

Biological Opinion and Incidental Take Statement  
for the Fanshell (*Cyprogenia stegaria*), Pink Mucket Pearly Mussel  
(*Lampsilis abrupta*), Sheepnose (*Plethobasus cyphus*), and Snuffbox  
(*Epioblasma triquetra*) for the Robert C. Byrd Hydroelectric Project and  
Navigation Channel Maintenance Dredging  
at the existing Robert C. Byrd Locks and Dam  
in Gallia County, Ohio and Mason County, West Virginia

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## TABLE OF CONTENTS

INTRODUCTION.....	4
CONSULTATION HISTORY.....	4
BIOLOGICAL OPINION.....	11
DESCRIPTION OF THE PROPOSED ACTIONS.....	11
R.C. Byrd Hydroelectric Project.....	12
R.C. Byrd Locks and Dam Navigation Channel Maintenance Project.....	13
Conservation Measures.....	17
R.C. Byrd Hydroelectric Project.....	17
R.C. Byrd Locks and Dam Navigation Channel Maintenance Project.....	18
Action Area.....	19
STATUS OF THE SPECIES.....	20
Species Descriptions.....	20
Fanshell.....	20
Pink Mucket Pearly Mussel.....	20
Sheepnose.....	21
Snuffbox.....	21
Life History .....	22
Fanshell.....	22
Pink Mucket Pearly Mussel .....	22
Sheepnose.....	23
Snuffbox.....	23
ENVIRONMENTAL BASELINE.....	24
Status of the Fanshell, Pink Mucket Pearly Mussel, Sheepnose, and Snuffbox in the Action Area.....	24
EFFECTS OF THE ACTION.....	28
Direct Effects.....	28
R.C. Byrd Hydroelectric Project.....	28
R.C. Byrd Locks and Dam Navigation Channel Maintenance Project.....	29
Indirect Effects.....	30
R.C. Byrd Hydroelectric Project.....	30
R.C. Byrd Locks and Dam Navigation Channel Maintenance Project.....	30
Cumulative Effects.....	31
Summary of Effects.....	31
R.C. Byrd Hydroelectric Project.....	31
R.C. Byrd Locks and Dam Navigation Channel Maintenance Project.....	31
CONCLUSION.....	32
INCIDENTAL TAKE STATEMENT.....	32

AMOUNT OR EXTENT OF TAKE.....	33
EFFECT OF THE TAKE.....	34
REASONABLE AND PRUDENT MEASURES.....	34
Terms and Conditions.....	34
R.C. Byrd Hydroelectric Project Terms and Conditions.....	34
R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program Terms and Conditions.....	35
 CONSERVATION RECOMMENDATIONS.....	 35
REINITIATION NOTICE.....	36
LITERATURE CITED.....	37
 Table 1. Consultation History.....	 6
Table 2. Mussel data for the survey area downstream of R.C. Byrd Locks and Dam along the right descending bank.....	25
 Figure 1. Location of the proposed R.C. Byrd Hydroelectric Project.....	 14
Figure 2. Dredge Area, Disposal Area, and Mussel Beds Downstream of RCB Dam.....	16

## INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service's) Biological Opinion based on our review of the Federal Energy Regulatory Commission's (FERC's) proposed issuance of a license to the City of Wadsworth, Ohio to construct and operate a hydroelectric facility on the Robert C. Byrd Locks and Dam and review of the U.S. Army Corps of Engineers' (Corps') navigation channel maintenance dredging at the Robert C. Byrd Locks and Dam. This Biological Opinion analyzes the effects of the Robert C. Byrd Hydroelectric Project and the Corps' maintenance dredging at the Robert C. Byrd Locks and Dam on the fanshell (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis abrupta*), sheepnose (*Plethobasus cyphus*), and snuffbox (*Epioblasma triquetra*) in accordance with section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). FERC's request for consultation was received on February 6, 2017. The Corps' request for reinitiation of consultation was received on March 2, 2017.

This BO is based on information provided in FERC's Environmental Assessment (EA), the Corps' Biological Assessment (BA), and additional information provided to the Service by the Applicant and the Corps. A complete administrative record of this consultation is on file at the Service's Ohio Field Office (OHFO).

