federal Facilities Compliance Agreement to be entered into between EPA and the ACOE (see below). Through these discussions, NMFS was able to gather and review the information necessary to make a determination of the most appropriate manner in which to proceed with consultation. This information included reports pertaining to the operations of the Washington Aqueduct, the revised NPDES permit, a fact sheet, BE, and draft FFCA. Formal consultation with EPA was reinitiated on May 21, 2003. In a letter dated June 12, 2003, EPA requested that NMFS consider additional modifications to the March 14 permit as part of the action under consultation. These changes included a modification of the definition of the spring spawning season to include the period from February 15 to June 30 each year. In addition the requirement for EPA to perform certain studies was removed from the permit.

Because EPA recognized that the Washington Aqueduct could not immediately comply with the effluent limitations in the permit, EPA and the ACOE entered into a Federal Facility Compliance Agreement (FFCA),to provide an enforceable compliance schedule for achieving the effluent limitations. The FFCA is an expression of EPA's enforcement discretion and provides a legally mandated plan for the Aqueduct to achieve and maintain compliance with the NPDES permit and thus the CWA. The FFCA was signed by both agencies on June 13, 2003.

The FFCA contains 63 paragraphs in 14 sections. Section V (paragraphs 19-29) outlines the compliance program. In summary, this section requires the following of the ACOE:

- To take any and all necessary steps within its power to achieve compliance with the numeric discharge limits set forth in the NPDES permit as soon as practicable, consistent with the permittee's obligations pursuant to NEPA (Paragraph 19).

- By June 3, 2005, the Corps must set forth a schedule that will achieve compliance with the numeric discharge limitations set forth in the NPDES permit at one or more of the sedimentation basins no later than March 1, 2008 and to achieve full compliance with the numeric discharge limitations at all basins no later than December 30, 2009 (Paragraph 22).
- Other than the numeric discharge limitations described in Parts I.A., B, C and D of the permit, immediately comply with all provisions of the issued permit (including the prohibitions on discharges during the spring spawning season) (Paragraph 25).
- Until the ACOE has achieved compliance with the numeric discharge limitation set forth in the permit, not discharge through Outfall 002 (discharge from Dalecarlia sedimentation basins numbered 1, 2, 3 and 4), unless the flow in the Potomac River is equal to or greater than 800 million gallons per day (MGD) as measured at the gauge station at Little Falls, and through Outfall 003 (discharge from Georgetown sedimentation basin number 1) and Outfall 004 (discharge from Georgetown sedimentation basin number 2), unless the flow in the Potomac River is equal to or greater than 1500 MGD as measured at the gauge station at Little Falls (Paragraph 25).
- Until the ACOE has achieved compliance with the numeric discharge limitations set forth in the permit, the ACOE will slow the flocculent/sediment discharge rate from Outfalls 003 and 004 to a minimum of 36 hours per basin. In addition, the permittee will increase the amount of untreated process water that it uses to flush and clean each of the Georgetown sedimentation basins to twice the amount used for each cleaning in calendar year 2001 (Paragraph 26).
- During an upset or bypass that occurs during the spring spawning season, the ACOE will use best efforts to slow the rate of discharge from Outfalls 003 and 004 to 72 hours per basin (Paragraph 26).

Consultation was concluded with the issuance of an Opinion on July 14, 2003. In the Opinion, NMFS concluded that the operation of the Aqueduct pursuant to the March 14, 2003 draft permit and FFCA was likely to adversely affect, but not likely to jeopardize, shortnose sturgeon. Accompanying the Opinion was an Incidental Take Statement which exempted the take of early life stages (i.e., eggs and larvae) of shortnose sturgeon present in the vicinity of the outfalls during a spring spawning season discharge. The Opinion also noted that a spring spawning season discharge was not likely to occur more than once every five years.

The permit that EPA issued in March 2003 was appealed by both the ACOE and the National Wilderness Institute, an environmental advocacy group. On November 17, 2003, EPA offered a modified permit for public comment that reflected a settlement of the issues with the ACOE related to the performance of certain scientific studies. The public comment period ended on December 16, 2003. EPA issued the modified permit in February of 2004.

As noted above, when the NPDES permit was issued in March of 2003, EPA and the Corps entered into a FFCA (Docket No. CWA-03-2003-0136DN). The June 12, 2003 FFCA set forth a schedule by which the Washington Aqueduct must achieve compliance with specific milestones, including the numeric discharge limitations set forth in the NPDES permit. Paragraph 22 of the FFCA required that one or more of the new sedimentation basins must be completed no later than March 1, 2008, and full compliance with the numeric discharge limitations at all basins must be achieved no later than December 30, 2009.

On May 3, 2007, the ACOE requested two modifications to paragraph 22 of the FFCA. These modifications related to the following: (1) an extension of the final December 30, 2009 deadline to November 30, 2010; and (2) elimination of the March 1, 2008 interim deadline for compliance with one or more of the sedimentation basins. EPA reports that there were several reasons why these modifications were requested including, a necessary but unanticipated extension of the public comment period under the National Environmental Policy Act (NEPA) concerning the identity of remedial alternatives; contracting issues; discovery of large boulders beneath the Aqueduct property through which the foundation of the new treatment building must be placed; and, increased cost of construction.

Following a 30-day public comment period and the receipt of a formal request by the Corps for modification of the FFCA; the modifications were approved by EPA by letter dated October 12, 2007. EPA and the Corps anticipate entering into technical amendments to the FFCA to incorporate into the FFCA the numeric discharge limitations set forth in this permit. EPA has indicated that they do not anticipate that issuance of the new NPDES permit will affect the schedule for compliance set forth in the FFCA as modified by the October 12, 2007 letter.

Washington Aqueduct Residuals Project
In order to comply with the FFCA and NPDES effluent limits, the ACOE is working to eliminate the discharge of sediments into the Potomac River. To achieve this, the ACOE is undertaking a residuals management project which will result in the elimination of the discharge of residuals to the river. The design for the residuals management facilities was completed in July of 2007. Construction advertising followed which was completed in November of 2007, followed by an issuance of notice to proceed. The Corps has evaluated construction proposals and awarded a contract on March 19, 2008. Construction began in May of 2008 and will be completed by November 30, 2010 in accordance with the terms of the modified FFCA. This project has been approved by the Washington Aqueduct Wholesale Customer Board and construction spending has been approved up to $96 million.

The construction of the proposed residuals processing facility will allow residuals to be collected and conveyed from the forebay portion of the Dalecarlia Reservoir and the sedimentation basins at both the Georgetown Reservoir and the Dalecarlia WTP to a central location to be thickened and dewatered prior to being loaded onto trucks that will haul the residuals to one or more remote disposal sites. The proposed residuals processing facility will be constructed on an existing cleared site immediately north of Little Falls Road; this site is referred to as the East Site for Thickening and Dewatering Residuals or the East Dalecarlia Processing Site.

The residuals project includes a number of essential design elements which will be implemented at the plant including the following:

1. Modifications to existing sedimentation basins at Dalecarlia to permit the installation of new continuous residuals collection equipment which is required to convey residuals to a central processing facility.

2. Construction of three new residuals pumping facilities (the Georgetown Residuals Pump Station, the Dalecarlia Residuals Pump Station and the Forebay Residuals Pump Station) which are required to pump the collected residuals to a central processing facility.

3. Expansion of an existing booster control station at the north end of the Dalecarlia Reservoir to provide power for new forebay residuals dredging and pumping facilities.

4. Installation of several new underground liquid residuals conveyance pipelines.

5. Construction of a new central residuals processing facility.

As explained above, the construction of the residuals processing facility must be complete and operational by November 30, 2010. At that time, discharges to the river that result from the cleaning of the sedimentation basins will no longer occur.

CONSULTATION HISTORY

In March 2008, EPA alerted NMFS that the current NPDES permit for the Aqueduct was set to expire and that EPA was planning on issuing a new NPDES permit for the facility. On April 18, 2008, EPA provided a final BE to NMFS as well as information on the basin discharges that had occurred since the 2004 permit was issued. On June 2, 2008, NMFS received letters from both EPA and the ACOE requesting Section 7 consultation and indicating that EPA would be the lead Federal agency for the purposes of consultation. The 2004 permit has been administratively extended until a new permit can be issued.

DESCRIPTION OF THE PROPOSED ACTION

The proposed action under consideration is the issuance of a new NPDES permit (DC0000019) which will authorize discharges from the Washington Aqueduct facility until such time as the residuals processing facility is on line or no later than November 30, 2010. The proposed permit authorizes discharges from seven outfalls numbered 002-004 and 006-009, as described below. In addition to the requirements outlined below, the proposed permit requires that pH of effluents must be between 6.0 and 8.5 standard units, prohibits the discharge of floating solids or visible foam and prohibits the discharge of chlorine in detectable amounts (defined as greater than

0.1mg/L). EPA is also requiring quarterly monitoring for perchlorate[1].

Outfall 002 is the primary outfall for process water and the alum treated sediments from the Dalecarlia Sedimentation Basins. In addition, Outfall 002 is the discharge point for the permitted leakage from the sedimentation basins and a spring located beneath the Dalecarlia basins. The leakage, which has an average flow of 19.3 million gallons per year, is captured in a pipe which discharges to Outfall 002. Outfall 002 discharges to the Potomac River at approximately rkm 187.3, just upstream of Chain Bridge. EPA indicated in the Draft Fact Sheet that each of the Dalecarlia Sedimentation Basins is discharged approximately four times per year (eight discharges per year for all the basins in an average year). The proposed permit requires that discharges from Outfall 002 are monitored for flow, Total Suspended Solids (TSS), aluminum, iron and copper. The proposed permit contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L), Aluminum (monthly average 4mg/L; maximum daily 8mg/L), Iron (average monthly 155mg/L and maximum daily 226mg/L) and Copper (monthly average 0.61mg/L; maximum daily 0.90mg/L). Additionally, the permit requires a minimum of 85% removal of incoming solids to the sedimentation basins.

Effluent not associated with a cleaning discharge, but comprised of leakage and/or discharge from the spring located underneath the Dalecarlia Sedimentation Basin must be monitored for flow, TSS, aluminum, iron, total chlorine, perchlorate and chloroform. Additionally, the permit prohibits the discharge of chlorine in detectable amounts (defined as greater than 0.1mg/L) and contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L) and aluminum (monthly average 4mg/L; maximum daily 8mg/L).

The Georgetown Sedimentation Basins have two outfalls identified as *Outfalls 003* and *004*. Both outfalls discharge to the Potomac River at approximately rkm 183.6 and 183, respectively. Outfall 003 is the principal outfall for the process water and alum treated sediments discharged from Georgetown sedimentation basin 2. According to the Draft Fact Sheet, the Georgetown Sedimentation Basin is generally discharged twice per year. Outfall 004 is the outfall for process water and alum treated sediments from Georgetown sedimentation basin 1. Since Georgetown sedimentation basins 1 and 2 are connected, when Georgetown Sedimentation Basin 2 is cleaned (and discharged through Outfall 003), a concurrent discharge may occur from Outfall 004. The proposed permit requires that discharges from Outfall 003 and 004 are monitored for flow, TSS, aluminum, iron and copper. The proposed permit contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L), Aluminum (monthly average 1mg/L; maximum daily 1mg/L), Iron (average monthly 1.9mg/L and maximum daily 3.8mg/L) and Copper (monthly average 0.017mg/L; maximum daily 0.025mg/L). Additionally, the permit requires a minimum of 85% removal of incoming solids to the sedimentation basins.

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1 According to EPA, during the late spring and summer of 2003, concentrations of perchlorate were found during the investigation and cleanup associated with the Spring Valley neighborhood. EPA has detected low levels of perchlorate (less than 8ppb) in effluent from the Aqueduct which is a combination of groundwater and leakage from the Dalecarlia sedimentation basin underdrain. EPA believes that the source of the perchlorate is the Spring Valley Superfund Site and that perchlorate is infiltrating the groundwater at that location.

Georgetown Conduit discharges through *Outfall 006* to Rock Creek. This discharge is treated water which is cleared from the Georgetown conduit every one to five years to enable the conduit to undergo inspection. The average annual flow is one million gallons per year. City Tunnel discharges through *Outfall 007* to Rock Creek. This discharge is treated water which is cleared from the City Tunnel approximately every five to ten years to enable the tunnel to undergo inspection. The average annual flow is 0.06 million gallons per year. The proposed permit requires that discharges from Outfall 006 and 007 are monitored for flow, TSS, aluminum, iron and chlorine. The proposed permit contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L), Aluminum (monthly average 4mg/L; maximum daily 8mg/L), and Iron (average monthly 4mg/L and maximum daily 8mg/L).

Second High Reservoir discharges dechlorinated finished water through *Outfall 008* to the District's stormwater system. Discharges associated with cleaning or inspection occurs approximately once every five to eight years. When the discharge occurs the average flow is 14 million gallons. The proposed permit requires that discharges from Outfall 008 are monitored for flow, TSS, aluminum, iron and chlorine. The proposed permit contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L), Aluminum (monthly average 4mg/L; maximum daily 8mg/L), and Iron (average monthly 4mg/L and maximum daily 8mg/L).

Third High Reservoir discharges dechlorinated finished water through *Outfall 009* to Mill Creek. Discharges associated with cleaning or inspection occur once every five to eight years. When this discharge occurs the average flow is 20 million gallons. The proposed permit requires that discharges from Outfall 009 are monitored for flow, TSS, aluminum, iron and chlorine. The proposed permit contains effluent limits for TSS (average monthly 30mg/L; maximum daily 60 mg/L), Aluminum (monthly average 4mg/L; maximum daily 8mg/L), and Iron (average monthly 4mg/L and maximum daily 8mg/L).

In addition to the outfall-specific conditions outlined above, the permit contains 13 General Conditions, several administrative sections outlining operation and maintenance of pollution controls including definitions of key terms, reporting requirements, nine best management practices and several special conditions summarized below. See Appendix C (Draft Permit dated April 2008) for a complete description of all conditions.

- A 1 and B1. The permittee is prohibited from discharging the contents of the sedimentation basins through Outfalls 002, 003 or 004, during the spring spawning season, which the permit defines as February 15 through June 30 each year. In the event that a discharge as a result of a bypass or upset occurs during this period of time, the permittee must follow certain procedures outlined in the permit.

- A 2. The permittee is required to test the liquid and solid discharge from the Dalecarlia basins for chlorine. If these samples show a detectable level of chlorine, which for the purpose of the permit is defined as equal to or greater than 0.1 mg/L, the permittee shall provide treatment to ensure that the discharge contains no detectable amounts of chlorine before it is discharged to the Potomac River.

- A 3. The permittee is not authorized to discharge from the Dalecarlia sedimentation basins through Outfall 002 upon the completion of the Residuals Processing Facility or no later than November 30, 2010.

- B 2. The permittee is not authorized to discharge from the Georgetown sedimentation basins through Outfalls 003 or 004 upon the completion of the Residuals Processing Facility or no later than November 30, 2010.

- C1. The permittee must record surface, mid-depth and bottom water temperatures 24 hours in advance of an anticipated discharge and no later than 24 hours after an unanticipated discharge during the March 1 through May 15 time period.

- C2. The permittee is prohibited from discharging dredged material from the Dalecarlia Reservoir to the Potomac River.

- D1. The permittee shall continue to perform the toxicity monitoring program which constitutes a study to evaluate discharges from Outfalls 002 and 003 for acute and chronic toxicity.

- D2. If any batch discharges from the sedimentation basins occur during the spring spawning season (February 15 - June 30), toxicity testing to evaluate the effect of solids on embryo-larval fish will be required. All batch discharges from the sedimentation basins shall be prohibited on or no later than November 30, 2010.

- E1. Between March 1 and May 15, 24 hours in advance of an anticipated upset or bypass or within 24 hours of the commencement of an unanticipated upset or bypass, the permittee must provide NMFS with information regarding the water temperature in the vicinity of the outfall at which the discharge will occur.

- E2. The permittee must perform ichthyoplankton sampling immediately before, during and after a discharge which occurs during the spring spawning period (March 1 through May 15) or when water temperatures are between 8 and 15°C.

The prohibition of sediment release during the spring spawning season (A1, above) was first included in the 2003 permit and was a major departure in permitting for the Aqueduct. In past permits, the Aqueduct was encouraged to release sediments during the high river flows in the spring. The spring is also the time that the ACOE prepares for the peak summer production period by emptying and cleaning the basins to maximize storage capacity. As such, the ACOE has indicated that unexpected conditions could arise during this prohibited time period that would necessitate invoking the bypass provision (Part II Section B3) included in the Aqueduct permit. Under extreme conditions, these provisions enable the permittee to discharge during the prohibited time period if there is the potential for loss of life, personal injury or severe property damage. A bypass (i.e., a spring spawning season discharge) is prohibited by the permit (Part II Section B3d). However, the Director of EPA may approve an anticipated bypass after considering its adverse effects if the Director determines that it will meet the three conditions listed in Part II Section B3d of the Permit. The ACOE has stated that a bypass is not likely to occur more than once every five years (Pers. Comm. Tom Jacobus 2002). In preparation for this consultation, EPA and ACOE have stated that a spring discharge would only occur if the integrity of the drinking water supply for the Customers was threatened by an inability to clean and discharge from one of the basins or life or property was otherwise threatened by an inability to conduct a discharge. EPA and ACOE have indicated that as the conditions that would necessitate a spring spawning season discharge are rare and as such, it is extremely unlikely that a spring spawning season discharge would occur more than once between the time the 2008 NPDES permit is issued and the time the residual processing facility is operational (i.e., November 30, 2010). As residual solids will not be discharged to the river after the residuals processing facility is operational, there will be no potential for a spring spawning season discharge after that time. As such, for the purposes of this consultation, NMFS will consider it unreasonable to anticipate that more than one spring spawning season discharge would occur between the time the 2008 NPDES permit is issued and the time that the residuals processing facility becomes operational (by November 30, 2010).

Action Area
The action area is defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area for this consultation includes the area affected by the operation of the Washington Aqueduct facility pursuant to the proposed NPDES permit and the FFCA. This area extends from Great Falls Dam (rkm 189.4) to the area upstream of Key Bridge (rkm 178.8) in the District of Columbia (see Appendix A for map), an area approximately 10 kilometers long.

STATUS OF AFFECTED SPECIES
NMFS has determined that the action being considered in this biological opinion may affect the endangered shortnose sturgeon (*Acipenser brevirostrum*). No critical habitat has been designated for shortnose sturgeon. While listed sea turtles occur seasonally within the Chesapeake Bay, no sea turtles occur in the action area for this project.

Shortnose Sturgeon
Shortnose sturgeon life history
Shortnose sturgeon are benthic fish that mainly occupy the deep channel sections of large rivers. They feed on a variety of benthic and epibenthic invertebrates including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms (Vladykov and Greeley 1963; Dadswell 1979 *in* NMFS 1998). Shortnose sturgeon have similar lengths at maturity (45-55 cm fork length) throughout their range, but, because sturgeon in southern rivers grow faster than

those in northern rivers, southern sturgeon mature at younger ages (Dadswell et al. 1984). Shortnose sturgeon are long-lived (30-40 years) and, particularly in the northern extent of their range, mature at late ages. In the north, males reach maturity at 5 to 10 years, while females mature between 7 and 13 years. Based on limited data, females spawn every three to five years while males spawn approximately every two years. The spawning period is estimated to last from a few days to several weeks. Spawning begins from late winter/early spring (southern rivers) to mid to late spring (northern rivers)[2] when the freshwater temperatures increase to 8-9°C. Several published reports have presented the problems facing long-lived species that delay sexual maturity (Crouse et al. 1987; Crowder et al. 1994; Crouse 1999). In general, these reports concluded that animals that delay sexual maturity and reproduction must have high annual survival as juveniles through adults to ensure that enough juveniles survive to reproductive maturity and then reproduce enough times to maintain stable population sizes.

Total instantaneous mortality rates (Z) are available for the Saint John River (0.12 - 0.15; ages 14-55; Dadswell 1979), Upper Connecticut River (0.12; Taubert 1980b), and Pee Dee-Winyah River (0.08-0.12; Dadswell et al. 1984). Total instantaneous natural mortality (M) for shortnose sturgeon in the lower Connecticut River was estimated to be 0.13 (T. Savoy, Connecticut Department of Environmental Protection, personal communication). There is no recruitment information available for shortnose sturgeon because there are no commercial fisheries for the species. Estimates of annual egg production for this species are difficult to calculate because females do not spawn every year (Dadswell et al. 1984). Further, females may abort spawning attempts, possibly due to interrupted migrations or unsuitable environmental conditions (NMFS 1998). Thus, annual egg production is likely to vary greatly in this species. Fecundity estimates have been made and range from 27,000 to 208,000 eggs/female (Dadswell et al. 1984).

At hatching, shortnose sturgeon are blackish-colored, 7-11mm long and resemble tadpoles (Buckley and Kynard 1981). In 9-12 days, the yolk sac is absorbed and the sturgeon develops into larvae which are about 15mm total length (TL; Buckley and Kynard 1981). Sturgeon larvae are believed to begin downstream migrations at about 20mm TL. Laboratory studies suggest that young sturgeon move downstream in a 2-step migration; a 2 to 3-day migration by larvae followed by a residency period by young of the year (YOY), then a resumption of migration by yearlings in the second summer of life (Kynard 1997). Juvenile shortnose sturgeon (3-10 years old) reside in the interface between saltwater and freshwater in most rivers (NMFS 1998).

In populations that have free access to the total length of a river (e.g., no dams within the species' range in a river: Saint John, Kennebec, Altamaha, Savannah, Delaware and Merrimack Rivers), spawning areas are located at the farthest upstream reach of the river (NMFS 1998). In the northern extent of their range, shortnose sturgeon exhibit three distinct movement patterns. These migratory movements are associated with spawning, feeding, and overwintering activities. In spring, as water temperatures rise above 8°C, pre-spawning shortnose sturgeon move from

2 For purposes of this consultation, Northern rivers are considered to include tributaries of the Chesapeake Bay northward to the St. John River in Canada. Southern rivers are those south of the Chesapeake Bay.

overwintering grounds to spawning areas. Spawning occurs from mid/late March to mid/late May depending upon location and water temperature. Sturgeon spawn in upper, freshwater areas and feed and overwinter in both fresh and saline habitats. Shortnose sturgeon spawning migrations are characterized by rapid, directed and often extensive upstream movement (NMFS 1998).

Shortnose sturgeon are believed to spawn at discrete sites within their natal river (Kieffer and Kynard 1996). In the Merrimack River, males returned to only one reach during a four year telemetry study (Kieffer and Kynard 1996). Squires (1982) found that during the three years of the study in the Androscoggin River, adults returned to a 1-km reach below the Brunswick Dam and Kieffer and Kynard (1996) found that adults spawned within a 2-km reach in the Connecticut River for three consecutive years. Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (Dadswell et al. 1984; NMFS 1998). Additional environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 8 - 12° , and bottom water velocities of 0.4 to 0.7 m/sec (Dadswell et al. 1984; NMFS 1998). For northern shortnose sturgeon, the temperature range for spawning is 6.5-18.0°C (Kieffer and Kynard in press). Eggs are separate when spawned but become adhesive within approximately 20 minutes of fertilization (Dadswell et al. 1984). Between 8° and 12°C, eggs generally hatch after approximately 13 days. The larvae are photonegative, remaining on the bottom for several days. Buckley and Kynard (1981) found week old larvae to be photonegative and form aggregations with other larvae in concealment.

Adult shortnose sturgeon typically leave the spawning grounds soon after spawning. Non-spawning movements include rapid, directed post-spawning movements to downstream feeding areas in spring and localized, wandering movements in summer and winter (Dadswell et al. 1984; Buckley and Kynard 1985; O'Herron et al. 1993). Kieffer and Kynard (1993) reported that post-spawning migrations were correlated with increasing spring water temperature and river discharge. Young-of-the-year shortnose sturgeon are believed to move downstream after hatching (Dovel 1981) but remain within freshwater habitats. Older juveniles tend to move downstream in fall and winter as water temperatures decline and the salt wedge recedes. Juveniles move upstream in spring and feed mostly in freshwater reaches during summer.

Juvenile shortnose sturgeon generally move upstream in spring and summer and move back downstream in fall and winter; however, these movements usually occur in the region above the saltwater/freshwater interface (Dadswell et al. 1984; Hall et al. 1991). Non-spawning movements include wandering movements in summer and winter (Dadswell et al. 1984; Buckley and Kynard 1985; O'Herron et al. 1993). Kieffer and Kynard (1993) reported that post-spawning migrations were correlated with increasing spring water temperature and river discharge. Adult sturgeon occurring in freshwater or freshwater/tidal reaches of rivers in summer and winter often occupy only a few short reaches of the total length (Buckley and Kynard 1985). Summer concentration areas in southern rivers are cool, deep, thermal refugia, where adult and juvenile shortnose sturgeon congregate (Flourney et al. 1992; Rogers and Weber 1994; Rogers and Weber 1995; Weber 1996). While shortnose sturgeon are occasionally collected near the mouths of rivers and often spend time in estuaries, they are not known to participate in coastal migrations and are rarely documented in their non-natal river.

The temperature preference for shortnose sturgeon is not known (Dadswell et al. 1984) but shortnose sturgeon have been found in waters with temperatures as low as 2 to 3°C (Dadswell et al. 1984) and as high as 34°C (Heidt and Gilbert 1978). However, temperatures above 28°C are thought to adversely affect shortnose sturgeon. In the Altamaha River, temperatures of 28-30°C during summer months create unsuitable conditions and shortnose sturgeon are found in deep cool water refuges.

Shortnose sturgeon are known to occur at a wide range of depths. A minimum depth of 0.6m is necessary for the unimpeded swimming by adults. Shortnose sturgeon are known to occur at depths of up to 30m but are generally found in waters less than 20m (Dadswell et al. 1984; Dadswell 1979). Shortnose sturgeon have also demonstrated tolerance to a wide range of salinities. Shortnose sturgeon have been documented in freshwater (Taubert 1980; Taubert and Dadswell 1980) and in waters with salinity of 30 parts-per-thousand (ppt) (Holland and Yeverton 1973; Saunders and Smith 1978). Mcleave et al. (1977) reported adults moving freely through a wide range of salinities, crossing waters with differences of up to 10ppt within a two hour period. The tolerance of shortnose sturgeon to increasing salinity is thought to increase with age (Kynard 1996). Shortnose sturgeon typically occur in the deepest parts of rivers or estuaries where suitable oxygen and salinity values are present (Gilbert 1989).

Status and Trends of Shortnose Sturgeon Rangewide

Shortnose sturgeon were listed as endangered on March 11, 1967 (32 FR 4001), and the species remained on the endangered species list with the enactment of the ESA in 1973. Although the original listing notice did not cite reasons for listing the species, a 1973 Resource Publication, issued by the US Department of the Interior, stated that shortnose sturgeon were "in peril…gone in most of the rivers of its former range [but] probably not as yet extinct" (USDOI 1973). Pollution and overfishing, including bycatch in the shad fishery, were listed as principal reasons for the species' decline. In the late nineteenth and early twentieth centuries, shortnose sturgeon commonly were taken in a commercial fishery for the closely related and commercially valuable Atlantic sturgeon (*Acipenser oxyrinchus*). More than a century of extensive fishing for sturgeon contributed to the decline of shortnose sturgeon along the east coast. Heavy industrial development during the twentieth century in rivers inhabited by sturgeon impaired water quality and impeded these species' recovery; possibly resulting in substantially reduced abundance of shortnose sturgeon populations within portions of the species' ranges (e.g., southernmost rivers of the species range: Santilla, St. Marys and St. Johns Rivers). A shortnose sturgeon recovery plan was published in December 1998 to promote the conservation and recovery of the species (see NMFS 1998). Shortnose sturgeon are listed as "vulnerable" on the IUCN Red List.

Although shortnose sturgeon are listed as endangered range-wide, in the final recovery plan NMFS recognized 19 separate populations occurring throughout the range of the species. These populations are in New Brunswick Canada (1); Maine (2); Massachusetts (1); Connecticut (1);

New York (1); New Jersey/Delaware (1); Maryland and Virginia (1); North Carolina (1); South Carolina (4); Georgia (4); and Florida (2). NMFS has not formally recognized distinct population segments (DPS)[3] of shortnose sturgeon under the ESA. Although genetic information within and among shortnose sturgeon occurring in different river systems is largely unknown, life history studies indicate that shortnose sturgeon populations from different river systems are substantially reproductively isolated (Kynard 1997) and, therefore, should be considered discrete. The 1998 Recovery Plan indicates that while genetic information may reveal that interbreeding does not occur between rivers that drain into a common estuary, at this time, such river systems are considered a single population compromised of breeding subpopulations (NMFS 1998).

Studies conducted since the issuance of the Recovery Plan have provided evidence that suggests that years of isolation between populations of shortnose sturgeon have led to morphological and genetic variation. Walsh et al. (2001) examined morphological and genetic variation of shortnose sturgeon in three rivers (Kennebec, Androscoggin, and Hudson). The study found that the Hudson River shortnose sturgeon population differed markedly from the other two rivers for most morphological features (total length, fork length, head and snout length, mouth width, interorbital width and dorsal scute count, left lateral scute count, right ventral scute count). Significant differences were found between fish from Androscoggin and Kennebec rivers for interorbital width and lateral scute counts which suggests that even though the Androscoggin and Kennebec rivers drain into a common estuary, these rivers support largely discrete populations of shortnose sturgeon. The study also found significant genetic differences among all three populations indicating substantial reproductive isolation among them and that the observed morphological differences may be partly or wholly genetic.

Grunwald et al. (2002) examined mitochondrial DNA (mtDNA) from shortnose sturgeon in eleven river populations. The analysis demonstrated that all shortnose sturgeon populations examined showed moderate to high levels of genetic diversity as measured by haplotypic diversity indices. The limited sharing of haplotypes and the high number of private haplotypes are indicative of high homing fidelity and low gene flow. The researchers determined that glaciation in the Pleistocene Era was likely the most significant factor in shaping the phylogeographic pattern of mtDNA diversity and population structure of shortnose sturgeon. The Northern glaciated region extended south to the Hudson River while the southern non-glaciated region begins with the Delaware River. There is a high prevalence of haplotypes restricted to either of these two regions and relatively few are shared; this represents a historical subdivision that is tied to an important geological phenomenon that reflects historical isolation. Analyses of haplotype frequencies at the level of individual rivers showed significant differences among all systems in which reproduction is known to occur. This implies that although higher

3 The definition of species under the ESA includes any subspecies of fish, wildlife, or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature. To be considered a DPS, a population segment must meet two criteria under NMFS policy. First, it must be discrete, or separated, from other populations of its species or subspecies. Second, it must be significant, or essential, to the long-term conservation status of its species or subspecies. This formal legal procedure to designate DPSs for shortnose sturgeon has not been undertaken.

level genetic stock relationships exist (i.e., southern vs. northern and other regional subdivisions), shortnose sturgeon appear to be discrete stocks, and low gene flow exists between the majority of populations.

Waldman et al. (2002) also conducted mtDNA analysis on shortnose sturgeon from 11 river systems and identified 29 haplotypes. Of these haplotypes, 11 were unique to northern, glaciated systems and 13 were unique to the southern non-glaciated systems. Only 5 were shared between them. This analysis suggests that shortnose sturgeon show high structuring and discreteness and that low gene flow rates indicated strong homing fidelity.

Wirgin et al. (2005), also conducted mtDNA analysis on shortnose sturgeon from 12 rivers (St. John, Kennebec, Androscoggin, Upper Connecticut, Lower Connecticut, Hudson, Delaware, Chesapeake Bay, Cooper, Peedee, Savannah, Ogeechee and Altamaha). This analysis suggested that most population segments are independent and that genetic variation among groups was high.

The best available information demonstrates differences in life history and habitat preferences between northern and southern river systems and given the species' anadromous breeding habits, the rare occurrence of migration between river systems, and the documented genetic differences between river populations, it is unlikely that populations in adjacent river systems interbreed with any regularity. This likely accounts for the failure of shortnose sturgeon to repopulate river systems from which they have been extirpated, despite the geographic closeness of persisting populations. This characteristic of shortnose sturgeon also complicates recovery and persistence of this species in the future because, if a river population is extirpated in the future, it is unlikely that this river will be recolonized. Consequently, this Opinion will treat the nineteen separate populations of shortnose sturgeon as subpopulations (one of which occurs in the action area) for the purposes of this analysis.

Historically, shortnose sturgeon are believed to have inhabited nearly all major rivers and estuaries along nearly the entire east coast of North America. The range extended from the St John River in New Brunswick, Canada to the Indian River in Florida. Today, only 19 populations remain ranging from the St. Johns River, Florida (possibly extirpated from this system) to the Saint John River in New Brunswick, Canada. Shortnose sturgeon are large, long lived fish species. The present range of shortnose sturgeon is disjunct, with northern populations separated from southern populations by a distance of about 400 km. The species is anadromous in the southern portion of its range (i.e., south of Chesapeake Bay), while northern populations are amphidromous (NMFS 1998). Population sizes vary across the species' range. From available estimates, the smallest populations occur in the Cape Fear (~8 adults; Moser and Ross 1995) and Merrimack Rivers (~100 adults; M. Kieffer, United States Geological Survey, personal communication), while the largest populations are found in the Saint John (~100,000; Dadswell 1979) and Hudson Rivers (~61,000; Bain et al. 1998). As indicated in Kynard 1996, adult abundance is less than the minimum estimated viable population abundance of 1000 adults for 5 of 11 surveyed northern populations and all natural southern populations. Kynard 1996 indicates that all aspects of the species' life history indicate that shortnose sturgeon should be abundant in most rivers. As such, the expected abundance of adults in northern and north-central populations should be thousands to tens of thousands of adults. Expected abundance in southern rivers is uncertain, but large rivers should likely have thousands of adults. The only river systems likely supporting populations of these sizes are the St John, Hudson and possibly the Delaware and the Kennebec, making the continued success of shortnose sturgeon in these rivers critical to the species as a whole. While no reliable estimate of the size of either the total species or the shortnose sturgeon population in the Northeastern United States exists, it is clearly below the size that could be supported if the threats to shortnose sturgeon were removed.

Threats to shortnose sturgeon recovery

The Shortnose Sturgeon Recovery Plan (NMFS 1998) identifies habitat degradation or loss (resulting, for example, from dams, bridge construction, channel dredging, and pollutant discharges) and mortality (resulting, for example, from impingement on cooling water intake screens, dredging and incidental capture in other fisheries) as principal threats to the species' survival.

Several natural and anthropogenic factors continue to threaten the recovery of shortnose sturgeon. Shortnose sturgeon continue to be taken incidentally in fisheries along the east coast and are probably targeted by poachers throughout their range (Dadswell 1979; Dovel et al. 1992; Collins et al. 1996). Bridge construction and demolition projects may interfere with normal shortnose sturgeon migratory movements and disturb sturgeon concentration areas. Unless appropriate precautions are made, internal damage and/or death may result from blasting projects with powerful explosives. Hydroelectric dams may affect shortnose sturgeon by restricting habitat, altering river flows or temperatures necessary for successful spawning and/or migration and causing mortalities to fish that become entrained in turbines. Maintenance dredging of Federal navigation channels and other areas can adversely affect or jeopardize shortnose sturgeon populations. Hydraulic dredges can lethally take sturgeon by entraining sturgeon in dredge dragarms and impeller pumps. Mechanical dredges have also been documented to lethally take shortnose sturgeon. In addition to direct effects, dredging operations may also impact shortnose sturgeon by destroying benthic feeding areas, disrupting spawning migrations, and filling spawning habitat with resuspended fine sediments. Shortnose sturgeon are susceptible to impingement on cooling water intake screens at power plants. Electric power and nuclear power generating plants can affect sturgeon by impinging larger fish on cooling water intake screens and entraining larval fish. The operation of power plants can have unforeseen and extremely detrimental impacts to water quality which can affect shortnose sturgeon. For example, the St. Stephen Power Plant near Lake Moultrie, South Carolina was shut down for several days in June 1991 when large mats of aquatic plants entered the plant's intake canal and clogged the cooling water intake gates. Decomposing plant material in the tailrace canal coupled with the turbine shut down (allowing no flow of water) triggered a low dissolved oxygen water condition downstream and a subsequent fish kill. The South Carolina Wildlife and Marine Resources Department reported that twenty shortnose sturgeon were killed during this low dissolved oxygen event.

Contaminants, including toxic metals, polychlorinated aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs) can have substantial deleterious effects on aquatic life including production of acute lesions, growth retardation, and reproductive impairment (Cooper 1989; Sinderman 1994). Ultimately, toxins introduced to the water column become associated with the benthos and can be particularly harmful to benthic organisms (Varanasi 1992) like sturgeon. Heavy metals and organochlorine compounds are known to accumulate in fat tissues of sturgeon, but their long term effects are not yet known (Ruelle and Henry 1992; Ruelle and Kennlyne 1993). Available data suggests that early life stages of fish are more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976).

Although there is scant information available on the levels of contaminants in shortnose sturgeon tissues, some research on other related species indicates that concern about the effects of contaminants on the health of sturgeon populations is warranted. Detectible levels of chlordane, DDE (1,1-dichloro-2, 2-bis(p-chlorophenyl)ethylene), DDT (dichlorodiphenyl-trichloroethane), and dieldrin, and elevated levels of PCBs, cadmium, mercury, and selenium were found in pallid sturgeon tissue from the Missouri River (Ruelle and Henry 1994). These compounds were found in high enough levels to suggest they may be causing reproductive failure and/or increased physiological stress (Ruelle and Henry 1994). In addition to compiling data on contaminant levels, Ruelle and Henry also determined that heavy metals and organochlorine compounds (i.e. PCBs) accumulate in fat tissues. Although the long term effects of the accumulation of contaminants in fat tissues is not yet known, some speculate that lipophilic toxins could be transferred to eggs and potentially inhibit egg viability. In other fish species, reproductive impairment, reduced egg viability, and reduced survival of larval fish are associated with elevated levels of environmental contaminants including chlorinated hydrocarbons. A strong correlation that has been made between fish weight, fish fork length, and DDE concentration in pallid sturgeon livers indicates that DDE increases proportionally with fish size (NMFS 1998).

Contaminant analysis was conducted on two shortnose sturgeon from the Delaware River in the fall of 2002. Muscle, liver, and gonad tissue were analyzed for contaminants (ERC 2002). Sixteen metals, two semivolatile compounds, three organochlorine pesticides, one PCB Aroclor, as well as polychlorinated dibenzo-p-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs) were detected in one or more of the tissue samples. Levels of aluminum, cadmium, PCDDs, PCDFs, PCBs, DDE (an organochlorine pesticide) were detected in the "adverse affect" range. It is of particular concern that of the above chemicals, PCDDs, DDE, PCBs and cadmium, were detected as these have been identified as endocrine disrupting chemicals. Contaminant analysis conducted in 2003 of tissues from a shortnose sturgeon from the Kennebec River revealed the presence of fourteen metals, one semivolatile compound, one PCB Aroclor, Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) in one or more of the tissue samples. Of these chemicals, cadmium and zinc were detected at concentrations above an adverse effect concentration reported for fish in the literature (ERC 2003). While no directed studies of chemical contamination in shortnose sturgeon have been undertaken, it is evident that the heavy industrialization of the rivers where shortnose sturgeon are found is likely adversely affecting this species.

During summer months, especially in southern areas, shortnose sturgeon must cope with the physiological stress of water temperatures that may exceed 28°C. Flourney et al.(1992) suspected that, during these periods, shortnose sturgeon congregate in river regions which support conditions that relieve physiological stress (i.e., in cool deep thermal refuges). In southern rivers where sturgeon movements have been tracked, sturgeon refrain from moving during warm water conditions and are often captured at release locations during these periods (Flourney et al.1992; Rogers and Weber 1994; Weber 1996). The loss and/or manipulation of these discrete refuge habitats may limit or be limiting population survival, especially in southern river systems.

Pulp mill, silvicultural, agricultural, and sewer discharges, as well as a combination of non-point source discharges, which contain elevated temperatures or high biological demand, can reduce dissolved oxygen levels. Shortnose sturgeon are known to be adversely affected by dissolved oxygen levels below 5 mg/L. Shortnose sturgeon may be less tolerant of low dissolved oxygen levels in high ambient water temperatures and show signs of stress in water temperatures higher than 28°C (Flourney et al. 1992). At these temperatures, concomitant low levels of dissolved oxygen may be lethal.

Status of Shortnose Sturgeon in the Chesapeake Bay and its Tributaries

The action area is limited to a stretch of the Potomac River identified above. As such, this section will discuss the available information related to the presence of shortnose sturgeon in the Chesapeake Bay and the Potomac River.

Occurrence of Shortnose Sturgeon in the Chesapeake Bay System

The first published account of shortnose sturgeon in the Chesapeake system was an 1876 record from the Potomac River reported in a general list of fishes of Maryland (Uhler and Lugger 1876). There is evidence that at one time Atlantic and shortnose sturgeon were prolific in the Potomac River but it is generally accepted that at the turn of the 20th Century shortnose sturgeon were essentially extirpated from the Potomac and rarely seen in Chesapeake Bay (Hildebrand and Schroeder 1927). Other historical records of shortnose sturgeon in the Chesapeake include: the Potomac River (Smith and Bean 1899), the upper Bay near the mouth of the Susquehanna River in the early 1980's, and the lower Bay near the mouths of the James and Rappahannock rivers in the late 1970's (Dadswell et al. 1984). Dadswell et al. 1984, reports 13 records of shortnose sturgeon in the upper Chesapeake Bay during the 1970s and 1980s.

As explained above, the FWS Atlantic sturgeon reward program began in 1996. Through March 2008, the incidental capture of 73 individual shortnose sturgeon has been reported via the FWS reward program. Two fish were recaptured within one to two weeks of their initial capture date (February 1999 in the mainstem of the Bay and then in the Sassafras River and May/June 2000 in the mainstem of the Bay). All of these fish were captured alive in either commercial or recreational fisheries.

Most of the shortnose sturgeon documented in the reward program have been caught in the upper Bay, from Kent Island to the mouth of the Susquehanna River and the C&D Canal, in Fishing Bay and around Hoopers Island in the middle Bay, and in the Potomac River (Litwiler 2001, Skjeveland et al. 2000; Welsh et al, 2002). Eleven shortnose sturgeon have been reported as incidentally captured in the Potomac River. The location of capture has ranged between the river mouth to Indian Head (river km 103).