## CONSULTATION HISTORY

The Robert C. Byrd Hydroelectric Project (Project) lies within the ranges of the federally listed endangered Indiana bat (*Myotis sodalis*), fanshell (*Cyprogenia stegaria*), pink mucket pearly mussel (*Lampsilis abrupta*), sheepnose (*Plethobasus cyphus*), and snuffbox (*Epioblasma triquetra*) and the threatened northern long-eared bat (*Myotis septentrionalis*).

On July 14, 2014, FERC submitted the Draft Environmental Assessment (Draft EA) for the Project to the Service requesting concurrence that the proposed Project is "not likely to adversely affect" the Indiana bat, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. On July 24, 2014 and August 7, 2014, the Service's OHFO and West Virginia Field Office (WVFO) respectively, provided non-concurrence letters to FERC citing the lack of bat and mussel conservation plans and the lack of an operating agreement with the Corps to support the effect determinations. Furthermore, the Service notified FERC that the northern long-eared bat had been proposed for listing and recommended that conservation measures for the species be incorporated into the Project.

On January 30, 2015, FERC submitted the Final EA to the Service requesting concurrence that the proposed Project is "not likely to adversely affect" the Indiana bat, northern long-eared bat, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. On February 26, 2015, the Service provided a non-concurrence letter to FERC again citing the lack of bat and mussel

conservation plans and the lack of an operating agreement with the Corps to support the effect determinations.

On March 12, 2015, FERC submitted a request for initiation of formal consultation to the Service for the Indiana bat, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. On April 9, 2015 the Service sent a letter to FERC denying the request for formal consultation due to the receipt of an incomplete initiation package citing the lack of project details necessary for the Service to determine the action area and conduct a project effect analysis. The Service also notified FERC that due to the April 2, 2015 publication of a Final Rule listing the northern long-eared bat as a threatened species, consultation on the northern long-eared bat would also be necessary for the Project.

On February 6, 2017, the Service received a letter from FERC requesting concurrence with a “not likely to adversely affect” determination for the Indiana bat, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. FERC also requested that if the Service could not concur with a “not likely to adversely affect” determination, that formal consultation be initiated for the Project. The concurrence request did not include the northern long-eared bat. In a March 3, 2017 response letter, the Service concurred with FERC’s determinations that the Project is “not likely to adversely affect” the Indiana bat due to the Service’s receipt of an Indiana bat protection plan which supported the determination. The Service did not concur with a “not likely to adversely affect” determination for the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox due to a lack of data provided to support this determination and instead granted the request for formal consultation for these freshwater mussels. The Service also informed FERC that consultation for the northern long-eared bat would be necessary for the project. In response, the Service received a completed northern long-eared bat 4(d) Rule Streamlined Consultation Form from FERC on March 21, 2017 which fulfilled FERC’s consultation obligation for this species for the Project.

The Corps submitted a Biological Assessment on their Robert C. Byrd Locks and Dam Navigation Maintenance Dredging Program to the USFWS Ohio Field Office (OHFO) on August 16, 2012. The OHFO provided a letter to the Corps on September 10, 2012 concurring with the Corps’ determination that the maintenance dredging is “not likely to adversely affect” the pink mucket pearly mussel and sheepnose. Due to concerns that the proposed hydroelectric project may impair the Corps’ ability to implement conservation measures avoiding adverse effects on federally listed mussels, the OHFO requested that the Corps reinstate consultation and request initiation of formal consultation for their Robert C. Byrd Locks and Dam maintenance dredging program. Therefore, the Corps reinstated consultation and requested initiation of formal consultation on March 2, 2017.

A complete list of the consultation events is provided in the following table.