The FWS conducted two sampling studies between 1998 and 2000 in the Maryland waters of the Potomac River to determine occurrence and distribution of sturgeon within proposed dredge material placement sites in the Potomac River (Eyler et al. 2000). A two-year bottom gillnetting study was conducted at five sites located in the middle Potomac River. Although the sites were sampled for a total of 4,590 hours, no shortnose sturgeon were captured (Eyler et al. 2000).

A similar FWS sampling study was conducted in the upper Chesapeake Bay mainstem, lower Susquehanna River and Chesapeake/Delaware Canal during 1998 and 2000. No shortnose sturgeon were captured at any of the 19 sites sampled (Skjeveland et al. 2000).

In 1998 and 1999, sonic tags were attached to 13 shortnose sturgeon captured in fishing gear in the upper Chesapeake Bay and identified through the FWS Atlantic sturgeon reward program and to 26 shortnose sturgeon captured near Scudders Falls in the Delaware River. This study was designed to see if tagged fish used the Chesapeake and Delaware (C&D) canal to move between the Delaware River and Chesapeake Bay. Three of the 13 fish tagged in the Chesapeake Bay were later relocated in the C&D canal or the Delaware River. None of the fish tagged in the Delaware River were recorded in the canal. This study confirmed the use of the C& D canal by Chesapeake Bay fish (Welsh et al. 2002).

Researchers have theorized that shortnose sturgeon were extirpated from the Chesapeake Bay before the time they were first listed as an endangered species in 1967. Many believe that the present day population of shortnose sturgeon found in the Bay and its tributaries are descendants of fish which recolonized the Bay from the Delaware River via the C&D Canal (which opened in 1829). This theory is supported by the tag data showing use of the C&D canal and from recent genetic work using mtDNA (Grunwald et al. 2002, Wirgin et al. 2005, Wirgin in progress) and microsatellite DNA analysis (T. King in progress) which suggests that shortnose sturgeon captured in the Chesapeake Bay are not genetically distinct from shortnose sturgeon captured in the Delaware River. It is currently unknown if there are any remnant populations of shortnose sturgeon in the Chesapeake Bay or if all of the shortnose sturgeon in the Bay are more recent migrants from the Delaware and/or the descendants of recent migrants. Additionally, as there are no historic samples to compare the modern genetic samples, it is unknown whether fish from the Chesapeake Bay system and the Delaware River historically mixed or if at one time the two groups were distinct. It is also possible that due to historically poor water quality conditions, at some point in the past remnant shortnose sturgeon that survived the intense fishery in the Chesapeake Bay left the Bay via the C&D canal and mixed with the Delaware River fish.

Potential for shortnose sturgeon spawning in Chesapeake Bay tributaries
Research on shortnose sturgeon indicates that this species typically spawns just below the limit of upstream passage. In unimpeded rivers systems spawning typically occurs 200km or more upstream and in dammed rivers, spawning often occurs at the base of the first dam (Kynard 1997). A multi-year spawning study in the Connecticut River, perhaps the most comprehensive study of natural shortnose sturgeon spawning, indicates that spawning occurred at daily mean temperatures of 6.5-14.7°C. Females spawned in water depths of 1-5m with a peak at 1.5-1.9m. Bottom water velocity at the spawning site was a mean of 70cm/s with the greatest usage of 75-125 cm/s. The only substrate type females used was cobble/rubble (101-300 mm diameter). Substrate and flow are consistent in all areas where shortnose sturgeon spawning has been confirmed.

Extensive analyses of potential spawning habitat in the Chesapeake Bay tributaries have not been completed. Several Chesapeake Bay tributaries have habitat characteristics such as hard bottom substrate and areas of high flow that may be suitable for spawning. These include the Gunpowder, James, York and Susquehanna Rivers. No investigations have been made to determine if the habitat in these rivers could actually support shortnose sturgeon spawning and/or early life stages (i.e., whether nursery habitat is present). There have been anecdotal reports made by watermen of shortnose sturgeon presence in Gunpowder Falls, which enters the Gunpowder River in Baltimore County, although there has not been any documentation of spawning activity (Pers. Comm. John Nichols, NMFS, 2002). Adult shortnose sturgeon have been documented in the Susquehanna River in February, April and June, which is consistent with the time of year when spawning adults would be present. However, it is unknown if adequate spawning or nursery habitat occurs in the area below the Conowingo Dam, which is the first barrier to upstream passage. No shortnose sturgeon have been documented in the James or York rivers in the past 30 years.

A recent study in the Potomac attempted to identify important habitats for this species (Kynard 2007) and confirmed that there are areas within the Potomac River that are consistent with the type of habitat used by spawning shortnose sturgeon in other rivers (see below).

Shortnose sturgeon in the Potomac River
There is little historic information about shortnose sturgeon in the Potomac River. Four documents dated between 1876 and 1929 state that shortnose sturgeon inhabited the Potomac River. However, the only specimen that remains was collected by J. W. Milner at Washington, D.C on March 19, 1876 (Kynard 2007; currently in the collection of the Smithsonian Institute[4]).

A publication from 1898 regarding the fish of the District of Columbia lists shortnose sturgeon as being present in DC waters and Atlantic sturgeon (*Acipenser sturio* later changed to *Acipenser*

4 NMFS is currently exploring the potential to obtain a genetic sample from this specimen to compare to modern Potomac River sturgeon samples.

oxyrhynchus oxyrhynchus) as ascending the Potomac River in the spring to spawn. This publication also explains that fishermen did not typically differentiate between the two species of sturgeon. In addition to these historic records and the captures reported via the reward program, there are other recent anecdotal reports of adult sturgeon in the Potomac River. These reports include a letter from Mr. Mike Oetker, a trained fishery biologist, to NMFS dated October 8, 2002. In this letter Mr. Oetker described an incident that occurred in 1999 in which he noted the take of a sturgeon from the Potomac River near Fletcher's Boathouse. Mr. Oetker was not able to discern whether this fish was an Atlantic or shortnose sturgeon but noted that the size was between four and four and one half feet long.

Historic reports indicate that shortnose sturgeon likely spawned in the vicinity of Little Falls. In 1915, McAtee and Weed stated: "two [species] of sturgeon ascend to Little Falls but no further." The first mainstem dam on the Potomac River now occurs near Little Falls (river km 189). Although passage upstream of the low-head dam by sturgeons is not known, the 2-km reach downstream of the dam is a high gradient, boulder strewn reach of rapids, characterized by a small but turbulent falls that are likely prohibitive for sturgeon swimming abilities, especially egg-laden females. As the Little Falls Dam is thought to occur near the natural upstream limit of shortnose sturgeon in this river it is not thought to block passage to historic habitat.

Twelve shortnose sturgeon have been captured in the Potomac River since 1996. The eleven shortnose sturgeon captured in the Potomac River and reported via the FWS reward program were documented in the following locations: six at the mouth of the river (May 3, 2000, March 26, 2001, two on March 8, 2002, December 10, 2004, May 22, 2005); one at the mouth of the Saint Mary's River (April 21, 1998); one at the mouth of Potomac Creek (May 17, 1996); one at rkm 63 (March 22, 2006); one at rkm 57 (Cobb Bar; December 23, 2007); and, one at rkm 48 (March 14, 2008). Additionally, 1 adult female was captured by USGS researchers within the Potomac River (at rkm 103) in September 2005.

An ongoing tagging and telemetry study of shortnose sturgeon in the Potomac River began in 2004 (Kynard 2007). Three shortnose sturgeon (the 9/22/05, 3/22/06 and 3/14/08 fish mentioned above) have been tagged with CART tags (Combined Acoustic and Radio Transmitting). While the sex and reproductive status of the 2008 fish is unknown, the 2005 and 2006 fish were both females with late stage eggs. Tracking has demonstrated that the two females spent the majority of the year in a 79-km reach between river km 141–63. The 05 female migrated upstream in spring 2006 to a 2-km reach (river km 187–185) containing habitat determined to be suitable for spawning (Kynard et al. 2007). The fish tagged in 2008 has not been detected by the telemetry array that is within the Potomac River. This suggests that the fish either shed the tag or that the fish has left the Potomac River.

Although two late-stage females were captured and tracked, only one was observed to make an apparent spawning migration in the spring of 2006 (the most recent year for which information is available). Remote and manual tracking showed the 05 female arrived at the Fletchers Marina (River km 184.5) on April 9 and remained within a 2-km reach (river km 187-185) for 6 days.

During this time, mean daily river temperatures were 12.0–16.0°C and mean daily river discharge was 157–178 m^3/s. Although researchers filtered 100,000 m^3 of water at the Fletcher's site through 2-mm mesh anchored D-nets, no sturgeon ELS were captured (Kynard et al. 2007). Researchers have speculated that the female caught and tagged in 2006 may have failed to complete a spawning run due to the stress of capture, holding and tagging so close to the time of year when spawning was expected.

Investigations into the characteristics of the habitat in the Potomac River indicated that habitat suitable for spawning is located just downstream of Little Falls Dam and in the Fletchers-Chain Bridge reach. Bottom velocities, depth and substrate type were all consistent with areas in other rivers where shortnose sturgeon spawning has been confirmed. Kynard (2007) concluded that the wide range of acceptable velocity, the multiple sites with 1m/s velocity, and the widespread availability of a rocky bottom strongly suggest spawning conditions exist at many locations in the Fletchers-Chain Bridge area.

During the years when fish were tracked, the two females spent the summer-fall in a 78-km reach (river km 63–141). Most of this area was in tidal freshwater, however, the downstream section of the range experiences tidal salinity. The fish used depths between 4.1–21.3 m, but most locations (89.2%) were in the channel. Throughout the summer and winter, fish used a wide range of water temperature (1.8–32.0°C), DO (4.8–14.6 mg/L) and salinity (0.1–5.6 ppt; Kynard et al. 2007). Substrate measured at fish locations were mud (80.7%), sand/mud (15.8%), and gravel-mud (3.5%). This area is also characterized by prolific tracts of submerged aquatic vegetation and algae blooms.

Observations through the entire winter were made on only one tagged fish. All winter sites selected by this female occurred within the 78-km summer-fall reach. This female returned to the same reach for wintering three consecutive years. River lengths used by tagged fish were < 2 km during winter. The other tagged fish was tracked only to February 2007. The last time this fish was tracked, it occupied river km 85, the farthest downstream site this fish was tracked during the study. It is unknown whether this fish shed her tag or left the range of the receivers.

Researchers have indicated that while distribution and habitat use information is only available for two fish, as the habitats used and seasonal movements within those habitats are consistent with normal shortnose sturgeon movements and habitats, different conclusions regarding habitat use and distribution would not be expected even with a larger sample size (Kynard 2007). The tracking data confirms the assumptions made by NMFS in previous consultations related to the operation of the Washington Aqueduct that shortnose sturgeon are only likely to occur in the action area during the spring while spawning and that the area between Little Falls Dam and Fletchers Landing is where spawning is likely to occur.

Research has been conducted by the NYU School of Medicine involving mitochondrial DNA (mtDNA) analysis of shortnose sturgeon populations, including fish caught in the Potomac River (Grunwald et al. 2002; Wirgin et al. 2005; and Wirgin et al. in progress). In the 2002 paper, genetic comparisons were made among all shortnose sturgeon populations for which tissue samples were available. All population comparisons exhibited clear and significant differences in haplotype frequencies except for comparisons between the Upper/Lower Connecticut River and Delaware/Chesapeake. There were no unique haplotypes in the fish captured in the Chesapeake system. Samples from four fish from the Potomac River were analyzed and results indicate that these fish exhibited the same haplotypes as fish found elsewhere in the Chesapeake and in the Delaware River. Similar work published by Wirgin et al. (2005) and work currently in progress by Wirgin supports these initial results reported by Grunwald et al (2002). Many researchers have interpreted these results to support the hypothesis that in the recent past any distinct shortnose sturgeon populations existing in the Chesapeake Bay system were extirpated and that fish from the Delaware River may be recolonizing vacant habitat. This hypothesis appears to be supported by the tracking data which demonstrates sturgeon using the C&D canal to move between the Chesapeake and Delaware systems. However, as noted above few targeted surveys using accepted NMFS protocols (Moser et al. 2000) have been undertaken to establish the presence or absence of any remnant shortnose sturgeon populations. Further, it is unknown when in history mixing between the Chesapeake Bay and Delaware River began.

As the sample size is very small and as mtDNA represents only a fraction (less than 1%) of the genetic material and is maternally inherited, it is difficult to make conclusive statements regarding the potential for fish in the Potomac River to be genetically distinct from other fish in the Chesapeake Bay or from the Delaware River. However, as there were no unique haplotypes in the Potomac River fish and unique haplotypes are seen in almost every other population, the best available information suggests that fish occurring in the Potomac River are not genetically unique and are not genetically distinct from other fish in the Chesapeake Bay or fish occurring in the Delaware River. Nuclear DNA analysis is currently ongoing on the Potomac River samples; however, no results are available to report at this time.

There is not currently enough information to estimate the number of shortnose sturgeon in the Potomac River or the Chesapeake Bay system as a whole. Any estimate is further complicated by the likelihood that at least some percentage of the shortnose sturgeon captured in the Chesapeake Bay, particularly in the upper Bay, are migrants from the Delaware River. It is unknown whether these fish are residing and spawning in the Chesapeake Bay system or are merely making a seasonal or life-stage specific migration into the Bay. Tracking data has shown that shortnose sturgeon use the Chesapeake and Delaware Canal as a means of migrating between the upper Chesapeake Bay and the Delaware River. As explained above, twelve shortnose sturgeon have been captured within the Potomac River since 1996. Of these, two have been tagged with telemetry tags and have been tracked within the River over multiple years suggesting that these fish are residents of the Potomac River. Sixty-one additional shortnose sturgeon have been captured elsewhere in the Chesapeake Bay, at least some of which have been documented to move into the Delaware River via the C&D Canal. Estimates of the Delaware River population by three estimation procedures ranged from 6,408 to 14,080 adult sturgeon. This is the best available information on population size, but because the recruitment and migration rates between the population segment studied and the total population in the river are unknown, model assumptions may have been violated. Based on comparison to older population estimates, NMFS believes that the Delaware River population is increasing slightly or is stable.

Based on current research and information, it is impossible to estimate the number of shortnose sturgeon residing in the Potomac River; however, recent captures (since 1996) suggest that there are at least two and likely at least 12 adult shortnose sturgeon in the River. As explained above, several studies have attempted to document the use of the Potomac River by shortnose sturgeon. Only one shortnose sturgeon has been caught in the river during these targeted studies (2005). However, as evidenced by the reward program information and the tracking data collected by USGS/FWS, there is clearly at least a small shortnose sturgeon population in the Potomac River. This species is notoriously difficult to catch and is rarely captured using traditional sampling methods. Additionally, in some large rivers (e.g., Kennebec/Androscoggin complex, Altamaha River), shortnose sturgeon use only very discrete areas of the river. This makes detection of the species even more difficult as sampling done in the wrong part of the river could lead to zero detection even though the river supports a relatively large population.

It is not unprecedented that a shortnose sturgeon population could exist in a river without detection, or that many more fish could be present in a river than previously anticipated. Populations in other river systems have only been documented after extensive study which highlights the difficulty of capturing shortnose sturgeon. For example, it took researchers 21,432 net hours over a three year period to capture three shortnose sturgeon in the Cape Fear River (Moser and Ross 1995). Shortnose sturgeon were unknown in this river system with the exception of one female captured in a lower tributary of the Cape Fear River in 1987. During the course of their study, Moser and Ross interviewed commercial fishermen who set gill nets for striped bass and American shad. Fishermen reported capturing shortnose sturgeon regularly in the past, but always in small numbers. As these captures were never reported to authorities, there was no record of shortnose sturgeon in this system. During the three years of the targeted study, the incidental capture of five shortnose sturgeon was reported to the researchers by commercial fishermen. Researchers have estimated that this river likely supports a population of less than 50 shortnose sturgeon (Moser and Ross 1995).

Until 1987, there were only occasional sightings of and anecdotal reports about sturgeon in the Merrimack River. Kieffer and Kynard began investigating the Merrimack River for shortnose sturgeon in the mid-1980s and first documented a shortnose sturgeon in 1987. These researchers expended 11,396 net hours to capture 25 shortnose sturgeon in this river (Kieffer and Kynard 1993). Studies conducted throughout the 1990s have documented the spawning, foraging and overwintering grounds in this river. The foraging, or total adult population, is estimated to be 35 fish, with approximately 12 shortnose sturgeon spawning per year (Kieffer and Kynard 1993).

Additionally, recent work in the Altamaha River in Georgia (DeVries 2006) conducted between 2003-2005 has revealed that the river supports a much larger population than previously thought. The new population estimate of 6320 (95% CI 4387-9249) obtained in the recent study is nearly ten times larger than the previous estimate of 650 reported by Kynard (1997 – from Rogers and

Weber unpublished data).

Further, a shortnose sturgeon population in the Penobscot River was not discovered until 2006. The river was long suspected to support shortnose sturgeon due to the incidental capture of one adult fish in 1978 and occasional anecdotal reports of sturgeon sightings. However, despite several hundred hours of sampling in 1994 and 1995 no shortnose sturgeon were captured in the river until the University of Maine began a study targeting Atlantic sturgeon in spring of 2006. The study has shifted to targeting shortnose sturgeon and is ongoing. To date, more than one hundred-fifty shortnose sturgeon have been captured. Two population estimates indicate that the river supports 1,049 (95% CI 673, 6939) and 1710 shortnose sturgeon, respectively.

While it is impossible to accurately predict the number of shortnose sturgeon in the Potomac River, the best available information suggests that the river likely supports a small population, possibly of a similar size to that of the Merrimack River with approximately 35 adults and 12 spawners in any year. As noted by Kynard 2007, shortnose sturgeon abundance in the Potomac is likely very low, with fewer adults present than in any river yet found with a sustaining population. Kynard concludes that although shortnose sturgeon are rare in the river, the long residence time and repeated seasonal use of the same summering-wintering reaches by tagged adults, suggest that they are not coastal non-natal migrants that hace merely entered the river to forage. Kynard also concludes that the data suggests that the shortnose sturgeon in the Potomac River are either a remnant of a natal Potomac River population or colonizers from another north-central river. The available genetic data indicate that if the Potomac River is these fish's natal river, they are the descendants of relatively recent colonizers from the Delaware River. Otherwise, it is likely that they are migrants from the Delaware River.

The particulars of the population dynamics and habitat use of the Potomac River population is unknown. Based on the presence of habitat in the Potomac River that is consistent with habitat used by spawning shortnose sturgeon in other river systems combined with the presence of gravid females and the documented migration of a female shortnose sturgeon to the presumed spawning grounds in the Chain Bridge-Fletcher's Landing reach, NMFS assumes that at least limited spawning occurs in the Potomac River. Due to the likely low number of adults present in the river and the periodicity between spawning (i.e., males typically spawn every 2 years and females every 3 years) it is possible that spawning does not occur every year. There is not enough information on other rivers within the Chesapeake Bay to make any assumptions about the potential for current shortnose sturgeon spawning. Without an estimate of population size and without information on historical abundance it is impossible to speculate on the stability of any Chesapeake Bay population or about the long term survival and recovery of this population. However, as there are likely very few adults in the Potomac River, the population is likely to be extremely vulnerable to the effects of catastrophic events (e.g., oil or chemical spill, weather event etc.) that affect habitat quality, prey availability or results in direct mortality of a number of individuals. Based on a consistent level of incidental capture reported via the FWS reward program since 1996 (i.e., on average one fish per year), NMFS assumes that the number of shortnose sturgeon in the Potomac River is at best stable and at worst is decreasing. Based on the best available information, NMFS assumes that the shortnose sturgeon in the Potomac River are part of a larger Chesapeake Bay- Delaware River stock and that some level of genetic exchange continues to occur between these two systems.

ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this biological opinion includes the effects of several activities that may affect the survival and recovery of the endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation generally include the following: water quality impairment, scientific research, fisheries, bridge construction, dredging, and recovery activities associated with reducing the impacts from these activities.

Federal Actions that have Undergone Formal or Early Section 7 Consultation

NMFS has undertaken several ESA Section 7 consultations to address the effects of various federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways of reducing the probability of adverse impacts of the action on listed species.

Washington Aqueduct

As explained above, previous consultations have occurred between EPA and NMFS on the operation of the Washington Aqueduct. Biological Opinions were issued by NMFS on November 2, 2002 and July 14, 2003. The November 2, 2002 Opinion was withdrawn. In the July 2003 Opinion, NMFS concluded that the issuance of NPDES permits by EPA to the ACOE was likely to adversely affect but not likely to jeopardize the continued existence of shortnose sturgeon. In this Opinion, NMFS determined that a discharge that occurs when eggs and/or larvae are present would result in direct injury and/or mortality of fish through entrapment under sediments, decreased dissolved oxygen concentrations, and adverse effects from the effluent. Other effects of a discharge on shortnose sturgeon would include the disruption of migratory movements and impaired recruitment. The July 2003 Opinion issued for this project included an Incidental Take Statement which exempted the incidental take through injury and/or mortality of all shortnose sturgeon eggs and larvae present within 144 m of Outfall 002 and 453 m of Outfalls 003 and 004. This incidental take exemption was based on the locations of the 100 mg/l TSS contour, the area in which toxic effects from dissolved aluminum would be present, and the depositional footprint of the sediment plume.

As no discharges have occurred during the February 15 – June 30 period since the issuance of the 2003 Opinion, no take of shortnose sturgeon has occurred as a result of the operation of the Aqueduct.

Chesapeake Bay Specific Water Quality Criteria
In 2004, EPA issued recommended water quality criteria for dissolved oxygen, water clarity and chlorophyll *a* pursuant to the Chesapeake Bay Program's statutory mandate under Section 117(b)(2)(B) of the CWA. NMFS concluded consultation with EPA on the effects of the water quality criteria in a Biological Opinion dated April 14, 2004. The Opinion assessed the impacts of these aquatic life criteria for several different designated uses. For the designated uses that overlap with the action area for this consultation, no adverse effects were anticipated.

Scientific Research Permits
Currently, two valid research permits for shortnose sturgeon in the Potomac River are in place. Permit No. 1444, issued in June 2004 to Mr. Mike Mangold of the FWS Maryland Fisheries Resource Office authorizes the capture, handling, genetic sampling, and tagging of 50 adult and juvenile shortnose sturgeon annually. Floy T-bar and CART tagging, is authorized for a subset of the captured fish (20). The permit also authorizes the capture of 2,500 early life stage shortnose sturgeon (i.e., eggs or larvae). A Biological Opinion was completed on the issuance of this permit which concluded that this action may adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon. Adverse effects were limited to the capture, handling, sampling and tagging of adult and juvenile shortnose sturgeon and the lethal removal of eggs and larvae. This permit is valid for five years and expires on July 31, 2009. To date, only 1 adult shortnose sturgeon has been captured via sampling conducted under this permit. No early life stages of shortnose sturgeon have been captured.

Permit No. 1549, issued in February 2007 to Dr. Boyd Kynard of the US Geological Survey's S.O. Conte Anadromous Fish Research Center authorizes the lethal removal and transport of 1,000 fertilized shortnose sturgeon eggs from the Potomac River. This authorization may be used once during the five year life of the permit. A Biological Opinion was completed on the issuance of this permit which concluded that this action may adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon. In the Potomac River, adverse effects were limited to the lethal removal of fertilized eggs. This permit is valid for 5 years and is set to expire in February 2012. To date, no shortnose sturgeon eggs have been captured or removed via sampling conducted under this permit.

Other Federal Actions in the Action Area

In-water construction
NMFS has completed several informal consultations on effects of in-water construction activities in the Potomac River permitted by the US Army Corps of Engineers and the Federal Highway Administration. This includes several consultations conducted on the effects of the replacement of the Woodrow Wilson Bridge. No interactions with shortnose sturgeon have been reported in association with any of these projects.

Dredging
Maintenance dredging of federal navigation channels can adversely affect shortnose sturgeon

populations. In particular, hydraulic dredges (e.g., hopper and pipeline) have been documented to lethally harm sturgeon by entraining fish in the dredge dragarms and impeller pumps; however, shortnose and Atlantic sturgeon have also captured in mechanical dredges. The ACOE previously consulted with NMFS on the effects of dredging the Potomac River Federal Navigation Channel. Consultation was concluded on July 8, 1999 with NMFS finding that the project was not likely to adversely affect listed species under the jurisdiction of NMFS. The ACOE completed maintenance dredging of the Potomac River Federal Navigation Channel on February 8, 2000. During this dredging iteration the only portions of the project that were dredged were the Alexandria waterfront, the Hunting Creek Channel, and the Mattawoman Bar. These sites are approximately 16 miles downstream of the Aqueduct outfalls. These areas were dredged to a depth of 24 feet plus one-foot allowable overdepth and a width of 200 feet. Approximately 970,000 cubic yards of material was removed via mechanical dredging and was placed in the Gunston Cove disposal site. No interactions with shortnose sturgeon were observed during dredging.

NMFS has also completed several informal consultations on effects of private dredging projects permitted by the US Army Corps of Engineers. All of the dredging was with a mechanical dredge. No interactions with shortnose sturgeon have been reported in association with any of these projects.

NPDES Permits
NMFS has completed several informal consultations with EPA on effects of the issuance of NPDES permits by EPA. The facilities on which consultation has been conducted include: the Budget Rent A Car facility, JFK Center for the Performing Arts, Blue Plains Waste Water Treatment Plant, and the Mississippi Ave Pumping Station among others. NMFS has also completed consultation on EPA's approval of the District of Columbia's and the State of Maryland's water quality criteria. All of these consultations concluded that effects to shortnose sturgeon from the discharge of pollutants in the amounts authorized by the NPDES permits were insignificant and/or discountable. As such, NMFS concluded in each consultation that the action under consideration was not likely to adversely affect shortnose sturgeon.

FWS Reward Program for Atlantic Sturgeon
As explained above, the incidental capture of 11 shortnose sturgeon in the Potomac River has been reported via the FWS Atlantic Sturgeon Reward Program. As a result of techniques associated with this program, these sturgeon have been subjected to capturing, handling, tagging, and genetic sampling. However, while the Atlantic sturgeon reward program covers the waters within the action area for this consultation, none of these captures to date have occurred within the action area.

Non-Federally Regulated Actions

Fisheries
Shortnose sturgeon are taken incidentally in anadromous fisheries along the East coast and may

be targeted by poachers (NMFS 1998). Historically, the Chesapeake Bay and its tributaries supported a large, very productive commercial fishery for shortnose and Atlantic sturgeon. However, by the early 1900's, overfishing, pollution, and the construction of dams in several of the tributaries to the Bay resulted in a significant decline in both populations. Few shortnose or Atlantic sturgeon were reported as bycatch in Chesapeake Bay fisheries during the mid to late 1900's. Until the FWS Atlantic Sturgeon Reward Program documented a shortnose sturgeon in 1996 in the Potomac River, it was generally thought that this species had been extirpated from the Chesapeake Bay.

Shortnose sturgeon have been taken incidentally in fisheries in the Chesapeake Bay and its tidal tributaries. Of the 73 shortnose sturgeon incidentally reported via the FWS Atlantic sturgeon reward program, 26 were taken in poundnets, 12 in fyke nets, 23 in gill nets, 9 in catfish traps, 1 in an eel pot, 1 with hook and line, and 1 in a hoop net. It is possible that shortnose sturgeon are subject to additional unreported incidental takes in similar gear types that are set throughout the action area. As evidenced by the FWS reward program, the incidental take of shortnose sturgeon in the Chesapeake Bay and its tributaries has been documented in both commercial and recreational fisheries. While fisheries that have been documented to interact with shortnose sturgeon occur in the action area, to date no interactions with this species have been recorded in the action area.

Other Potential Sources of Impacts in the Action Area

Contaminants and Water Quality

Contaminants including heavy metals, polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs), can have serious, deleterious effects on aquatic life and are associated with the production of acute lesions, growth retardation, and reproductive impairment (Ruelle and Keenlyne 1993). Contaminants introduced into the water column or through the food chain, eventually become associated with the benthos where bottom dwelling species like shortnose sturgeon are particularly vulnerable.

Several characteristics of shortnose sturgeon life history including long life span, extended residence in estuarine habitats, and being a benthic omnivore, predispose this species to long term, repeated exposure to environmental contaminants and bioaccumulation of toxicants (Dadswell 1979).

Although there is little information available on the levels of contaminants in shortnose sturgeon tissues, some research on other related species indicates that concern about the effects of contaminants on the health of sturgeon populations is warranted. Detectable levels of chlordane, DDE (1,1-dichloro-2, 2-bis(p-chlorophenyl)ethylene), DDT (dichlorodiphenyl-trichloroethane), and dieldrin, and elevated levels of PCBs, cadmium, mercury, and selenium were found in pallid sturgeon tissue from the Missouri River (Ruelle and Henry 1994). These compounds were found in high enough levels to suggest they may be causing reproductive failure and/or increased physiological stress (Ruelle and Henry 1994). In addition to compiling data on contaminant levels, Ruelle and Henry (1994) also determined that heavy metals and organochlorine compounds (i.e., PCBs) accumulate in fat tissues. Available data suggest that early life stages of fish are more susceptible to environmental and pollutant stress than older life stages (Rosenthal and Alderdice 1976). Although there have not been any studies to assess the impact of contaminants on shortnose sturgeon, elevated levels of environmental contaminants, including chlorinated hydrocarbons, in several other fish species are associated with reproductive impairment (Cameron et al. 1992; Longwell et al. 1992), reduced egg viability (Von Westernhagen et al. 1981; Hansen 1985; Mac and Edsall 1991), and reduced survival of larval fish (Berlin et al. 1981; Giesy et al. 1986). Some researchers have speculated that PCBs may reduce the shortnose sturgeon's resistance to fin rot (Dovel et al. 1992). PCBs may also contribute to a decreased immunity to fin rot. In other fish species, reproductive impairment, reduced egg viability, and reduced survival of larval fish are associated with elevated levels of environmental contaminants including chlorinated hydrocarbons. A strong correlation that has been made between fish weight, fish fork length, and DDE concentration in pallid sturgeon livers indicates that DDE increase proportionally with fish size (NMFS 1998).

Point source discharges (e.g., municipal wastewater, industrial or power plant cooling water or waste water) and compounds associated with discharges (i.e., metals, dioxins, dissolved solids, phenols, and hydrocarbons) contribute to poor water quality and may also impact the health of sturgeon populations. The compounds associated with discharges can alter the pH of receiving waters, which may lead to mortality, changes in fish behavior, deformations, and reduced egg production and survival. Concentrated amounts of suspended solids discharged into a river system may lead to smothering of fish eggs and larvae and may result in a reduction in the amount of available dissolved oxygen.

According to the DC Water and Sewer Authority (WASA)(2000), the majority of point sources (e.g., wastewater treatment plants and industrial discharges) discharging directly to Potomac tidal waters are located in the DC metropolitan area. Due to the high rate of population growth in this area, organic carbon loads from wastewater more than tripled between 1913 and 1944 (WASA 2000). However, better treatment led to a 91% reduction over the next 40 years, and loads are now at pre-1913 levels. Section 305(b) of the CWA requires that states prepare a list biennially of the navigable waterbodies under their jurisdiction. This list describes the water quality in the navigable waterbody and provides an analysis of the extent to which all navigable waters of such State provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. The 2000 *305(b) Potomac River Assessment* divides the DC portion of the Potomac River into three segments: segment 01- Hains Point to the Woodrow Wilson Bridge, segment 02- Key Bridge to Hains Point, and segment 03- Chain Bridge to Key Bridge. The Washington Aqueduct Outfalls 002, 003, and 004 are in the vicinity of segment 03. In the 305(b) assessment, the DC Department of Health (DOH) indicates that the overall use support, which includes waters considered to be safe for humans to swim and from which it is safe to consume fish, in each of the three segments is not supported due to pH, pathogens, and total toxics. The non-attainment sources are considered to be municipal point sources, urban runoff/storm sewer, natural sources, combined sewer overflows (CSO), and other urban runoff. The aquatic life support, however, is fully supported for each of the three segments, which indicates that the dissolved oxygen concentrations, pH, and temperature ranges in each segment are adequate to sustain various aquatic life.

Surveys conducted by DC DOH in segment 03 (an area which encompasses the region immediately below Washington Aqueduct Outfalls 002 through 004 and overlaps with a portion of the action area), revealed the presence of toxics in the sediment. Fish tissue samples for some species showed elevated levels of contaminants including chlordane and PCBs. Biological samples from selected sites in this segment, suggest that the benthic community is severely stressed, and this stressed condition may be attributed to urban storm water runoff from upstream and polluted streams, CSO events, Aqueduct discharges, and impacts from adjacent industrial facilities.

An analysis of 19 years (1980-1999) of background levels of TSS in the action area (measured at Little Falls, at approximately rkm 190), indicated that the median suspended sediment load in the Potomac River was 218,000 kg/day (EA 2001). The average daily turbidity level in the Potomac is 150 NTUS (FHWA 2003).

Concentrations of chemical contaminants are reported to be high in areas where shortnose sturgeon have been documented (Litwiler 2001). The results of a sediment study conducted on sections of the Potomac and Anacostia (runs through Washington D.C.) rivers indicated high levels of lead, cadmium, and zinc, as well as PAHs, PCBs, chlordanes, and DDT in many areas (CBP 1993). A striped bass contaminant study conducted by the USFWS from 1984 to 1990 found that concentrations of cadmium, chromium, copper, lead, nickel, and zinc in the Potomac River exceeded water quality standards (CBP 1994).

While no studies of contaminant levels of shortnose sturgeon in the action area have been conducted, shortnose sturgeon in other river systems (Hudson, Delaware and Kennebec) have been demonstrated to carry significant contaminant loads and it likely that shortnose sturgeon occurring in the action area are exposed to contaminants and may be affected by this exposure. It is possible that the presence of contaminants in the action area may have adversely affected shortnose sturgeon abundance, reproductive success and survival.

Barriers to Fish Passage

The Little Falls Dam was built on the Potomac River in 1959 and prevented diadromous fish such as American shad and blueback herring from moving to spawning areas located upstream of the Dam. However, as the natural limit to upstream movement of shortnose sturgeon is located below the Little Falls Dam, the Dam is not thought to impede shortnose sturgeon movements within the action area or within the Potomac River as a whole.

Summary and Synthesis of the Status of the Species and Environmental Baseline

Impacts from actions occurring in the Environmental Baseline for the action area have the potential to impact shortnose sturgeon. Despite regulations on fisheries actions and improvements in water quality, shortnose sturgeon still face numerous threats in this area, primarily from poor water quality, habitat alteration and interactions with fishing gear.

As explained above, shortnose sturgeon in the Potomac River are considered to be part of a larger Chesapeake Bay-Delaware River complex. Within this complex, shortnose sturgeon are assumed to be spawning in at least the Delaware and Potomac Rivers, with some level of historic and current exchange between the two rivers. Without more information on the status of shortnose sturgeon in the Potomac River and the Chesapeake Bay, including reliable population estimates and information on the origin of fish caught in the Potomac River, it is difficult to speculate about the status of these populations. However, the best available information has led NMFS to make the determinations about species status as stated below.

No population estimate for shortnose sturgeon in the Penobscot River exists; however, 12 shortnose sturgeon have been captured in the river since 1996 and 2 adult females are actively being tracked within the river. The population of shortnose sturgeon in the Potomac River is likely small and may be similar in size to that in the Merrimack River in Massachusetts (approximately 35 adults). The particulars of the population dynamics of the Potomac River population are unknown. Information on habitat use is limited; however, it is consistent with what is known about shortnose sturgeon in other river systems and is not expected to change with a larger sample size. Without an estimate of population size and without information on historical abundance it is impossible to speculate on the stability of the population or about the long term survival and recovery of this population. However, as it is likely a very small population it may be vulnerable to the effects of catastrophic events (e.g., oil or chemical spill, weather event etc.) that affect habitat quality, prey availability or result in direct mortality of a number of individuals. Based on the consistent number of shortnose sturgeon reported in the Potomac River via the FWS reward program between 1996-2008 (approximately 1 fish per year), NMFS assumes that this population is at best stable and at worst is decreasing.

While no reliable estimate of the size of either the shortnose sturgeon population in the Northeastern US or of the species throughout its range exists, it is clearly below the size that could be supported if the threats to shortnose sturgeon were removed. Based on the number of adults in population for which estimates are available, there are at least 104,662 adult shortnose sturgeon, including 18,000 in the Saint John River in Canada. Based on the best available information, NMFS believes that the status of shortnose sturgeon throughout their range is at best stable, with gains in populations such as the Hudson, Delaware and Kennebec offsetting the continued decline of southern river populations, and at worst declining.

EFFECTS OF THE ACTION

This section of an Opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). This Opinion examines the likely effects (direct and indirect) of the proposed action on the shortnose sturgeon in the Potomac River and their habitat within the context of the species current status, the environmental baseline and cumulative effects.

The biology of shortnose sturgeon complicates the assessment of shortnose sturgeon movement and impacts to the species, as these fish have a long life span, delayed sexual maturity and non-annual spawning behavior (Buckley and Kynard 1985). For instance, migration patterns that are observed during one year are not always seen in consecutive years because mature adults will not return to the spawning site each year. Additionally, in many river systems, the species is very particular in habitat use and only found in discrete regions of the river system.

Shortnose sturgeon in the Action Area
Adult shortnose sturgeon are expected to be in the action area during the spring of each year while spawning. This is expected to coincide with the time period when water temperatures are between 8 and 15°C, although some adults may still be present when water temperatures are as high as 18°C. The adult shortnose sturgeon that are present are expected to spawn in the action area, likely between rkm 187 (Chain Bridge) and rkm 184.5 (Fletchers Landing) and return rapidly downstream into the tidal river after spawning. These determinations are supported by information on the typical movements of shortnose sturgeon in other river systems (summarized in NMFS 1998) and the tracking study completed by Kynard (2007). While eggs are expected to be restricted to the spawning grounds due to their demersal and adhesive qualities, larval shortnose sturgeon are expected to occur throughout the action area for several weeks following the spawning period. No estimates on the number of shortnose sturgeon that typically spawn in the action area is known and therefore no estimate of the number of eggs or larval sturgeon expected in the action area can be made.

Based on water temperature data in the action area from 2004-2007, water temperatures are expected to be between 8 and 15°C for several days between March 20 and April 23 each year (Kynard 2007). Temperatures typically reach 18°C by May 15. As explained above, shortnose sturgeon have been documented to spawn between 8 and 18°C. Shortnose sturgeon eggs generally hatch after approximately 9-12 days (Buckley and Kynard 1981). The larvae are photonegative, remaining on the bottom for several days. Larvae are expected to begin swimming downstream at 9-14 days old (Richmond and Kynard 1995). Larvae are expected to be less than 20mm TL at this time (Richmond and Kynard 1995). This initial downstream migration generally lasts two to three days (Richmond and Kynard 1995). Studies (Kynard and Horgan 2002) suggest that larvae move approximately 7.5km/day during this initial 2 to 3 day migration. In the Potomac River, this would bring larvae outside the action area within the first day of migration. Based on this information, adult shortnose sturgeon are likely to occur within the action area between March 20 and May 15 of any year. Depending on the date of spawning, eggs may be present from March 20 through May 27 (i.e., 12 days after the last day of spawning) and larvae may be present from March 29 (i.e., 9 days after the earliest spawning) through June 11 (i.e., 14 days after the last day off egg hatching). It is important to note that while in any given year these various life stages may be present in the action area between March 20 and June 11, there is typically only about 33 days a year when shortnose sturgeon of any life stage are likely to be present in the action area; this is due to the fact that spawning takes place over less than a week and all larvae are expected to swim away from the action area within 26 days of spawning,

Effects to Shortnose Sturgeon

In this section, the effects of the action on shortnose sturgeon pertain to the impacts from discharges occurring between the time the revised NPDES permit is issued (expected to occur in the Fall of 2008) through the time that the residuals processing facility is operational and discharges from the settling basins cease (mandated to occur by November 30, 2010). As explained above, discharges are prohibited from occurring during the spring spawning season (February 15 – June 30), as defined in Special Condition A1 of the proposed permit. However, as explained in the "Description of the Action" section above (see page 12), the Director of the EPA may approve a bypass during that time period should certain conditions be met. A spawning season discharge is expected to be a rare event not occurring more than once every five years. In preparation for this consultation, EPA and ACOE have stated that a spring discharge would only occur if the integrity of the drinking water supply for the Customers was threatened by an inability to clean and discharge from one of the basins or if the failure to conduct a discharge would otherwise threaten life or property. EPA and ACOE have indicated that as the conditions that would necessitate a spring spawning season discharge are rare, it is extremely unlikely that such a discharge would occur more than once between the time the 2008 NPDES permit is issued and the time the residual processing facility is operational (i.e., November 30, 2010). The operational history of the Washington Aqueduct since the prohibition on a spawning season discharge was implemented in 2003 supports this position. Since the prohibition to discharge during the February 15- June 30 time period was enacted in 2003, no spawning season discharges have occurred. As residual solids will not be discharged to the river after the residuals processing facility is operational, there will be no potential for a spring spawning season discharge after that time. As such, for the purposes of this consultation, NMFS will consider the effects of a spawning season discharge occurring in either 2009 or 2010.

As the effects to shortnose sturgeon from a non-spawning season discharge and a spawning-season discharge are different, the effects of a discharge during these two time periods will be discussed separately below. Following the discussion of the effects of discharges related to the cleaning of the basins is a discussion of the effects of other discharges associated with the operation of the Aqueduct (i.e., discharges from outfalls 006-009).

Spawning season discharge – Georgetown and Dalecarlia basins

As noted above, a discharge during the spawning season is generally prohibited, but may be authorized under certain circumstances. The EPA and ACOE have indicated that these circumstances are only likely to occur no more than once every five years. If a discharge was authorized during the prohibited period, it would likely only be from one basin. As other situations (i.e., discharges from more than one basin at a time, multiple discharges occurring during the spring spawning season, or discharges occurring in successive spawning seasons) are not reasonably likely to occur, this section will only consider the effects of the cleaning and subsequent discharge from one basin during one spawning season. As it is impossible to predict which basin will need to be cleaned, this section will consider it equally probable that a discharge could occur from any of the basins, and therefore from any of the three outfalls. As no discharges from these basins will be authorized following the completion of the residuals processing facility in 2010, this section will consider the effects of a spawning season discharge occurring from one basin in either 2009 or 2010.