**Table 1. Consultation History**

<b>Date</b>	<b>Event</b>
December 28, 2008	USFWS receives a letter and Pre-Application Document Information Questionnaire from AMP Ohio, Inc. (AMP, Agent for the City of Wadsworth) for the R.C. Byrd Hydroelectric Project
February 3, 2009	USFWS emails response to AMP regarding the 12/28/2008 request
June 16, 2009	AMP files a Notice of Intent to File and Application for Original License and request for Designation as Non-Federal Representative; Request to use the Traditional Licensing Process; and Pre-Application Document for the Project
August 19, 2009	Dept. of the Interior provides comments to FERC on the Review of Notice of Application for Preliminary Permit for the Project
September 17, 2009	USFWS receives invitation to a 10/1/2009 Joint Agency/Public/Tribal Meeting for the Project
September 23, 2009	USFWS receives AMP's study plan for conducting a mussel survey for the Project
October 1, 2009	Site Visit and Joint Agency/Public/Tribal Meetings at R.C. Byrd Locks and Dam. Attended by USFWS
February 19, 2010	Joint agency Project meeting. USFWS OHFO participates via phone
March 12, 2010	USFWS OHFO receives report "Freshwater Mussel Survey of the Ohio River at R.C. Byrd Locks and Dam" from EA Engineering (EA)
June 22, 2010	Project survey review meeting in Farmington, WV. USFWS OHFO participates via phone
July 1, 2010	EA submits Draft Bat Study Plan to USFWS OHFO
July 6, 2010	USFWS OHFO provides site-specific authorization to Environmental Solutions and Innovations (ESI) to conduct the bat survey for the Ohio portion of the Project
July 15, 2010	USFWS OHFO sends letter to AMP in response to the mussel survey report received March 12, 2010
July 21, 2010	EA notifies USFWS OHFO of change in bat surveyor from ESI to Jackson Environmental Consultants (Jackson)
July 22, 2010	USFWS OHFO authorizes Jackson to conduct the bat survey

August 2010	EA submits letter to USFWS OHFO requesting updated technical assistance for the Project
August 17, 2010	USFWS OHFO sends letter to EA in response to request for updated information
October 13, 2010	USFWS OHFO receives bat survey report from Jackson
November 10, 2010	USFWS OHFO sends response letter to Jackson regarding bat survey report
February 11, 2011	USFWS OHFO receives notification of February 18, 2011 joint agency/public meeting in Columbus, Ohio
February 18, 2011	Joint agency/public meeting in Columbus, Ohio
April 11, 2011	FERC announces Notice of Application Tendered for Filing with the Commission and Soliciting Additional Study Requests for the Project
May 4, 2011	USFWS OHFO sends letter to FERC in response to the April 11, 2011 announcement
February 12, 2012	FERC issues the initial Scoping Document for the R.C. Byrd Hydroelectric Project
March 1, 2012	USFWS OHFO receives notice of NEPA scoping and Scoping Document from FERC
March 8, 2012	USFWS OHFO receives letter from AMP requesting information on raptors in the vicinity of the proposed transmission line for the Project
March 27, 2012	USFWS OHFO sends letter to AMP regarding their request for raptor information
March 28, 2012	FERC holds two public scoping meetings in Gallipolis, Ohio and a site visit at the Corps' R.C. Byrd Locks and Dam facility
August 16, 2012	USFWS OHFO receives Biological Assessment from the Corps for R.C. Byrd Locks and Dam Maintenance Dredging
August 20, 2012	FERC issues the revised Scoping Document for the R.C. Byrd Hydroelectric Project
September 10, 2012	USFWS OHFO provides letter to Corps concluding section 7 consultation for R.C. Byrd Locks and Dam Maintenance Dredging
October 15, 2012	FERC issues Notice of Application Ready for Environmental Analysis and Soliciting Comments for the Project

December 11, 2012	DOI sends FERC a “no comment” response to the Notice of Application Ready for Environmental Analysis and Soliciting Comments for the Project
July 14, 2014	USFWS receives Draft EA and request for section 7 consultation from FERC
July 24, 2014	USFWS OHFO sends section 7 non-concurrence letter to FERC in response to the July 14, 2014 request. Additional data regarding federally listed mussels and bats requested.
August 7, 2014	USFWS WVFO sends section 7 non-concurrence letter to FERC in response to the July 14, 2014 request. Additional data regarding federally listed mussels and bats requested
September 8, 2014	USFWS receives Notice of Teleconference to discuss the USFWS’s responses to the section 7 consultation request
September 23, 2014	USFWS, FERC, and AMP teleconference to discuss section 7 consultation for the Project
January 30, 2015	USFWS receives Final EA and request for section 7 consultation from FERC
February 26, 2015	USFWS OHFO and WVFO send joint section 7 non-concurrence letter to FERC reiterating data needs for federally listed mussels and bats
March 12, 2015	USFWS receives request for formal section 7 consultation from FERC
March 13, 2015	USFWS OHFO emails Corps requesting information on the timeline for development and completion of an operating agreement between the Applicant and Corps
March 23, 2015	Corps emails response to USFWS OHFO providing information on the timing of the development of an operating agreement. Corps also states that they are uncertain of the effect the operation of the Project would have on steering currents used by the Corps to protect the downstream mussel bed during maintenance dredging
April 3, 2015	FERC provides a Notice of Teleconference on April 20, 2015 to discuss FERC’s request for consultation with the USFWS
April 9, 2015	USFWS OHFO and WVFO send joint letter denying FERC’s March 12, 2015 request for formal consultation citing the same information needs as specified in the July 24, 2014 and August 7, 2014 letters. USFWS also notified FERC that consultation for the recently listed northern long-eared bat would also be necessary
April 20, 2015	Teleconference with USFWS, FERC, AMP, and Corps to discuss data