As explained above, various life stages of shortnose sturgeon are likely to be present in the action area for approximately 33 days between March 20 and June 15. A discharge occurring during this time period could affect shortnose sturgeon in the following ways: disrupting and/or delaying spawning by adults; smothering or burying eggs and/or larvae; and, exposing shortnose sturgeon to potentially toxic effects of the discharge.

Effects to Spawning Adults

The discharge of residual solids and associated water from one of the basins during the spring spawning season could affect the movements and behaviors of adult shortnose sturgeon. This would only occur if the discharge occurred just prior to or during the time when shortnose sturgeon were moving to the spawning grounds and actually spawning. As explained previously, these behaviors take place when water temperatures are between 8 and 18°C, with the majority of spawning taking place before water temperatures reach 15°C. These temperatures typically occur in the Potomac River between March 20 and April 23 (May 15 for 18°C) each year and spawning occurs over a 3-6 day period during that time. As such, only a discharge occurring between March 20 and May 15 has the potential to affect the movement and behavior of adult shortnose sturgeon as no adult shortnose sturgeon are likely to occur within the action area outside of this time of year. Spawning adults are expected to be moving to spawn in the area between Little Falls Dam and Fletchers Landing, a stretch of river approximately 5 km long.

Seasonal floods and changes in temperature, velocity, and turbidity may all be cues in triggering spawning in shortnose sturgeon. As such, the suspended sediment plumes, changes in ambient river temperature, and alterations in the flow rates resulting from an Aqueduct discharge could interfere with adult shortnose sturgeon migratory movements and spawning behavior. Shortnose sturgeon typically spawn over less than 7 days during the period when water temperatures are between 8- 15°C. However, Kynard (1997) found that in 1994, when high river flows delayed spawning, shortnose sturgeon had the physiological flexibility to spawn successfully at 18°C. Therefore, disruptions in shortnose sturgeon spawning behavior directly related to changes in the ambient river temperature and velocities are expected to be limited as shortnose sturgeon have some ability to delay spawning until temperature and velocity conditions are appropriate.

Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580mg/L to 700,000mg/L depending on species. Studies with striped bass adults showed that pre-spawners did not avoid concentrations of 954 to 1,920 mg/L to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton 1993). While there have been no directed studies on the effects of TSS on shortnose sturgeon, shortnose sturgeon juveniles and adults are often documented in turbid water and Dadswell (1984) reports that shortnose sturgeon are more active under lowered light conditions, such as those in turbid waters. As such, shortnose sturgeon are assumed to be as least as tolerant to suspended sediment as other estuarine fish such as striped bass.

NMFS has considered the potential for a spawning season discharge to result in the abandonment of spawning by spawning adults. Studies have demonstrated that short-term pulses in turbidity can trigger alarm reactions in fish (Wilber and Clarke 2001). The available information suggests that while the rapid change in turbidity associated with a basin cleaning discharge,could result in fish abandoning a spawning run and returning to downstream reaches of the river, this is highly unlikely to occur as adult fish are relatively tolerant of elevated turbidity levels and only a small portion of the river would experience elevated turbidity levels. Additionally, as noted above, shortnose sturgeon have some flexibility in the timing of spawning and may be able to delay spawning for a short period of time. In order for the spawning run to be abandoned due to a discharge from the Aqueduct, the timing of the discharge would have to be exactly correlated to the short period of time when spawning occurs, effects from the discharge would have to continue for the duration of the time when water temperatures are suitable for spawning and the entire spawning grounds would have to be affected by the discharge. As this scenario is extremely unlikely to occur, NMFS has concluded that it is unreasonable to anticipate that an entire years spawning run would be abandoned due to a spring spawning season discharge from the Aqueduct.

Without an estimate of the number of shortnose sturgeon spawning in the Potomac River it is difficult to predict the number of shortnose sturgeon attempting to spawn in any particular year. However, as individual shortnose sturgeon do not spawn each year (i.e., males spawn once every 2 years on average and females spawn once every 3 years on average), only approximately one-half to one-third of adults are likely to be on the spawning grounds each year. Depending on the suspended sediment levels and flow, a discharge occurring just prior to or during the spawning migration or during spawning could cause adult sturgeon to temporarily delay spawning. While such a delay would alter the normal behavior of individual fish, the effects would only be temporary and the number of adults spawning that year would not be reduced and therefore, the number of eggs and larvae present that year would not be reduced. As explained above, there is a low likelihood that this would occur as it would require the discharge to be timed to the exact timing of the narrow window in which spawning occurs. Further, as the plume that contains high TSS concentrations does not cover the entire river; there would be room for shortnose sturgeon to potentially avoid the disturbance.

A discharge occurring just prior to spawning or during the time when spawning is occurring could result in a reduction in the amount of available habitat for spawning by causing an increase in TSS and temporarily blanketing a portion of the river bottom with sediment. However, as shortnose sturgeon are only likely to spawn in the area between Little Falls Dam and Fletchers Landing, only a discharge from Outfall 002 would effect the area where spawning is likely to occur. Effects to the bottom from a discharge from Outfall 002 are expected to extend no further than 340m (see full explanation below) from the outfall, which is equivalent to approximately 7% of the river between Little Falls Dam and Fletchers Landing. Therefore, only a small portion of the available spawning habitat would experience adverse levels of turbidity or sediment deposition and at least 4.5km of spawning habitat would remain available. As such, while a discharge could cause individual adult shortnose sturgeon to alter their normal movements, there is not expected to be any reduction in the amount of spawning or in the number of eggs or larvae.

Smothering or burying eggs and/or larvae
The discharge of residual solids and associated water from one of the basins during the spring spawning season could affect any eggs or larvae present in the action area. This would only occur if the discharge occurred during the limited time when eggs and/or larvae are present. As explained previously, eggs are likely to be present for less than 20 days between March 20 through May 27 and larvae are likely to be present for less than 21 days between March 29 and June 11. These time frames coincide with the 9-12 day post-spawning incubation period for eggs and the 9-14 day post-hatching residence period for larvae. As such, only a discharge occurring between March 20 and June 11 has the potential to affect eggs or larvae as these life stages are only likely to occur within the action area during this time of year. Eggs and larvae present within the action area when a discharge occurred would be vulnerable to burial/entrapment and/or smothering resulting from a decrease in the availability of dissolved oxygen.

As stated previously, the action area experiences naturally high levels of suspended sediment. Records of TSS (measured at Little Falls upstream of the Aqueduct outfalls) covering a period of almost 20 years (1980-1999) indicated that the median suspended load in the Potomac River was 218,000 kg/day. A representative discharge event from Dalecarlia Outfall 002 (May 25, 2000) released approximately 17,800 kg of solids. This value is exceeded on 90 percent of the days each year by the daily mass of solids in the Potomac River which pass Little Falls. The May 3, 2000 discharge event from the Georgetown Reservoir released an estimated 153,600 kg of solids. This solids loading from the Georgetown Reservoir is exceeded on 55 to 60 percent of the days each year by the daily mass of solids passing Little Falls.

The modeling results from the Water Quality Studies showed deposition of some sediment in the river following a discharge. The rapid decrease in TSS concentrations downstream from the outfalls are also indicative of sediment deposition (EA Engineering, Science and Technology, Inc. 2001). The Water Quality Studies indicate that the majority of the suspended solids fall to the substrate within a relatively short distance of the discharge outfall. Therefore, during a spring discharge, incubating eggs and non-motile larvae within that region may be covered by sediment and may suffer mortality from entrapment within sediments and reduced dissolved oxygen concentrations.

Studies have been conducted on the effects of sediment deposited on demersal fish eggs. These studies have examined the smothering effect of the sediment and entrapment of larvae beneath the sediment layer. Morgan et al. (1973) found that the deposition of sediments on recently spawned white perch eggs (diameter 0.90 mm), which like shortnose sturgeon eggs are adhesive and demersal, may have more significant effects on eggs than suspended sediment. They determined that blanketing of the eggs by sediment greater than 2 mm in thickness (a covering of 1.2 mm over the top of the egg) resulted in 100 percent mortality; and 50 percent of the eggs died when the sediment thickness was 0.5 to 1.0 mm (Morgan et al. 1973). Researchers also found that the developmental rates of white perch eggs were lowered significantly at a sediment thickness of over 0.8 mm. Bjornn and Reisser concluded that emergence of coho salmon sac fry may be impeded by sediments of 2-6.4 mm in percentages above approximately 10 percent (Bjornn and Reisser 1991 in Waters 1995). Coho salmon eggs are larger than shortnose sturgeon eggs having a diameter of 4.5-6.0 mm and 3.0-3.2 mm, respectively. It is reasonable to expect that sediment deposited in excess of 2 mm will result in a higher degree of shortnose sturgeon egg mortality, as they are smaller than the coho salmon eggs. Because shortnose sturgeon eggs are demersal and adhesive, mortality is expected to result from entrapment of emerging larvae. Also, shortnose sturgeon larvae are photonegative and unable to swim for several days following hatching and therefore, remain on the bottom. Thus, this life stage is also susceptible to smothering by deposited sediments.

High concentrations of suspended sediments may lead to reduced dissolved oxygen concentrations, which result when organic material in sediment is released into the water column stimulating oxygen consuming bacteria (Burton 1993). As such, suspended sediment may affect fish resources. Sherk et al. (1975) conducted research on the impacts of elevated levels of suspended sediments and found species tolerance ranged from 580 mg/l to 24,500 mg/l. Sherk et al. (1975) also suggested that substantial alterations of striped bass movement as a result of high turbidity were unlikely because striped bass are prolific in estuaries, which are fairly turbid environments (Sherk et al. 1975). Research conducted on other species indicates that certain levels of suspended sediments may be lethal and/or inhibit normal behavior. In extreme cases, exposure to high concentrations has resulted in fish kills due to sediment saturation of the gills (Muncy et al. 1979 in Burton 1993). Surveys on striped bass conducted by Radtke and Turner (1967) found that suspended sediment concentrations as low as 350 mg/l blocked upstream migrations. Vinyard and O'Brien (1976) found reduced activity among largemouth bass and green sunfish exposed to turbidity levels of 14-16 NTUs (Heimstra et al. 1969 in Burton 1993). Wilbur and Clarke (2001) found that short-term pulses (rapid increases within an hour) of suspended sediment concentrations disrupt feeding behavior and the dominance hierarchies in juvenile coho salmon (*Oncorhynchus kisutch*) and also trigger alarm reactions that potentially result in fish relocating downstream from the disturbance. In a laboratory study, rainbow smelt (*Osmerus mordax*) showed increased swimming behavior which is indicative of an alarm reaction when exposed to suspended sediment concentrations of 10 mg/l or higher (Wilbur and Clarke 2001).

Several studies have examined the effects of suspended solids on fish larvae. Observations in the

Delaware River indicated that larval populations may be affected when suspended material settles out of the water column (Hastings 1983). Larval survival studies conducted by Auld and Schubel (1978) showed that striped bass larvae tolerated 50 mg/l and 100 mg/l suspended sediment concentrations and that survival was significantly reduced at 1000 mg/l. According to Wilber and Clarke (2001), hatching is delayed for striped bass and white perch eggs exposed for one day to sediment concentrations of 800 and 100 mg/l, respectively.

In a study on the effects of suspended sediment on white perch and striped bass eggs and larvae performed by the ACOE (Morgan et al. 1973), researchers found that sediment began to adhere to the eggs when sediment levels of over 1000 parts per million (ppm) were reached. Researchers have speculated that sediment and flocculants present in the water from an Aqueduct discharge would detract from the adhesiveness of freshly fertilized shortnose sturgeon spawn (Pers. Comm. John O'Herron, 2002). If adhesiveness is affected, the eggs are likely to drift with the water currents rather than settling in the crevices of rocks and adhering to the substrate. Drifting spawn are more susceptible to predation and can be expected to experience poorer survival compared to adhesive, hidden eggs.

According to EA Engineering, Science and Technology, Inc. (2001), exposure to TSS levels of 100 mg/l appears to be a conservative threshold for effects on some species. The best available information (presented above) is consistent with this conclusion. Eggs and larvae exposed to sediment levels less than 100mg/L are not likely to be adversely affected. Based on the modeled TSS concentrations during discharge events, TSS concentrations in the water column exceeded the 100 mg/l threshold only very near the outfalls (see below).

In December 2002, a supplemental modeling study was produced by EA Engineering at the request of EPA Region 3 to demonstrate the sensitivity of the predicted sediment transport and deposition scenarios to sediment characteristics (including particle class, shear stress for deposition, and settling velocity). As a result of technical discussions with EPA staff, model scenarios were performed using alternate particle characteristics including:

- a lower depositional shear stress,
- a settling velocity with a concentration dependence,
- a refined model grid.

The results from these studies were presented in EA Engineering's December 2002 Supplemental Modeling report. For both Dalecarlia Outfall 002 and Georgetown Outall 003, model scenarios were performed using the alternate particle characteristics for both the original particle classification, and for an alternate particle classification. The particle classifications used in the original modeling were sand, floc, and silt. The alternate particle classification used only two classifications for sand and a cohesive particle. Resulting plume lengths for water column TSS and sediment deposition are provided in Table 2 (Appendix B). The table includes dimensional results for three scenarios:

1) The original model results provided in EA's October 2002 memo
2) Alternate 1 – Original particle classification with the alternate particle characteristic,
3) Alternate 2 – Alternate particle classification with alternate particle characteristics.

The scenarios examined correspond to flow conditions discussed in the Washington Aqueduct's 2003 permit, which are consistent with the flows in the current proposed permit. These Potomac River flows are 800 mgd for Outfall 002; and 1,500 mgd for Outfall 003. For each model scenario, plume contours for TSS and sediment deposition were evaluated. TSS was examined at a time corresponding to the end of the discharge event, and represents maximum plume build-up before the plume begins to dissipate. It is also important to understand that background TSS concentrations during these events are approximately 6-8 mg/l, and that the values reported are net values above the background concentration. Sediment deposition was examined at the end of the model run, after all water column TSS had either settled or passed beyond the downstream model boundary.

The modeling results, which are considered to be the best available information, indicate that for a discharge from outfall 002 resulting from the cleaning of a basin at Dalecarlia, TSS levels greater than 100mg/L are experienced within an area extending 144m from the outfall. For Outfalls 003 and 004 (Georgetown), TSS levels greater than 100mg/L are experienced within an area extending approximately 453m from the outfall. TSS levels of 100mg/L or higher will be persist throughout the duration of the discharge (i.e., up to 72 hours). These predictions result from utilizing the worst case information obtained during both the original modeling and the alternate modeling scenarios.

Based on the results of scientific studies on the impacts of sediment deposition on other species of fish with demersal eggs outlined above, adverse effects will be experienced by eggs and larvae in the area in which the sediment deposition exceeds 0.5mm in thickness. Adverse effects are likely to range from delayed hatching to mortality and may also include loss of adhesives which will cause the eggs to drift in the water column where they are more vulnerable to predation and less likely to successfully hatch. Demersal eggs and larvae may also experience lower dissolved oxygen and be smothered or buried which would prevent hatching or inhibit the motility of larvae. NMFS anticipates mortality of all shortnose sturgeon eggs and larvae present in the area in which the sediment deposition exceeds 2 mm in thickness.

For outfall 002, deposition of 0.5 and 1.0 mm of sediment were modeled (see Table 2 in Appendix B for complete modeling results). As the thickness of sediment is greater the closer to the outfall, the area experiencing levels of 2mm sediment will be smaller than that experiencing sediment of 1mm thick. In the worst case scenario, an area extending less than 340m from outfall 002 is expected to experience sediment thickness of 0.5mm and an area extending less than 190m from outfall 002 is expected to experience sediment thickness of 2mm.

Outfall 002 discharges approximately 2km downstream of Little Falls Dam and 300 meters upstream of Chain Bridge. Kynard (2007) reported that suitable shortnose sturgeon spawning habitat was present in the vicinity of Little Falls Dam and between Chain Bridge and Fletchers Landing. Shortnose sturgeon eggs drift for a short distance before landing on the substrate and becoming adhesive. As outfall 002 is within the spawning grounds it is likely that eggs would be present in the area where sediment thicknesses exceed 0.5mm. Demersal and mobile larvae are also likely to be present within that zone. As such, in the event of a spring discharge from outfall 002, both eggs and larvae are likely to be exposed to effects of the discharge. Any eggs or larvae located within 340m of the outfall (i.e., the 0.5mm zone) would experience a loss of adhesiveness, injury, burial, suffocation and/or death. All eggs and larvae within an area less than 190m from the outfall (i.e., the 2mm zone) would be killed.

For outfall 003 and 004, depositions of 0.5, 1.0, 5 and 20 mm were modeled. The area with 2mm of sediment will fall between the area of 5 and 1 mm. In the worst case scenario, an area extending no further than 595m from the outfall is expected to experience sediment thickness of 0.5mm and an area extending no further than 516m from these outfalls will experience levels of 2mm sediment

Outfall 003 discharges approximately 900 meters downstream of Fletchers Landing and Outfall 004 discharges approximately 1.5km downstream of Fletchers Landing. Based on the determination that suitable spawning habitat does not exist downstream of Fletchers Landing (Kynard 2007) and that the area where outfalls 003 and 004 discharge to is inconsistent with areas where shortnose sturgeon eggs are expected to occur (i.e., the water is slow moving to still rather than high velocity), no eggs or demersal larvae are likely to be present in the area. However, as larvae migrate several kilometers from the spawning site, mobile larvae would likely be present in the impact zone for outfalls 003 and 004. As such, in the event of a spring discharge, larvae are likely to be exposed to effects of the discharge. Any larvae located within 595m (i.e., the 0.5mm zone) would experience a loss of adhesiveness, injury, burial, suffocation and/or death. All larvae within an area less than 516m (i.e., the 2mm zone) of the outfall would be killed.

Summary of effects to early life stages

In summary and as explained above, adverse effects (decreased growth, loss of adhesiveness, injury, burial and/or death) are expected for eggs or larvae exposed to TSS levels of 100mg/L or greater. These effects are expected only to occur in the area within 144 m of Outfall 002 and within 453 m of Outfalls 003 or 004 (see above). Adverse effects are expected for all eggs or larvae in areas where sediment deposition exceeds 0.5 mm in thickness and mortality is expected for all eggs or larvae in areas where sediment deposition exceeds 2 mm in thickness. Based on this information and the modeling results presented above, eggs and larvae located within 340m of outfall 002 and larvae present within 595m of outfalls 003 or 004 will be injured or killed. As the zone of impact where deposited sediment levels will be greater than 0.5mm is larger than that where TSS levels will be 100mg/L or greater, it is likely that any eggs or larvae located within the 0.5mm sediment deposition zone will experience a combination of adverse effects resulting from burial under the sediment and exposure to high TSS levels.

Assuming that eggs are distributed evenly over the Little Falls Dam (rkm 189.4) to Fletchers Landing (rkm 184.5) reach and that even in the worst case scenario (as modeled by EA in 2002) only eggs in an area extending approximately 340 meters from outfall 002 would be injured or killed, the result of a discharge from any of the outfalls between March 20 and June 11 would be the death of no more than 7% of the eggs spawned that year (340 meters where adverse affects would be experienced divided by 7900m total). As no eggs are likely to be present in the discharge zone for outfall 003 or 004, no eggs would be impacted by a discharge from either of these outfalls.

As larvae are mobile and migrate up to 15km from the spawning grounds, they are likely to be distributed from the Little Falls Dam (rkm 189.4) to at least rkm 170 (15km downstream from Fletchers Landing). In the worse case scenario (as modeled by EA in 2002), a discharge from outfall 002 would result in the injury or mortality of all larvae located within 340 m of the outfall and a discharge from outfall 003 or 004 would result in the injury or mortality of all larvae located within 595 meters of those outfalls. Assuming that larvae are evenly distributed between rkm 189.4 and rkm 170, the result of a discharge from any of the outfalls between March 20 and June 11 would be the death of no more than 3% of the larvae spawned that year (595 meters where adverse affects would be experienced divided by 18.9km total.

As explained throughout, a spring spawning season discharge will only occur under certain exceptional circumstances and is not likely to occur more than once between the time the 2008 NPDES permit is issued and the time when the residuals processing facility becomes operational (i.e., by November 30, 2010).

Toxic effects of the discharge
The constituents of the discharge (except for the aluminum and chlorine which are added in the water treatment process) are not contaminants or pollutants but rather constituents of the raw river water.

Effluent toxicity testing was performed on samples from the Aqueduct in order to determine the toxicity of the discharges to freshwater species. Toxicity tests were conducted on three different components of the Aqueduct effluent: whole effluent samples (for the acute toxicity tests), supernatant from the settled whole effluent (for the chronic toxicity tests), and the settled solids of the whole effluent (for the benthic tests). The water flea (*Daphnia magna*), the fathead minnow (*Pimephales promelas*), and the striped bass (*Morone saxatilis*) were used for the acute toxicity tests. Chronic toxicity tests were performed on the water flea (*Ceriodaphnia dubia*), fathead minnow, and a freshwater algae (*Selenastrum capricornutum*). Test organisms were continuously exposed in the laboratory test for a period of two to ten days (depending on the test) while actual water column exposure in the Potomac, under the conditions specified in the NPDES permit, is expected to be transient, lasting approximately eight hours.

In a study entitled "Assessing contaminant sensitivity of American shad, Atlantic sturgeon, and shortnose sturgeon" (Dwyer et al. 2000), during acute toxicity tests (96-hour Lethal

Concentration (LC) 50), researchers found that both species of sturgeon were somewhat more sensitive to contaminant exposure than are rainbow trout. In this study, Atlantic sturgeon were found to be the most sensitive species studied while shortnose sturgeon were the second most sensitive species (Dwyer et al. 2000). In a second assessment, involving 96-hour water renewal toxicity tests, results indicated that the fathead minnow survival test appears to be a reliable estimator of effects to American shad and Atlantic sturgeon. As Atlantic sturgeon appeared to be slightly more sensitive to most contaminants than shortnose sturgeon, and without results to the contrary, the fathead minnow survival test is assumed to be a reliable estimator for the effects to shortnose sturgeon as well. It is important to note that during this study, high rates of mortality occurred with the controls and therefore, these results are not conclusive.

While the toxic effects of the Aqueduct discharges on shortnose sturgeon have not been assessed, the fathead minnow was used as a test organism, and this species appears to be a reliable estimator of the effects to shortnose sturgeon (Dwyer et al. 2000). Therefore, for the purposes of this analysis and in the absence of direct data to the contrary, NMFS considers the results of the toxicity tests for fathead minnow to be a reasonable surrogate for toxicity tests on shortnose sturgeon.

Results indicated that with one exception the whole effluent samples were not acutely toxic to the test organisms. One fathead minnow test showed dose-related toxicity, which resulted in a 96-hour LC50 value of 67.6 percent effluent. The chronic toxicity test results indicated that in two of the four rounds, the effluent was not chronically toxic. In addition, 7-day chronic effluent toxicity tests which were conducted in 1992 by Dynamac showed that the effluent released from the sampled sedimentation basins had no effect on either mortality or growth of the fathead minnows. This result was consistent with observations of fathead minnows living in the sedimentation basins.

Additional toxicity testing has occurred annually since 2004. The test procedures were developed with the assistance of NMFS. Results from 2004-2007 are currently available. These results indicate that there would be no instream chronic toxicity to any aquatic organisms in the receiving waters. Solid phase toxicity testing has also occurred. Ten-day survival values were determined for Hyalella (an amphidod). Survival ranged from 85-99% in the highest exposure concentration tested and was not significantly different from controls. In 2004, growth was reduced relative to controls. This reduction is believed to result from the floc layers which reduces access to food particles rather than resulting from toxic effects of the discharge. This reduction in growth was seen consistently each year. Toxicity testing of Potomac River sediments from above and below Outfalls 002 and 003 was conducted in 2004 and 2005. Tests with H. axteca revealed that there was no significant mortality in any of the four test treatments as compared to the control (95-99% survival). In addition, growth data showed no significantly significant difference between any of the test treatments and the control. This more recent data is consistent with previously available information which indicates that the effluent is not chronically toxic.

The toxicity of aluminum is known to be dependent on pH levels and the presence of other compounds and may vary depending upon environmental conditions and the presence of the dissolved form of the metals (Sutherland 1999). Sutherland (1999) reports that studies with juvenile striped bass have indicated that this species is very sensitive to several forms of aqueous aluminum. Studies indicate that aluminum toxicity varies depending on the surrounding environmental conditions. Polymers created from aluminum and water collect on gills thereby limiting respiration (Sutherland 1999). Changes in the polymerization process occur when waters with different pH, temperature, and ionic strength are mixed or when wastewater is discharged into a river system (Sutherland 1999).

The dissolved form of aluminum is believed to be more toxic than the total form of aluminum. Toxicity test results demonstrate that total aluminum concentrations for the Dalecarlia and Georgetown basins averaged 2,273 and 1,510 mg/l respectively, for the period from 1997 - 2001. EPA's October 21, 2002, sampling found total aluminum at 983,000 ug/L (983 mg/l). The EPA 1988 aluminum criteria document lists LC50 concentrations for several fish species ranging from 3,600 to 50,000 ug/L. However, during a typical 3.5 hour discharge event, these concentrations will exist in a small area for a very short period of time. Further, LC50 values for fish are based on a 96 hour continuous exposure to a given concentration in a laboratory, whereas exposure to elevated concentrations in the river during a discharge event are expected to last for a short period of time, (four to twelve hours depending upon the size of the basin being discharged). The laboratory experiment values are derived from dissolved aluminum whereas the aluminum in the discharge is the less toxic form measured as total aluminum.

Benthic testing on the settled solids of the whole effluent was also conducted. Growth effects were seen in the benthic organisms, and as shortnose sturgeon eggs and larvae are also benthic organisms, similar results are expected to occur to shortnose sturgeon eggs and larvae buried under sediments discharged from the Aqueduct.

On October 21, 2002, the ACOE discharged solids from Dalecarlia sedimentation basin number two. EPA sampled the supernatant and solids from that basin as well as aqueous samples from the Dalecarlia Reservoir. The samples were analyzed at EPA's laboratory at Fort Meade for the following parameters: volatile organics, pesticides/PCBs, herbicides, BOD, TSS, chloride, nitrite, sulfate, fecal coliform, dissolved and total metals, and total residual chlorine.

EPA performed a reasonable potential analysis using the results of the October 21 sampling. The reasonable potential analysis showed that the effluent and stream samples for dissolved arsenic, dissolved nickel, dissolved copper and dissolved zinc were below quantification limits. EPA, therefore, assumed that the concentration for these parameters is zero and no reasonable potential analysis was necessary for these metals.

A reasonable potential analysis performed on total aluminum results analyzed from the October 21, 2002 sampling found that total aluminum had the potential to exceed water quality standards. Therefore, EPA calculated water quality based effluent limits for total aluminum. EPA calculated limits of 41.9 mg/l average monthly and 61.2 mg/l maximum daily averages. Since the District of Columbia does not have a water quality standard for total aluminum, EPA used the technology-based limits of 4 mg/l monthly average and 8 mg/l daily maximum aluminum for the draft permit. In this case, the technology-based limits are more restrictive than the calculated water quality-based limits and the stricter limits apply.

EPA has indicated that the dissolved form of metals is most appropriate in accurately determining risk to aquatic organisms. The Water Quality Studies indicate that in the project area the dissolved aluminum concentrations were approximately 15 percent of the total concentrations, and therefore, it is unlikely that toxic effects would be present beyond the immediate vicinity of Outfall 002 or beyond 300-400 m below Outfalls 003 and 004. Although total aluminum concentrations from the Aqueduct discharges are high, effluent toxicity testing indicates that the aluminum in the effluent samples is not highly bioavailable or toxic (EA Engineering, Science and Technology, Inc. 2001). EPA has indicated that from the results of the water quality studies, it is anticipated that aluminum concentrations in the river will return to ambient or background levels within approximately 3.5 hours of the discharge event. Therefore, toxic effects to shortnose sturgeon from the alum in the discharge are not expected beyond the immediate vicinity of Outfall 002 or 400 m below Outfalls 003 and 004.

EPA has included a permit condition prohibiting the discharge of chlorine in detectable amounts. There are a number of studies that have examined the effects of total residual chlorine (TRC) on fish (Post 1987; Buckley 1976; EPA 1986). The EPA has set the Criteria Maximum Concentration at 0.019mg/L based on an analysis of exposure of 33 freshwater species in 28 genera (EPA 1986) where acute effect values ranged from 28ug/L for *Daphia magna* to 710ug/L for the threespine stickleback. While no directed studies that have examined the effects of TRC on shortnose sturgeon, NMFS assumes that shortnose sturgeon are no more sensitive to chlorine than the most sensitive species studies to date. As chlorine in detectable amounts is not allowed to be discharged, no chlorine in detectable amounts should be present in the action area. As such, no effects to shortnose sturgeon from exposure to chlorine are likely.

As explained in the "Description of the Action" section above, the EPA is requiring quarterly monitoring for perchlorate. While the source of the perchlorate is not the Aqueduct, but rather the Spring Valley Superfund site, water containing perchlorate does flow through the Aqueduct system and may be discharged from the aqueduct's outfalls. Sampling for perchlorate conducted in 2003, 2004 and 2005 revealed perchlorate concentrations of 5ug/L (ppb), 6.49 ppb and 7.9 ppb. The effect of perchlorate on aquatic life has not been well studied. High concentrations of perchlorate have been linked with thyroid effects in humans. EPA has issued a recommended Drinking Water Equivalent Level for perchlorate of 24.5 ppb. As such, researchers have speculated that high concentrations of perchlorate in the aquatic environment may have negative effects on fish. To date, EPA has not issued aquatic life criteria for perchlorate. A recent article in the journal Environmental Toxicology and Chemistry (Dean et al. 2004) compiled all available data regarding the effects of perchlorate to aquatic organisms, and reported the results of additional toxicity and bioconcentration tests. Based on this information, the authors recommended an acute criterion of 20 mg/L and a chronic criterion of 9.3 mg/L. As the levels of perchlorate documented in the Aqueduct discharges are well below the levels demonstrated to have adverse effects to aquatic life, it is not likely that shortnose sturgeon will be affected by exposure to perchlorate from Aqueduct discharges.

In summary, while whole effluent from Aqueduct discharges have not been demonstrated to have toxic effects to test organisms, there is the potential for toxic effects to any adult shortnose sturgeon that may be in the immediate vicinity of Outfall 002 or within 400 m below Outfalls 003 and 004 as a result of high levels of dissolved aluminum in these areas. However, these increased levels of dissolved aluminum are not expected to be long lasting and it is not likely that the dissolved aluminum will have toxic effects on adult shortnose sturgeon. In addition, adverse affects, including reduction in growth, to shortnose sturgeon eggs and larvae are likely to occur as a result of burial under sediments discharged from the Aqueduct.

Non-spawning season discharge – Georgetown and Dalecarlia basins

Based on information provided by EPA, between 3 and 6 discharges from the Georgetown basins are expected each year and between 12 and 14 discharges from the Dalecarlia basins are expected each year. As discharges related to the cleaning of these basins will cease following the operation of the residuals processing facility that is currently under construction, this type of discharge will no longer occur after November 30, 2010.

As explained in the Description of the Action section above, the cleaning of the Dalecarlia and Georgetown basins results in the discharge of solids and associated flushing water to outfalls 002 (Dalecarlia) and outfalls 003 and 004 (Georgetown basins 2 and 1, respectively). Outfall 002 is located approximately 4 kilometers upstream of outfall 003, which is located approximately 600 meters upstream of outfall 004.

As explained above, shortnose sturgeon are only likely to occur within the action area between March 20 and June 11 of any year. As such, no shortnose sturgeon will be present in the action area during a non-spawning season discharge (i.e., one that occurs between July 1 and February 14).

Because of the velocity and volume of the flow and the scouring effect of storms and snow melt, EPA has indicated that they do not believe that material deposited during a discharge remains in the area for an extended period of time. This supposition is supported by the results of a benthic study performed by Dynamac. In this study, an area upstream of the Washington Aqueduct outfalls was sampled, and researchers were not able to resample locations due to shifting river sediments. Also, the Hester-Dendy study performed by EA Engineering, Science and Technology, Inc. documented the presence of a very high naturally occurring sediment load in the Potomac River near the Aqueduct outfalls. The consultants found that the sediments in this region of the river are continually redistributed following medium to high river flow events. The benthic community that was collected during the course of the Hester-Dendy study consisted of tolerant species, which is a consequence of the rigorous naturally occurring environmental conditions to which they are exposed.

Based on the best available information, it is extremely unlikely that even if a discharge occurred on February 14 (the last day allowed prior to the spring spawning season) that suspended or deposited sediment would remain in the action area when shortnose sturgeon arrived to spawn. As explained above, shortnose sturgeon are not likely to occur in the action area before water temperatures reach 8°C, which is not likely to occur prior to March 20 each year. This means that in a year when no spawning season discharge occurs, there will be at least 30 days for any sediment to be flushed out of the action area. The naturally high river flows experienced during the early spring, the naturally high turbidity level of water in the action area, and the amount of time between an allowable discharge and the time when shortnose sturgeon are likely to occur in the action area, make it extremely unlikely that material from a previous discharge will remain in the action area and make the effect of a discharge outside of the spring spawning season discountable.

Discharges from Outfalls 006-009

As explained in the Description of the Proposed Action (see page 10), discharges from outfalls 006, 007, 008 and 009 are not associated with the cleaning of the Dalecarlia or Georgetown sedimentation basins. Discharges from these outfalls occurs infrequently (every 1-10 years depending on the particular outfall) and are related to the cleaning and inspection of the Georgetown conduit, City Tunnel, Second High Reservoir and Third High Reservoir. Discharges from these outfalls flow into Rock Creek (outfall 006 and 007), the Districts' stormwater system (008) and Mill Creek (009). Shortnose sturgeon do not occur in Rock Creek, Mill Creek or the stormwater system; however all three of these systems ultimately drain into the action area. As these discharges will continue to occur once the residuals processing facility is in place, the following analysis considers the effects of these discharges occurring between the time the permit is issued until it expires in 2013.

EPA is requiring that discharges from these outfalls meet the following effluent limitations: TSS - average monthly 30mg/L; maximum daily 60mg/L; aluminum -monthly average 4 mg/L; maximum daily 8mg/L; and, iron – average monthly 4mg/L and maximum daily 8mg/L.

As explained above, TSS levels of less than 100 mg/L will have insignificant effects on shortnose sturgeon. As the permit will limit discharges from outfalls 006-009 to a maximum of 60 mg/L, the effect of the discharge of this level of TSS on shortnose sturgeon will be insignificant. Additionally, the discharge will occur several miles from the action area and will be significantly diluted by the time it enters the action area.

Iron is an essential metal for normal metabolism yet at high enough levels it can be acutely toxic (EPA 1980). The Criterion Continuous Concentration (CCC[5]) set for iron by EPA is 1.0mg/L.

5 CCC – defined by EPA as an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect

EPA has set a maximum daily end of pipe limit of 8.0mg/L which is equivalent to the technology-based limit for iron. As the technology-based limit is more restrictive than the calculated water quality-based limits the stricter limits apply. This end of pipe limit will ensure that once mixed with the receiving water, the effluent does not exceed the 1.0mg/L CCC. The CCC for iron is based on field observations and laboratory studies of a wide range of aquatic species. While iron limits protective of shortnose sturgeon are not known, NMFS assumes that the levels of iron that would have negative effects on this species would be consistent with the level of iron seen to have deleterious effects on other aquatic species. As such, as the CCC for iron is designated for the protection of aquatic life and is based on the goal of protecting the most sensitive species, NMFS assumes that it is will also be protective of shortnose sturgeon. The potential for effects to shortnose sturgeon from the discharge of iron from these outfalls is also decreased by the rarity of the discharges (i.e., once every 1-10 years for each of the three outfalls), the likelihood that the planned discharge would not occur during the spawning season, and the distance that the effluent travels (i.e., several miles) and the dilution that occurs before it reaches the action area. Based on this information, the effect of these levels of iron being discharged into the receiving waters on shortnose sturgeon will be insignificant.

The toxicity of aluminum is discussed above (see page 44). The Criteria Maximum Concentration (CMC[6]) set for aluminum by EPA is 0.75mg/L. EPA has set a maximum daily end of pipe limit of 8.0mg/L which is equivalent to the technology-based limit for aluminum. As the technology-based limit is more restrictive than the calculated water quality-based limits the stricter limits apply. This end of pipe limit will ensure that once mixed with the receiving water, the effluent does not exceed the 0.75mg/L CMC. The CMC for aluminum is based on laboratory studies of a wide range of aquatic species and is designed to be protective of the most sensitive species. While aluminum limits protective of shortnose sturgeon are not known, NMFS assumes that the levels of aluminum that would have negative effects on this species would be consistent with the level of aluminum seen to have deleterious effects on other aquatic species. As such, as the CMC for aluminum is designated for the protection of aquatic life, NMFS assumes that it is will also be protective of shortnose sturgeon. The potential for effects to shortnose sturgeon from the discharge of aluminum from these outfalls is also decreased by the rarity of the discharges (i.e., once every 1-10 years for each of the three outfalls), the likelihood that the planned discharge would not occur during the spawning season, and the distance that the effluent travels (i.e., several miles) and the dilution that occurs before it reaches the action area. Based on this information, the effect of these levels of aluminum being discharged into the receiving waters on shortnose sturgeon will be insignificant.

CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action

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6 CMC – defined by EPA as an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect

area of the Federal action subject to consultation.

Several features of the shortnose sturgeon's natural history, including delayed maturation, non-annual spawning (Dadswell et al. 1984; Boreman 1997), and long life-span, affect the rate at which recovery can proceed. Future state and private activities in the action area that are reasonably certain to occur during project operations are recreational and commercial fisheries, pollutants, and development and/or construction activities resulting in excessive water turbidity and habitat degradation.

Impacts to shortnose sturgeon from non-federal activities are largely unknown in this river. It is possible that recreational and commercial fishing for anadromous fish species may result in incidental takes of shortnose sturgeon. Incidental take of shortnose sturgeon is likely with the continued operation of pound net and other fisheries in the Potomac River. The operation of these fisheries could result in future shortnose sturgeon mortality and/or injury.

Pollution from point and non-point sources has been a major problem in this river system, which continues to receive discharges from sewer treatment facilities, power plants and other industrial facilities. Contaminants introduced into the water column or through the food chain, eventually become associated with the benthos where bottom dwelling species like shortnose sturgeon are particularly vulnerable.

Industrialized waterfront development will continue to impact the water quality in and around the action area. Sewage treatment, industrial, and electric generating facilities present in the action area are likely to continue to operate. Excessive water turbidity, water temperature variations and increased shipping traffic are likely with continued future operation of these facilities. As a result, shortnose sturgeon foraging and/or distribution in the action area may be adversely affected.

INTEGRATION AND SYNTHESIS OF EFFECTS

Shortnose sturgeon are endangered throughout their entire range. Approximately 19 spawning populations remain, with limited exchange of individuals between populations[7]. The shortnose sturgeon residing in the Potomac River form one of these nineteen populations.

NMFS has estimated that the proposed action, the issuance of a new NPDES permit by the EPA for the ACOE owned and operated Washington Aqueduct, may in certain circumstances, result in adverse effects to shortnose sturgeon. As explained in the "Effects of the Action" section, a discharge resulting from the cleaning of the sedimentation basins and occurring outside of the prohibited spring spawning season is not likely to adversely affect shortnose sturgeon.

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7 While shortnose sturgeon are expected to remain in their natal river for the duration of their life, recent tracking studies have revealed movements of small numbers of sturgeon into neighboring rivers. These movements have been documented between the Connecticut and Hudson Rivers and the Kennebec and Penobscot Rivers as well as between the upper Chesapeake Bay and the Delaware River. As this information is new, the significance and frequency of these movements is currently unknown.

Additionally, as explained above in the "Effects of the Action" section, discharges from Outfalls 006-009 are not likely to adversely affect shortnose sturgeon.

Adverse effects may result from a discharge during the spring spawning season, as defined by the proposed permit (i.e., February 15 – June 30). As noted throughout, a spring discharge is generally prohibited and can only be authorized under certain circumstances. As EPA and the ACOE have stated that this situation is only likely to occur no more than once every five years and will no longer occur when the residuals processing facility is operational (by November 30, 2010), a spring spawning season discharge is only likely to occur once between the time the new NPDES permit is issued and November 30, 2010. As such, in this Opinion, NMFS has considered the effects of one basin being cleaned and the resulting solids and water being discharged from one outfall during the spring (i.e., Feb 15 – June 30) of 2009 or 2010.

As explained above, shortnose sturgeon adults are expected to occur in the action area for less than a week between March 20 and May 15 each year. If a discharge occurred during the small window (less than 7 days) when spawning adults were attempting to spawn or migrating to the spawning site, these adults may delay spawning or have a reduced amount of habitat in which to spawn. A delay in spawning would alter the normal behaviors of these individuals but is not expected to result in a reduction in spawning or a reduction in eggs or larvae. A discharge during the spawning window could also cause some amount of the spawning grounds (up to 7%) to be unsuitable for spawning due to increased TSS and deposition of sediment. This may cause adults to alter their normal movements on the spawning grounds. However, as at least 4.5km of river within the spawning grounds will be unaffected by the discharge and shortnose sturgeon are not known to be limited by the amount of suitable spawning habitat, any effects to individual shortnose sturgeon will be insignificant and there is not likely to be a reduction in the amount of spawning or the number of eggs or larvae.

Shortnose sturgeon eggs and larvae are expected to occur in the action area for less than 22 days between March 20 and June 11. As explained in the "Effects of the Action" section above, eggs and/or larvae located within a certain distance from the various outfalls at the time of a discharge are likely to be injured or killed as a resulting of smothering and burial under discharged sediments. These eggs and larvae are also likely to be affected by exposure to concentrated levels of metals in the discharge.