	needs to complete section 7 consultation for federally listed mussels and bats
June 15, 2015	USFWS OHFO receives FERC's Summary of Teleconference for the April 20, 2015 teleconference
June 17, 2015	EA Engineering emails Draft Bat and Mussel Protection Plans for the Project to USFWS and Corps
July 22, 2015	USFWS and Corps have teleconference to discuss Draft Bat and Mussel Protection Plans
July 31, 2015	USFWS OHFO and WVFO sends joint letter to EA Engineering providing comments on the Draft Bat and Mussel Protection Plans
September 25, 2015	EA Engineering emails agencies requesting teleconference to discuss the Draft Bat and Mussel Protection Plans
October 19, 2015	Teleconference with EA Engineering to discuss draft bat and mussel Protection Plans
February 10, 2016	EA Engineering emails USFWS and Corps the report Examining the Effect of Potential Water Velocities on Mussel Populations at R.C. Byrd Locks and Dam on the Ohio River
March 22, 2016	FERC emails USFWS requesting a teleconference to discuss progress on the bat and mussel studies/surveys/draft protection plans
April 4, 2016	FERC announces Notice of Teleconference on April 28, 2016 to discuss progress on the bat and mussel studies/surveys/draft protection plans
April 28, 2016	FERC teleconference with USFWS, Corps, EA Engineering, and AMP to discuss progress on the bat and mussel studies/surveys/draft protection plans
May 13, 2016	FERC issues Summary of Teleconference for the April 28, 2016 teleconference
June 16, 2016	USFWS PAFO sends letter to FERC regarding the status of the section 7 consultation and information needs
June 24, 2016	DOI files Motion for Late Intervention with FERC for the Project
June 27, 2016	USFWS Pennsylvania Field Office (PAFO) sends letter to FERC for Application for Original Major License – Request of USFWS to Reserve FPA Section 18 Authority to Prescribe Fishways
July 12, 2016	EA Engineering submits Supplemental Information to FERC in response to

	the USFWS's June 16, 2016 letter
August 16, 2016	USFWS receives FERC Notice Granting Late Intervention to the DOI
August 29, 2016	USFWS and Corps teleconference to discuss the Supplemental Information provided by EA Engineering on July 12, 2016
August 30, 2016	USFWS receives FERC's Notice of Teleconference for September 20, 2016 teleconference
September 16, 2016	USFWS PAFO sends letter to FERC regarding the Supplemental Information provided by EA Engineering on July 12, 2016
September 20, 2016	Teleconference to discuss Supplemental Information provided by EA Engineering on July 12, 2016
October 17, 2016	AMP files additional information with FERC on bat studies
October 25, 2016	FERC issues Summary of Teleconference for the September 20, 2016 teleconference
November 17, 2016	FERC sends letter to AMP requesting numeric hydraulic and sediment transport modeling information for the proposed Project
November 22, 2016	USFWS WVFO sends letter to FERC requesting an updated Indiana Bat Protection Plan
December 1, 2016	FERC sends letter to AMP requesting updated mussel and bat Protection Plans for the USFWS
December 2, 2016	AMP submits supplemental information to FERC on AMP's numeric hydraulic and sediment transport model
December 29, 2016	AMP submits to FERC and USFWS WVFO a response to comments on the Myotis Bat Conservation Plan
January 10, 2017	USFWS PAFO submits comments to FERC on AMP's updated numeric hydraulic and sediment transport model
February 6, 2017	USFWS OHFO received FERC's request for initiation of section consultation for federally listed mussels and bats
February 10, 2017	Teleconference between USFWS and Corps to discuss sediment transport modeling
February 24, 2017	Teleconference between USFWS and Corps to discuss reinitiation of consultation for maintenance dredging

February 27, 2017	USFWS OHFO mail to Corps recommending reinitiation of consultation regarding maintenance dredging at R.C. Byrd Locks and Dam
March 2, 2017	USFWS OHFO receives request for reinitiation of consultation from the Corps for R.C. Byrd Locks and Dam Maintenance Dredging
March 3, 2017	USFWS OHFO sends letters to FERC and Corps acknowledging initiation for formal consultation for federally listed mussels and concluding informal consultation for the Indiana bat
March 21, 2017	USFWS receives FERC's northern long-eared bat 4(d) Rule Streamlined Consultation Form concluding consultation for the species
May 12, 2017	USFWS OHFO sends draft BO to the Corps for review
May 26, 2017	Corps submits comments on draft BO to OHFO
May 30, 2017	USFWS OHFO sends draft BO to FERC and the Corps for review
June 9, 2017	AMP submits comment on draft BO to USFWS OHFO and FERC
June 19, 2017	USFWS OHFO issues final BO to FERC and the Corps concluding formal consultation

## **BIOLOGICAL OPINION**

### **DESCRIPTION OF THE PROPOSED ACTIONS**

The federal actions evaluated in this Biological Opinion (BO) are FERC's proposed issuance of a license to the Applicant, the City of Wadsworth, Ohio, to authorize the construction and operation of the Robert C. Byrd Hydroelectric Project and the Corp's Navigation Channel Maintenance Dredge Program at the existing Robert C. Byrd Locks and Dam (RCB dam) on the Ohio River in Gallia County, Ohio and Mason County, West Virginia (Figure 1). Both projects are being evaluated in one BO because the construction and operation of the hydroelectric project may interfere with the Corp's ability to be protective of federally listed mussels during dredging operations in the lower approach to the dam locks.

The Service is issuing this BO pursuant to section 7 of the ESA. Direct and indirect effects of the federal actions (licensing by FERC and dredging by the Corps) and the interrelated or interdependent activities are analyzed to ensure they are not likely to jeopardize the continued

existence of federally listed or proposed endangered or threatened species. Indirect effects of a federal action include, "...effects that are caused by or result from the action, are later in time but are reasonably certain to occur..." Interdependent actions have no independent utility apart from the proposed action, and interrelated actions are part of a larger action and depend on the larger action for their justification (50 CFR §402.02).

The R.C. Byrd Locks and Dam (formerly Gallipolis Locks and Dam), were constructed between 1935 and 1937. The Corps began replacing the locks in November of 1987 and completed their reconstruction in January 1993. The dam underwent rehabilitation that began in 1992 and was completed in 2002. The existing facilities consist of a concrete, high-lift, gated dam; two active parallel locks; and two deactivated locks. The dam has a height of 29.5 feet above the sills. The top length of the gated section is 1,148 feet. There are eight roller gates, with a clear span of 125.5 feet between nine, 16-foot-wide piers. The Corps numbers its roller gates from east to west, with gate 1 closest to the lock wall on the West Virginia side of the dam and gate 8 adjacent to the Ohio shoreline. The Corps numbers its piers from the lock wall on the West Virginia side (pier 1) to the Ohio shoreline (pier 9).

The area upstream of the RCB dam to the Racine Locks and Dam is referred to as the R.C. Byrd Pool and the area downstream of the RCB dam is the Greenup Pool, which extends downstream to the Greenup Locks and Dam.