This action is not likely to reduce reproduction of shortnose sturgeon in the Potomac River because, at worst, it could result in individual shortnose sturgeon delaying spawning during one spawning season. In order for this scenario to occur, a spawning season discharge must not only be authorized but it would have to occur during the short (i.e., less than a week) time frame when the shortnose sturgeon spawning run occurs. As explained in the "Effects of the Action" section above, even if a discharge occurred under these circumstances, it is only likely to result in the temporary delay of spawning or cause the elimination of suitable habitat in a small percentage of the spawning grounds (i.e., due to an increase in TSS and the deposition of sediment on the bottom). While a delay in spawning would affect the movements of an individual shortnose sturgeon, it is not expected that it would result in a reduction in reproductive effort. Similarly, while up to 7% of the available spawning grounds between Chain Bridge and Fletchers Landing could be temporarily unsuitable for spawning due to an increase in TSS and the deposition of sediment on the bottom, shortnose sturgeon spawning in the Potomac River is not thought to be limited by available spawning habitat and the temporary loss of 7% of available spawning habitat is not likely to reduce the level of reproduction or the number of eggs or larvae in that year class. Additionally, as explained in the "Status of the Species" section above, the shortnose sturgeon in the Potomac River are considered to be part of a larger Chesapeake Bay-Delaware River population. As spawning also occurs in the Delaware River (with over a thousand adults spawning annually) and may possibly occur in other rivers in the Chesapeake Bay, the effect of this small decrease in the amount of reproduction is further reduced.

Additionally, any effects to spawning habitat will be temporary and as all sediment resulting from a previous discharge would be scoured from the area prior to the next spawning season, would only effect one spawning season. As explained throughout, there is a low likelihood of a spawning season discharge occurring in any particular year. Based on the information provided by EPA and ACOE and the operational history of the Washington Aqueduct since the prohibition on a spawning season discharge was enacted in 2003, NMFS has determined that it is unreasonable to consider that a spawning season discharge would occur in two consecutive years. As such, a spawning season discharge is only likely to affect spawning in the one year in which it occurs. In the year following a spawning season discharge, spawning would be expected to occur normally as the substrate is expected to be unaffected by the previous years spawning season discharge.

In the event that a discharge occurred during the time when shortnose sturgeon eggs and larvae are expected to occur in the action area (i.e., a variable 22 day period between March 20 – June 11 each year), all eggs and larvae located within a certain distance of the outfall discharging the residual solids are likely to be injured or killed. Based on the analysis outlined in the "Effects of the Action" section above, depending on the timing and location of a discharge, no more than 7% of the eggs and demersal larvae or 3% of the mobile larvae spawned in a particular year are likely to be injured or killed. This would affect the ultimate size of this year class of shortnose sturgeon. However, as early life stages naturally experience high levels of mortality the loss of a small percentage of eggs or larvae is not equivalent to the loss of a similar percentage of juveniles or adults. While the loss of eggs and larvae will have an effect on the number of juvenile and eventually the number of adult sturgeon in a particular year class, the reduction in size would be extremely small. As shortnose sturgeon are long lived species, there are up to at least 30 year classes in a population at a particular time. It is unlikely that a small one time reduction in one year class would be detectable at the population level. Therefore, the loss of these shortnose sturgeon will not have a detectable effect on the number of shortnose sturgeon in the species as a whole. Further, as explained in the "Status of the Species" section above, the shortnose sturgeon in the Potomac River are considered to be part of a larger Chesapeake Bay-Delaware River population. As spawning also occurs in the Delaware River and may possibly occur in other rivers in the Chesapeake Bay, the effect of this small decrease in the number of shortnose sturgeon in a particular year class is further reduced.

While the loss of a small number of individuals from a subpopulation or species may have an effect on the numbers, reproduction and distribution of the species, in general this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of shortnose sturgeon because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity (see status of the species section above), and there are thousands of shortnose sturgeon spawning each year.

The proposed action is not likely to reduce distribution because the action will not impede shortnose sturgeon from accessing foraging or overwintering grounds in the Potomac River and only has the potential to result in a temporary delay in access to the spawning grounds. The action is not expected to reduce the river by river distribution of shortnose sturgeon.

For these reasons, NMFS believes that there is not likely to be any reduction in reproduction and distribution and only a small decrease in the numbers of shortnose sturgeon in the Potomac River population that is not expected to have a detectable effect on the Potomac population or the species as a whole. Additionally as no unique genetic haplotypes have been identified in shortnose sturgeon sampled in the Potomac River or the Chesapeake Bay, it is unlikely to result in the loss of genetic diversity. As there will not be a detectable reduction in reproduction or numbers of shortnose sturgeon in the Potomac River and no reduction in the rangewide distribution of shortnose sturgeon, this action is not likely to reduce the ability of the species to recover. As such, there is not likely to be an appreciable reduction in the likelihood of survival and recovery in the wild of the Potomac River population, the Chesapeake Bay-Delaware River complex, or the species as a whole.

CONCLUSION

After reviewing the current status of the species discussed herein, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is NMFS' biological opinion that the issuance of a new NPDES permit by the EPA for the ACOE owned and operated Washington Aqueduct, may adversely affect but is not likely to jeopardize the continued existence of shortnose sturgeon. NMFS has considered the potential of one spring discharge occurring between the time the new NPDES permit is issued and the residuals processing facility is operational (i.e., November 30, 2010) when making this determination. Because no critical habitat has been designated for this species, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. NMFS interprets the term "harm" as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering (50 CFR §222.102). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Incidental Take

The proposed action has the potential to directly affect shortnose sturgeon adults by resulting in the delay of spawning and/or affecting the movements of adults on the spawning grounds and has the potential to result in the injury or death of eggs and larvae located within a certain distance of the outfalls. As explained in the "Effects of the Action" section of the accompanying Opinion, these situations are only likely to occur if an otherwise prohibited spring spawning season discharge occurs at a time when shortnose sturgeon are present. As explained throughout, a spring spawning season discharge will not occur more than once. As such, the take explained below is for a one time event.

For adults, NMFS has determined that a discharge occurring between March 20 and May 15 (when water temperatures are between 8 and 18°C) could result in the delay of spawning. The delay of spawning until suitable conditions return will be considered harassment. This is only likely to occur if a discharge occurred over the narrow window (less than 7 days) when spawning adults are present on the spawning grounds. A spring discharge could also result in the harassment of adults by forcing adults to navigate around an area with high TSS levels and/or sediment covered river bottom to find a suitable spawning site. A discharge could also result in the temporary loss of no more than 7% of suitable spawning habitat. These delays to spawning are expected to be temporary and not result in a reduction of spawning effort or a reduction in the number of eggs or larvae.

For eggs and larvae, NMFS has determined that a discharge between March 20 and June 11 would result in the injury and/or death of eggs and larvae located within 340m of Outfall 002 and 595 m of Outfalls 003 and 004. These distances are based on the locations of the 100 mg/l TSS contour, the area in which toxic effects from dissolved aluminum would be present, and the depositional footprint of the sediment plume where sediment thickness is greater than 0.5mm. The impact zone for Outfall 002 is less than the area for Outfalls 003 and 004 due to the high river velocities found at Outfall 002, which disperse the sediments at a quicker rate. As it is impossible to estimate the percentage of eggs and larvae within the impact zone that will merely be injured rather than killed, NMFS will assume that the entire take of eggs and larvae is lethal.

NMFS believes this level of incidental take is reasonable given the likely seasonal distribution and abundance of shortnose sturgeon in the action area and the modeling results provided by EPA and the ACOE. In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species. As explained throughout, any incidental take will only occur in the event of a spring spawning season discharge resulting from the cleaning of one of the basins. After the residuals processing facility is operational (by November 30, 2010), these discharges will no longer occur.

Reasonable and prudent measures

Reasonable and prudent measures are those measures necessary and appropriate to minimize incidental take of a listed species. For this particular action, however, NMFS is not requiring reasonable and prudent measures to minimize and monitor take, because the draft NPDES permit already contains necessary or appropriate measures to minimize and monitor take. These measures are included as special conditions of the permit. It should be noted that the special conditions included in the 2008 draft NPDES permit reflect the Reasonable and Prudent Measures and Terms and Conditions of NMFS 2003 Biological Opinion on the effects of the operation of the Washington Aqueduct. These special conditions are requirements for the ACOE to obtain coverage under the NPDES permit for the operation of the Aqueduct.

The most critical measure to minimize the likelihood of take is the general prohibition on a spring spawning season discharge. This will ensure that take is only likely to occur in extreme circumstances (i.e., the integrity of the drinking water supply for the Customers was threatened by an inability to clean and discharge from one of the basins during the February 15 to June 30 time frame). Additional measures to minimize take include measures required to minimize the impact of a spring spawning season discharge should one occur (i.e., slowing down the discharge to allow maximum dilution). There are also several special conditions that will serve to monitor take should a spring discharge occur. These include the requirement to conduct ichthyoplankton sampling prior to, during and subsequent to a spring spawning season discharge (to document the presence of early life stages of shortnose sturgeon) as well as requirements related to measuring water temperature (to determine if conditions are suitable for shortnose sturgeon spawning). Additionally, in the event of a spring discharge, EPA and the ACOE will report to NMFS the dates of the discharge, the estimated volume of the discharge, the duration of the discharge and river conditions (i.e., flow at the Little Falls gage) during the discharge. This will allow NMFS to compare the actual discharge to the discharge scenarios modeled to determine whether the actual discharge exceeded the "worst case scenario" parameters modeled and reported by ACOE. As the level of incidental take is based on the worst case scenario modeled, NMFS should be able to determine whether take was exceeded with this information. In addition, the ACOE has agreed to obtain contact information from NMFS for any researchers working on shortnose sturgeon projects in the Potomac River. In the event of a spring spawning season discharge, ACOE will notify the researchers and obtain information on the location of any tagged shortnose sturgeon. This information will help ACOE and EPA determine whether any tagged shortnose sturgeon were in the action area during the discharge. NMFS believes that all measures necessary and appropriate to minimize and monitor incidental take will be implemented by the EPA and ACOE and no additional measures to minimize or monitor take are reasonable and prudent. As NMFS is not requiring reasonable and prudent measures, NMFS is not requiring any implementing terms and conditions.

As explained above, all measures necessary and appropriate to minimize and monitor take are already part of the proposed action. However, if, during the course of the action, the level of incidental take is exceeded, reinitiation of consultation is required and review of the special conditions in the permit may be necessary. In the event that the level of incidental take is exceeded, EPA must immediately provide an explanation of the causes of the taking and review with NMFS the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS has determined that, provided a discharge during the spring spawning season does not occur more than one time within the five year duration of the permit, the issuance of a NPDES permit for the Washington Aqueduct is not likely to jeopardize the continued existence of endangered shortnose sturgeon located in the vicinity of the project area. To further reduce the adverse effects to listed species, NMFS recommends that ACOE implement the following conservation recommendations.

1. Population information on all life stages is still sparse for this river system and the Chesapeake Bay. EPA and the ACOE should support further studies to evaluate habitat and the use of the river and the Bay, in general, by shortnose sturgeon.

REINITIATION OF CONSULTATION

This concludes formal consultation on the continued operation of the Washington Aqueduct by ACOE pursuant to the terms of the revised NPDES permit and the FFCA entered into by EPA and the ACOE. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, Section 7 consultation must be reinitiated immediately.

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Appendix A
Map of Action Area

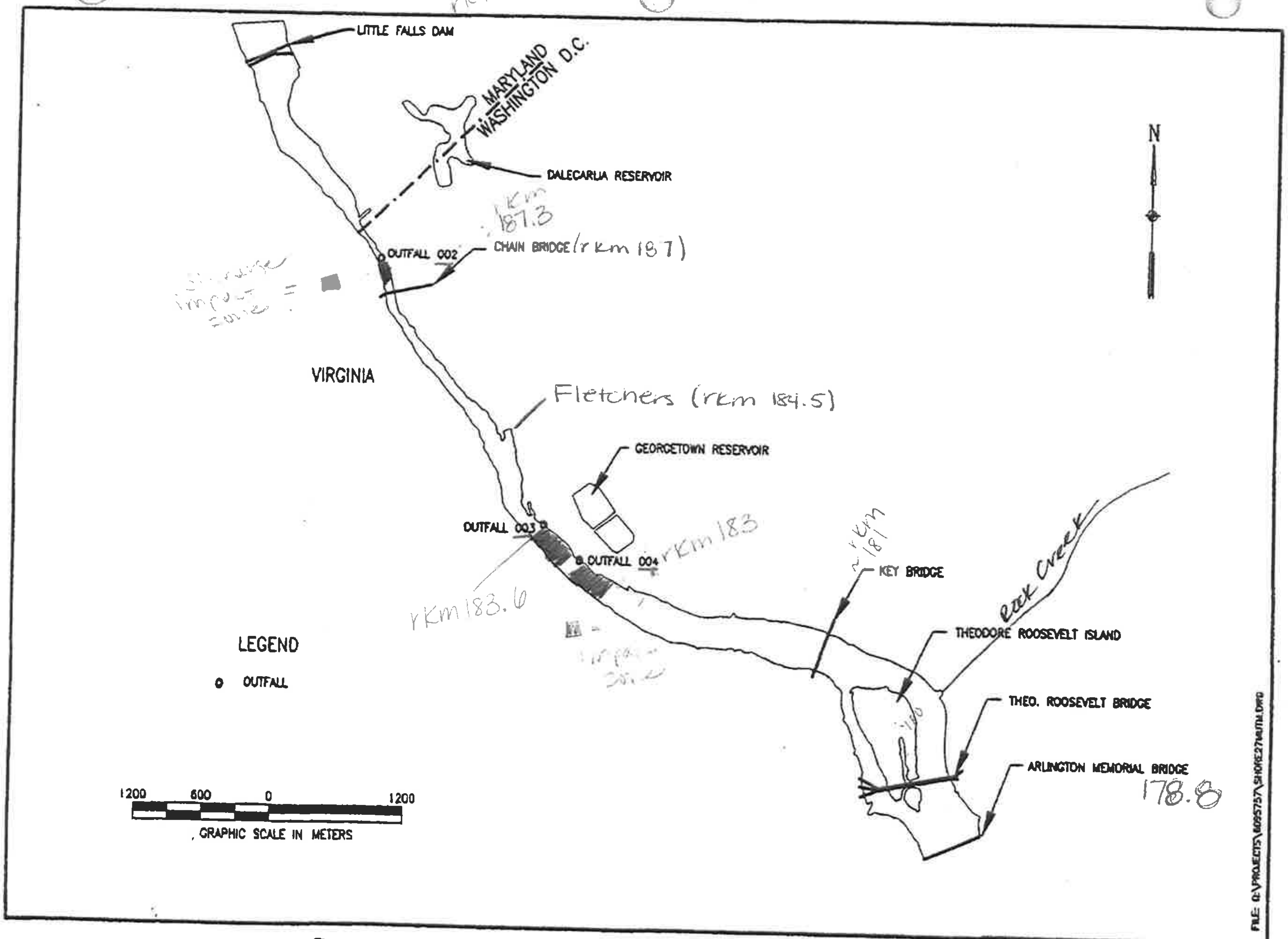
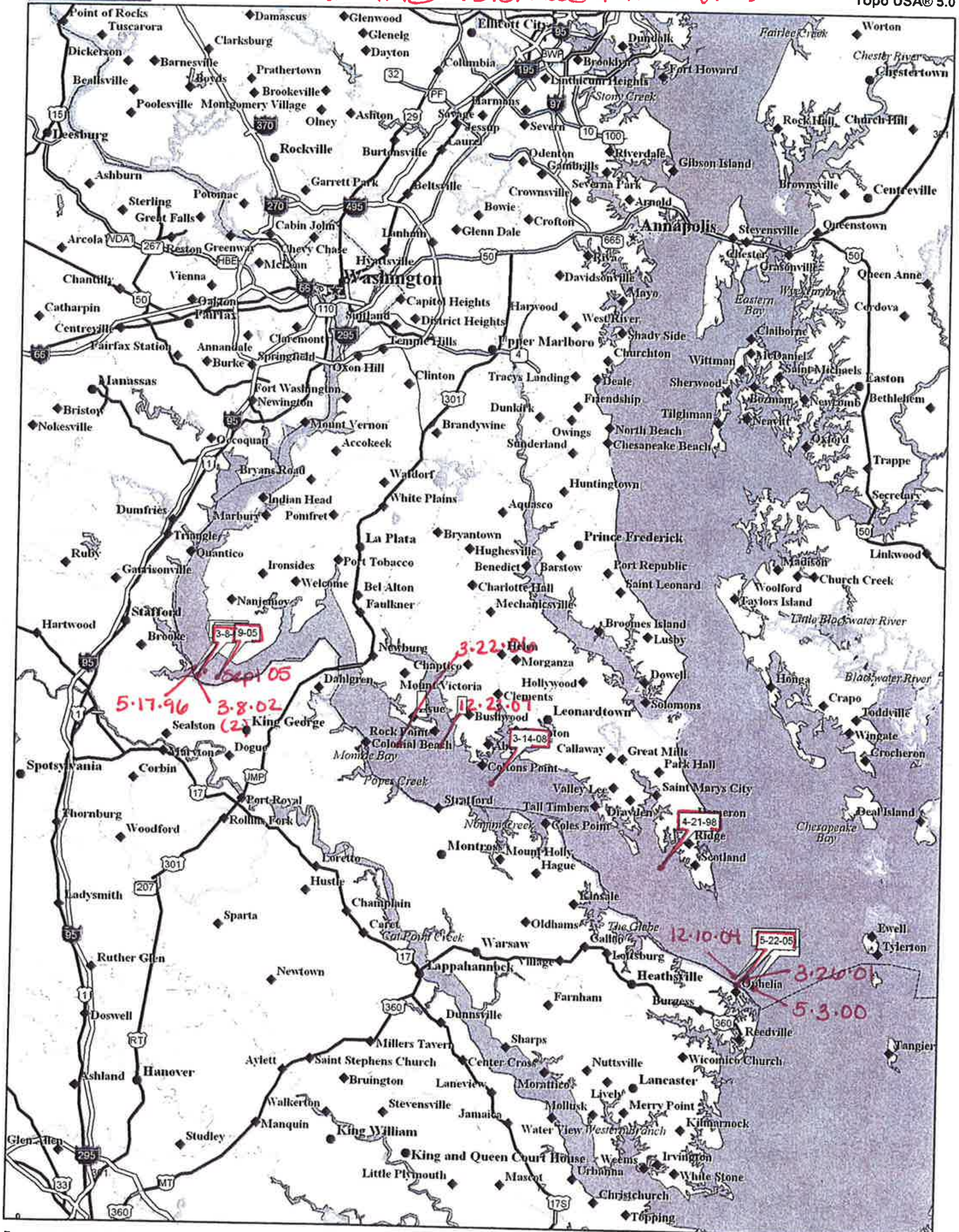


Figure 1-1. Study Area for the Washington Aqueduct Water Quality Studies.

Shortnose Sturgeon Captures in the Potomac River (12)

Topo USA® 5.0



TN

MN (10.8°W)

Scale 1 : 800,000

1" = 20.32 km

Data Zoom 8-0

Appendix B Table 1. **Basin Washing Dates**

2003

1/7/2003	Dalecarlia #4	7/14/2003	Dalecarlia #4
1/13/2003	Dalecarlia #3	7/21/2003	Dalecarlia #2
2/4/2003	Dalecarlia #1	7/29/2003	Georgetown #2
2/24/2003	Dalecarlia #2	10/10/2003	Dalecarlia #1
2/21/2003	Dalecarlia #4	10/15/2003	Dalecarlia #2
2/26/2003	Dalecarlia #3	10/21/2003	Dalecarlia #3
7/1/2003	Dalecarlia #1	10/27/2003	Dalecarlia #4
7/7/2003	Dalecarlia #3	11/17/2003	Georgetown #2

2004

1/13/2004	Dalecarlia #1	8/2/2004	Dalecarlia #4
1/14/2004	Dalecarlia #2	8/9/2004	Dalecarlia #3
1/15/2004	Georgetown #2	8/11/2004	Georgetown #2
1/20/2004	Dalecarlia #3	10/27/2004	Dalecarlia #1
2/8/2004	Dalecarlia #4	11/13/2004	Dalecarlia #1
7/14/2004	Dalecarlia #1	11/14/2004	Dalecarlia #2
7/20/2004	Dalecarlia #2	11/20/2004	Dalecarlia #3
7/21/2004	Georgetown #1	11/30/2004	Dalecarlia #4
7/25/2004	Dalecarlia #3	12/4/2004	Georgetown #1

2005

1/3/2005	Dalecarlia #3	7/12/2005	Georgetown #1
1/18/2005	Dalecarlia #2	7/18/2005	Dalecarlia #4
1/26/2005	Dalecarlia #1	10/17/2005	Dalecarlia #3
1/31/2005	Dalecarlia #4	10/24/2005	Dalecarlia #1
1/31/2005	Georgetown #2	10/31/2005	Dalecarlia #2
2/7/2005	Dalecarlia #3	10/31/2005	Georgetown #2
7/4/2005	Dalecarlia #3	11/7/2005	Dalecarlia #4
7/10/2005	Dalecarlia #1	11/28/2005	Georgetown #1
7/12/2005	Dalecarlia #2		

2006

1/14/2006	Dalecarlia #1	7/13/2006	Georgetown #2
1/16/2006	Georgetown #1	7/15/2006	Dalecarlia #4
1/22/2006	Dalecarlia #3	7/30/2006	Dalecarlia #2
1/29/2006	Dalecarlia #2	10/4/2006	Georgetown #1
1/30/2006	Georgetown #2	10/29/2006	Dalecarlia #1
2/5/2006	Dalecarlia #4	11/7/2006	Georgetown #2
7/4/2006	Dalecarlia #1	11/5/2006	Dalecarlia #2
7/5/2006	Georgetown #1	11/12/2006	Dalecarlia #3
7/6/2006	Dalecarlia #4	11/27/2006	Dalecarlia #4
7/9/2006	Dalecarlia #3		

2007

1/22/2007	Dalecarlia #3	7/16/2007	Dalecarlia #2
1/29/2007	Dalecarlia #4	8/21/2007	Georgetown #1
2/2/2007	Dalecarlia #1	10/15/2007	Dalecarlia #4
2/4/2007	Georgetown #2	10/21/2007	Dalecarlia #1
2/4/2007	Dalecarlia #2	10/24/2007	Dalecarlia #2
7/7/2007	Dalecarlia #4	10/28/2007	Dalecarlia #3
7/10/2007	Dalecarlia #3	10/30/2007	Georgetown #1
7/15/2007	Dalecarlia #1		

2008

1/2/2008	Dalecarlia #3	1/22/2008	Dalecarlia #2
1/5/2008	Georgetown #2	1/29/2008	Dalecarlia #4
1/14/2008	Dalecarlia #1		

Appendix B

Table 2. Comparison of Plume Characteristics Between Original and Alternate Model Scenarios for Washington Aqueduct Outfalls Under Low Flow Conditions (E.A. Engineering, 2003)

Outfall 002 - 800-mgd Potomac River Flow

TSS (mg/L)	Distance from Outfall (m)		
	Original (a)	Alternate 1 (b)	Alternate 2 (c)
100	120	144	139
20	780	583	538
5	1070	871	837
2	1150	966	941
1	1210	1019	998
Sediment Deposition (mm)			
1.0	190	85	93
0.5	340	235	127

Outfall 003 - 1500-mgd Potomac River Flow

TSS (mg/L)	Distance from Outfall (m)		
	Original (a)	Alternate 1 (b)	Alternate 2 (c)
100	210	234	453
20	570	547	676
5	970	808	893
2	1160	951	1017
1	1270	1050	1098
Sediment Deposition (mm)			
20	62	88	62
5	150	217	96
1.0	280	516	159
0.5	520	595	200

(a) Original model scenario.
(b) Original particle classification with alternate model parameters.
(c) Alternate particle classification with alternate model parameters.