### **R.C. Byrd Hydroelectric Project**

The proposed Project would be constructed on the Ohio shoreline, adjacent to the right abutment of the existing RCB dam. (Figures 1 and 2). It would consist of the following new facilities: (1) a 1,200-foot-long intake channel conveying flow to two equally sized intakes approximately 60 feet wide by 73 feet high; (2) a trash rack located in front of each of the generating unit intakes, with a bar spacing of approximately 8 inches; (3) a reinforced concrete powerhouse measuring approximately 258 feet long by 145 feet wide by 110 feet high, and housing two bulb-type turbine generator units with a total installed capacity of 50 megawatts; (4) a 900-foot-long tailrace channel; (5) a 2.41-mile-long, 138-kilovolt transmission line, and (6) appurtenant facilities. The proposed project would have an estimated average annual generation of 266,000 megawatt-hours.

The transmission line would cross the Ohio River from the proposed power plant and traverse private land and Corps land within Mason County, West Virginia. The transmission line would cross the river supported on steel lattice towers, and beyond the river crossing, would be strung on wood pole structures to a point of connection at an existing American Electric Power substation near Apple Grove, West Virginia.

A temporary cofferdam would be constructed to isolate the main Project construction area from the river. The cofferdam extending upstream and downstream of the existing spillway gate structure would consist of circular steel sheet pile cells filled with granular materials and would be high enough in elevation to provide protection against the 100-year flood. The cells would be

ted to the existing spillway structure and would encompass gate 8 and possibly gate 7.

The proposed Project would use head created by the Corps' existing RCB dam to generate power. Wadsworth would operate the Project with flows made available by the Corps. The final design of the powerhouse and intake and tailrace channels has not yet been developed and Wadsworth intends to conduct physical hydraulic modeling prior to the start of construction to assist in developing the final design. Wadsworth will also develop an operating agreement with the Corps as part of the section 408 permitting process to authorize the Project to utilize the Corps' dam structure.

There would be no additional water storage associated with the proposed Project, and the total discharge into the lower pool would not be altered from existing conditions. The Corps would continue to be responsible for determining the flows required to maintain the desired pool elevations. However, after construction, some of the water that previously would have been released through the RCB dam would instead pass through the turbines to generate electricity. Other flows (lockage and leakage flows, river flows less than the minimum hydraulic capacity of the turbines or greater than the hydraulic capacity of the turbines) would continue to be released through the RCB dam.

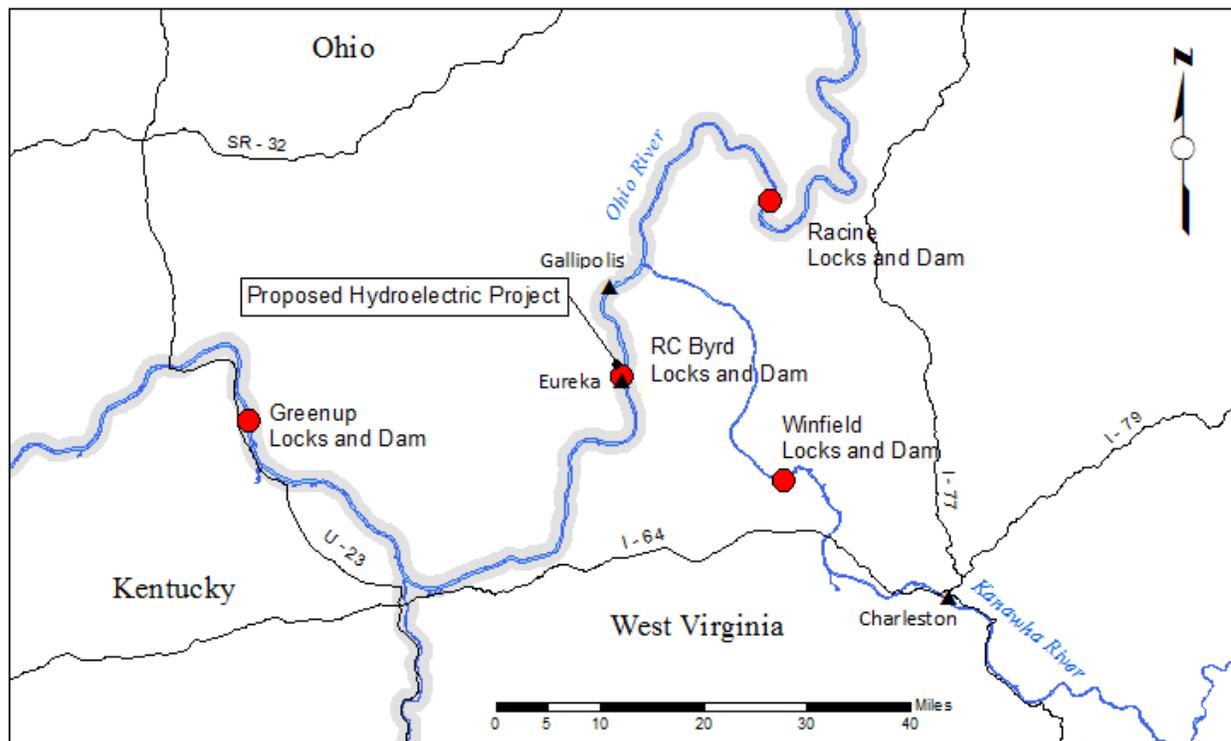
The proposed power plant hydraulic capacity is estimated at 50,000 cubic feet per second (cfs). The estimated minimum operating flows through one unit when operating at a reduced gate setting and at partial load would range from about 1,000 to 6,000 cfs, depending upon the prevailing head. Wadsworth would coordinate with the lockmaster to determine the flow that is necessary to discharge through the Project powerhouse in order to maintain the upper and lower pools at the required level.