APPENDIX C
DRAFT PERMIT - APRIL 2008

Permit number: DC 0000019

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, 33 U.S.C.A. § 1251 et seq. (The "Act")

Department of the Army
Baltimore District, Corps of Engineers
Washington Aqueduct Division

Referred to herein as "Permittee"

is authorized to discharge from a facility located at

5900 MacArthur Boulevard, NW
Washington D.C. 20016-2514

to receiving waters named the Potomac River, Rock Creek, Mill Creek and Little Falls Branch in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III herein.

This permit shall become effective on __________________________.

This permit and the authorization to discharge shall expire 5 years after this date.

____
Jon M. Capacasa, Director   Date
Water Protection Division
U.S. Environmental Protection Agency, Region III

B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - GEORGETOWN SEDIMENTATION BASINS

During the period beginning with the effective date and lasting through November 30, 2010, the expiration date of this permit, the permittee is authorized to discharge from the Georgetown Sedimentation Basins through Outfalls 003 and 004. Outfall 004 is the discharge point for effluent and solids from the Georgetown sedimentation basin #1 . Outfall 004 and Outfall 003 are discharge points for effluent and solids from the Georgetown sedimentation basin #2. Subject to the special condition provisions found at Part III of this permit, permittee may discharge from Outfalls 003 and 004.

Discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic kg/day(lb/day)	Discharge Limitations		Other Limits (Specify)		Monitoring Requirements	
	Avg Monthly	Max. Daily	Avg Monthly	Max. Daily	Measurement Frequency	Sample Type
Flow (mgd)	N/A	N/A	gpd[1]	gpd[1]	continuous	recorded
Total Suspended Solids	N/A	N/A	30 mg/l	60 mg/l	2x week	24-hr. composite
Aluminum (total) (3)	N/A	N/A	1 mg/l	1 mg/l	2x week	24-hr. composite
Iron (dissolved)	N/A	N/A	1.9 mg/l [1]	3.8 mg/l[1]	2x week	24-hr. composite
Removal[2]	---------------- 85% (minimum) for TSS ----------------					
Copper (4)	N/A	N/A	0.017 mg/l	0.025 mg/l	2 x week	24-hr. composite

The pH shall not be less than 6.0 standard units nor greater than 8.5 standard units and shall be monitored once per day by grab sample.
There shall be no discharge of floating solids or visible foam in other than trace amounts.
Samples taken in compliance with the monitoring requirements specified above shall be taken at the location in each of the sedimentation basins where the effluent is discharged from that basin.

(1)- New limit based on Reasonable Potential Analysis, DC Water Quality Standards, Chronic Exposure Criterion.
(2) - Using a combination of engineering and/or Best Management Practices, the permittee shall increase the amount incoming residual solids removed from the Georgetown sedimentation basins to meet the TSS removal effluent limit. This represents a minimum of 85% removal of incoming solids to the sedimentation basins.
(3) – New limit based on Reasonable Potential Analysis and Technology Based Standards, Acute Exposure Criterion.
(4) – New limit based on Reasonable Potential Analysis and DC Water Quality Standards, Acute Exposure Criterion

D. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - CITY TUNNEL AND GEORGETOWN CONDUIT

During the period beginning with the effective date and lasting through the expiration date of this permit, the permittee is authorized to discharge from Outfall number 006 directly to the Potomac River and from Outfall 007 from the City Tunnel to Rock Creek. Discharge from Outfall 006 is treated water blowoff from the Georgetown Conduit. Discharge from Outfall 007 is treated water blowoff from the City Tunnel.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day(lb/day)		All Units (mg/L)		Measurement	Sample
	Avg Monthly	Max. Daily	Avg Monthly	Max Daily	Frequency	Type
Flow (mgd)0	N/A	N/A	N/A	N/A	1x discharge	estimate
Total Suspended Solids	N/A	N/A	30	60	1x discharge	Grab*
Total Aluminum	N/A	N/A	4	8	1x discharge	Grab*
Iron dissolved	N/A	N/A	4	8	1x discharge	Grab*
Total Residual Chlorine(1)	N/A	N/A	N/A	N/A	1x discharge	Grab*

The pH shall not be less than 6.0 standard units nor greater than 8.5 standard units and shall be monitored at the point of discharge.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

1) No chlorine shall be discharged in detectable amounts. For the purpose of this permit no detectable amounts is defined as <0.1 mg/L.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following locations: at Outfalls 006 and 007.

* A grab sample shall be taken at the beginning and the midpoint of the above discharges, except for Total Residual Chlorine which shall be sampled at the start of the discharge.

* A grab sample shall be taken at the beginning and the midpoint of the above discharges, except for Total Residual Chlorine which shall be sampled at the start of the discharge.

F. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS - Third High Reservoir

During the period beginning with the date of issuance and lasting through the expiration date of this permit, the permittee is authorized to discharge from Outfall number 009 directly to Mill Creek. Mill Creek is a tributary to Little Falls Branch. Discharge from Outfall 009 is dechlorinated potable water from the Third high reservoir.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day(lb/day)		All Units (mg/L)		Measurement	Sample
	Avg Monthly	Max. Daily	Avg Monthly	Max Daily	Frequency	Type
Flow (mgd)	N/A	N/A	N/A	N/A	1x discharge	estimate
Total Suspended Solids	N/A	N/A	30	60	1x discharge	Grab*
Total Aluminum	N/A	N/A	4	8	1x discharge	Grab*
Iron dissolved	N/A	N/A	4	8	1x discharge	Grab*
Total Residual Chlorine[(1)]	N/A	N/A	N/A	N/A	1x discharge	Grab*

The pH shall not be less than 6.0 standard units nor greater than 8.5 standard units and shall be monitored at the point of discharge.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

[1)] No chlorine shall be discharged in detectable amounts. For the purpose of this permit no detectable amounts is defined as <0.1 mg/L.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: from the 24" overflow line located in the manhole east of the Davenport and Belt Road streets intersection.

Part II STANDARD CONDITIONS FOR NPDES PERMITS

SECTION A. GENERAL CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for an enforcement action; for permit termination, revocation and re-issuance or modification; and/or for denial of a permit renewal application.

2. Penalties for Violations of Permit Conditions.

1. Criminal Penalties

1. Negligent Violations. Section 309(c)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1313(c)(1), provides that any person who negligently violates any permit, condition or limitation implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA, is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year or both.

2. Knowing Violations. Section 309(c)(2) of the CWA, 33 U.S.C. § 1313(c)(2), provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA is subject to a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years or both.

3. Knowing Endangerment. Section 309(c)(3) of the CWA, 33 U.S.C. § 1313(c)(3), provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the CWA, and knows at the time that he is placing another person in imminent danger of death or serious bodily injury is subject to a fine of not more than $250,000, or by imprisonment for not more than 15 years, or both.

4. False Statement. Section 309(c)(4) of the CWA, 33 U.S.C. § 1313(c)(4), provides that any person who knowingly makes any false material statement, representation or certification in any application, record, report, plan or other document filed or required to be maintained under the Act or who knowingly falsifies, tampers with, or renders inaccurate, any monitoring device or method required to be maintained under the Act, shall upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than 2 years, of by both. If a conviction is for a violation committed after a first conviction of such person under this paragraph, punishment shall be by a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years or by both. False statements concerning matters with the jurisdiction of a federal agency are also punishable pursuant to 18 U.S.C. § 1001 by a prison term of up to five years, a fine imposed under Title 18, Crimes and Criminal Procedure,

6. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

7. State Laws.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any District of Columbia law or regulation under authority preserved by Section 510 of the Act. No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

8. 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 infringement of Federal, State or local laws or regulations.

9. Severability

The provisions of this permit are severable, and if any provisions of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

10. Transfer of Permit

In the event of any change in ownership or control of facilities from which the authorized discharge emanates, the permit may be transferred to another person if:

1. The current permittee notifies the Director, in writing of the proposed transfer at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement, between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the current permittee and the new permittee of intent to modify, revoke and reissue, or terminate the permit and require that a new application be submitted.

11. Construction Authorization

30, 2010.

In addition, this permit requires that the permittee submit to NMFS an annual calendar year compilation of the Discharge Monitoring Reports (DMRs), which will be used by NMFS to further assess the potential for effects on endangered or threatened species. If these data indicate it is appropriate, requirements of this NPDES permit may be modified to prevent adverse impacts on habitats of endangered and threatened species.

The set of DMRs for each calendar year are to be submitted by February 15 of the following year to:

The National Marine Fisheries Service
Protected Resource Division
1 Blackburn Drive
Gloucester, MA 01930
Attention: Endangered Species Coordinator

National Park Service
C&O Canal NHP
1850 Dual Highway, Suite 100
Hagerstown, Maryland 21740
Attention: Superintendent

National Park Service
National Capital Region
1100 Ohio Drive, SW
Washington, DC 20242
Attention: Regional Director

Interstate Commission on the Potomac River Basin (ICPRB)
Suite 300
6110 Executive Boulevard
Rockville, MD 20852
Attention: Executive Director

2. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Part II, Section D, Paragraph 6 (24 -hour notice).

3. Permittee must use its best efforts to notify National Oceanic and Atmospheric Administration (NOAA) Fisheries, orally and in writing, 24 hours in advance of a discharge taking place and no later than 24 hours after commencement of the discharge (if it is an unanticipated bypass) during the shortnose sturgeon spawning season. The shortnose sturgeon spawning season is defined as March 1 - May 15. Such notice shall be made to the ESA Section 7 Fishery Biologist at 978-281-9328 or the Endangered Species Coordinator at 978- 281-9208, or a NOAA Fisheries designee contacted through the NOAA Fisheries general number at 978-281-9328.

4 Notice of all bypass occurrences, including but not limited to the location, time and duration of the bypass shall be made to EPA Region III, DC DOH, US FWS, NPS, ICPRB and NMFS. Notice to the NPS and NMFS shall be sent to the names and addresses found at Part II.A.13 above. Notice to EPA and DC DOH shall be sent to the names and addresses found at Part II.C.5 below. Notice to the US FWS shall be made to the following address:

177 Admiral Cochrane Drive,
Annapolis, MD 20401,
Attention: Environmental Contaminants
Chris Guy

d. Prohibition of bypass.

1. Bypass is prohibited and the Director may take enforcement action against a permittee for bypass, unless:

i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This conditions is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

Atmospheric Administration (NOAA) Fisheries, orally and in writing, 24 hours in advance of a discharge taking place and no later than 24 hours after commencement of the discharge (if it is an unanticipated upset) during the shortnose sturgeon spawning season. Such notice shall be made to the ESA Section 7 Fishery Biologist at 978-281- 9328 or the Endangered Species Coordinator at 978- 281-9208, or a NOAA Fisheries designee contacted through the NOAA Fisheries general number at 978-281-9328.

6. Notice of all upset occurrences, including but not limited to the location, time and duration of the upset shall be made to EPA Region III, DC DOH, US FWS, NPS, ICPRB and NMFS. Notice to the NPS and NMFS shall be sent to the names and addresses found at Part II.A.13 above. Notice to EPA and DC DOH shall be sent to the names and addresses found at Part II.C.5 below. Notice to the US FWS shall be made to the following address:

177 Admiral Cochrane Drive,
Annapolis, MD 20401,
Attention: Environmental Contaminants Program Leader.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in the permit. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 C.F.R. Part

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 C.F.R. 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR form. Such frequency shall also be indicated.

9. Retention of Records

The permittee shall retain records of all monitoring information, including all calibration and maintenance record and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for the life of this permit.

10. Record Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling of measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

11. Inspection and Entry

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other document as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

12. Definitions

a. The "daily discharge" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represent the calendar

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. The permittee may submit to the permitting authority requests for modification of this provision in accordance with future promulgated regulations.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit regulations.

3. Transfers

This permit is not transferable to any person except after notice to the Director as specified in Part II, Section A, Paragraph 10. The Director may require modification or revocation and reassurance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

4. Monitoring Reports

Monitoring results shall be reported at the intervals and in the form specified in Part II, Section C, Paragraph 5 (Reporting of Monitoring Results).

5. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance may include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

6. Twenty-Four Hour Reporting

The permittee shall report to EPA, DC DOE, USNPS, USFWS, ICPRB and NMFS at the addresses listed in Part II.A.13 and Part II.C.5 of this permit of any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; the

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application shall be submitted at least 180 days before the expiration date of this permit. The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date. In the event that a timely and complete re-application has been submitted and the Director is unable, through no fault of the permittee, to issue a new permit before the expiration date of this permit, the terms and conditions of this permit are automatically continued and remain fully effective and enforceable.

10. Signatory Requirements

All applications, reports or information submitted to the Director shall be signed and certified as required by 40 C.F.R. 122.22.

11. Availability of Reports

Unless a confidentiality claim is asserted pursuant to 40 C.F.R. Part 2, all reports submitted in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. If a confidentiality claim is asserted, the report will be disclosed only in accordance with the procedures in 40 C.F.R. Part 2. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

12. Correction of Reports

If the permittee becomes aware that it submitted incorrect information in any report to the Director, it shall promptly submit the correct information.

13. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe that any activity has occurred or will occur that would result in the discharge of any toxic pollutant which is not limited in this permit.

SECTION E - BEST MANAGEMENT PRACTICES

1. Applicability

These conditions apply to all permittees who use, manufacture, store, handle or discharge any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act or any pollutant listed as hazardous under Section 311 of the Act and who have ancillary manufacturing operations which could result in significant amounts of these pollutants reaching waters of the United States. These operations include material storage areas; plant site runoff; in-plant transfer, process and material handling areas; loading and unloading operations and sludge and waste disposal areas.

5. Specific Requirements

The plan shall be consistent with the general guidance contained in the publication entitled "NPDES Best Management Practices Guidance Document" and shall, at a minimum, include the following baseline BMPs:

a. BMP committee
2. Reporting of BMP incidents
3. Risk identification and assessment
4. Employee training
5. Inspections and records
6. Preventive maintenance
7. Good housekeeping
8. Materials compatibility
9. Security
10. Materials inventory

6. Hazardous Waste Management

The permittee shall assure the proper management of solid and hazardous waste in accordance with regulations promulgated under the Solid Wastewater Disposal Act, as amended by the Resource Conservation and Recovery Act of 1978 (RCRA) (40 U.S.C. 6901 et seq.) Management practices required under RCRA regulations shall be referenced in the BMP plan.

7. Documentation

The permittee shall maintain a description of the BMP plan at the facility and shall make the plan available to the Director upon request.

8. BMP Plan Modification

The permittee shall amend the BMP plan whenever there is a change in the facility or change in the operation of the facility which materially increased the potential for the ancillary activities to result in a discharge of significant amount of hazardous or toxic pollutants.

9. Modification for Effectiveness

If the BMP plan proves to be ineffective in achieving the general objective of preventing the release of significant amounts of toxic or hazardous pollutants to surface waters and the specific objectives and requirements under Part II, Section E, Paragraph 4, Subparagraphs b and c, the permit and/or the BMP plan shall be subject to modification to incorporate revised BMP requirements.

PART III SPECIAL CONDITIONS

All special conditions implementation plans and study plans required under Part III shall be developed and submitted by the permittee to EPA for review, comment and approval. EPA will coordinate with other involved federal agencies and DC DOH during the review, comment and approval of these plans and their implementation. Involved federal agencies are not limited to those identified in this permit.

A. The permittee is authorized to discharge in accordance with the terms and conditions set forth in Part I of this permit.

During the spring spawning season there shall be no direct discharge of the contents of the sedimentation basins through outfalls 002, 003 or 004.

In addition, the following conditions shall apply to the discharges from the Dalecarlia Sedimentation basins through Outfall 002.

1. Part III of this permit specifically prohibits the direct discharges of contents of the sedimentation basins during the spring spawning season (February 15 through June 30). In the event that a discharge as a result of a bypass or upset occurs during this period of time, the permittee shall follow notification procedures found at Part II.B.3.c.2b; Part II.B.3.c.3; Part II.B.4.c.iv; and shall take the actions found at Part II.D.6 and Part III.E of this permit.

2. Permittee is required to test the liquid and solid discharge from the Dalecarlia basins for chlorine. The sampling location shall be at an access port in the discharge pipe between the Dalecarlia Basins and the point of entry into the Potomac River. If these samples show a detectable level of chlorine, which for the purpose of this permit is defined as equal to or greater than 0.1 mg/L, the permittee shall provide treatment to ensure that the discharge contains no detectable amounts of chlorine before it is discharged to the Potomac River.

3. Perrmittee is not authorized to discharge from the Dalecarlia Sedimentation Basins through Outfall 002 upon the completion of the Residuals Processing Facility or no later than November 30, 2010. After the residuals processing facility is operable, in the event that there is leakage, runoff, small amounts of wash waters or other accumulations of non-process waters in the basins, the Corps may request, in writing, authority to discharge these waters from outfall 002. The request must contain a certified chemical analysis describing the pollutants and concentrations of those pollutants. The analyses must be performed for the pollutants named in Part I.A of this permit and the concentrations of those pollutants must meet the numeric and narrative limits described therein. The request must be made no later than two weeks prior to the proposed discharge and shall be sent to EPA Region III and the DC DOE.

Processing Facility which shall be no later than November 30, 2010.

2. The permittee is prohibited from discharging dredged material from the Dalecarlia Reservoir to the Potomac River.

D. Additional Studies to be Performed

1. The permittee shall continue to perform the toxicity monitoring program which constitutes a study to evaluate discharges from Outfalls 002 and 003 for acute and chronic toxicity. Such studies may include (modified) chronic toxicity tests for a total of four discharges during each calendar year using daphnids and fathead minnows, and solid phase tests using *Hyalella*. Studies shall also include acute testing using striped bass, and annual benthic toxicity testing of sediments from above and below Outfalls 002 and 003 for the life of the permit. If unacceptable toxicity is measured, an additional confirmation test may be scheduled as soon as feasible. If unacceptable toxicity is confirmed for any species at an individual outfall within one year of initiation of testing, a plan for conducting water column or sediment Toxicity Identification Evaluation (TIE) testing of that discharge will be prepared and submitted to EPA, USFWS and NMFS for approval. Upon approval of the TIE plan, appropriate TIE testing will be conducted for that outfall during the following year. A written report describing the tests and results shall be submitted to EPA, USFWS and NMFS no later than February 1 of the calendar year following completion of the studies. These studies may be discontinued upon completion of the Residuals Processing Facility.

2. If any batch discharges from the sedimentation basins occur during the spring spawning season (February 15 - June 30), toxicity testing to evaluate the effect of solids on embryo-larval fish will be required. This testing shall evaluate the effect of Aqueduct solids on fish hatchability, as well as survival and growth. The study shall include toxicity testing using egg and larval stages of fathead minnows using EPA-approved methods, and fathead minnow hatchability using EPA Method 1001.0. If testing is required under this provision, toxicity testing shall be conducted on that discharge (if possible) or the next possible discharge from that outfall. A written report describing the test results shall be submitted to EPA and DC DOH within 6 months of completion of the studies. All batch discharges from the sedimentation basins shall be prohibited on or no later than November 30, 2010.

E. Requirements to Minimize the Impact of an Anticipated or Unanticipated Upset or Bypass on Shortnose Sturgeon

1. Between March 1 and May 15, 24 hours in advance of an anticipated