On-site personnel would initiate unit start-up and shutdown and normal operations would be monitored by on-site plant operators. Once the units are operating, plant personnel would place them in automatic mode, but could take over manual control, as necessary. The project would also have the capability of being operated and monitored from a remote location.

### **R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program**

The Corps, authorized by the Rivers and Harbors Act of March 3rd, 1827, conducts maintenance and emergency dredging at the lock approaches and at various locations within the Ohio River to maintain a continuous year-round, 24 hour a day operation of the 9.0-foot deep federal navigation channel within the Ohio River. Sediment in the Ohio River is transported downstream during storm events and accumulates within the maintained channel, particularly at lock approaches and near boat ramps. The Corps dredges these areas, some annually, to maintain authorized navigable depths.

**Figure 1. Location of the proposed R.C. Byrd Hydroelectric Project (Source: FERC Final EA).**



The RCB dam is operated as a run of the river dam. Roller gates are lifted and lowered to maintain river flow. During normal or high flows, the water is evenly distributed over all of the gates. During lower flows, some flow is prioritized for the gates along the Ohio side of the river to provide better angling opportunities. The present flow conditions of the RCB dam produce a back current and eddy along the left descending bank, which results in the deposition of sediment in the lock approach (USACE 2012a).

The lower RCB dam approach is dredged annually and in emergency situations. The lower approach dredge area extends from the West Virginia bank to beyond the lower approach guidewall (a width of approximately 600 ft; 180 m), from the lock chamber to approximately 3000 ft (914 m) downstream of the chamber; approximately 1600 ft (500 m) downstream of the lower lock wall (see Figure 2). Annual dredging removes an average of 73,172 cubic yards (CY) of material from this area with both clamshell and hydraulic dredge. Emergency dredging occurred in the lower approach in 2004, 2005, 2011, 2012, 2014, 2015, 2016, and 2017.

Emergency dredging is typically accomplished with a mechanical dredge, and removal per event averages 18,452 CY. Material is disposed mid-river (approximately 430 ft [130 m] from the Ohio bank), upstream of Ohio River Mile (ORM) 279.5 (Figure 2). The Water Quality Certification approved dredge disposal area used post-2001 extends from approximately 1000 ft

(300 m) to 2700 ft (825 m) downstream of the dam. The disposal area extended approximately 1650 ft (500 m) downstream of the current disposal area pre-2001, but is now limited to 825 m downstream of the dam due to the presence of the unionid mussel bed along the right descending bank (RDB) that was discovered in 2001 (MES 2001). Dredging of the lower approach is expected to occur with a similar frequency in the near future (at least annually).

The upstream (upper) approach to the RCB dam does not require frequent dredging. The upper approach was last dredged during construction in 1991. Material was disposed along the RDB approximately 550 m (1800 ft) upstream of the RCB dam. Dredging in the upstream approach is not expected to occur in the near future, but may be needed occasionally. This would include maintenance of the boat ramp (as in 2013) and to allow for mooring in the old lock chambers.

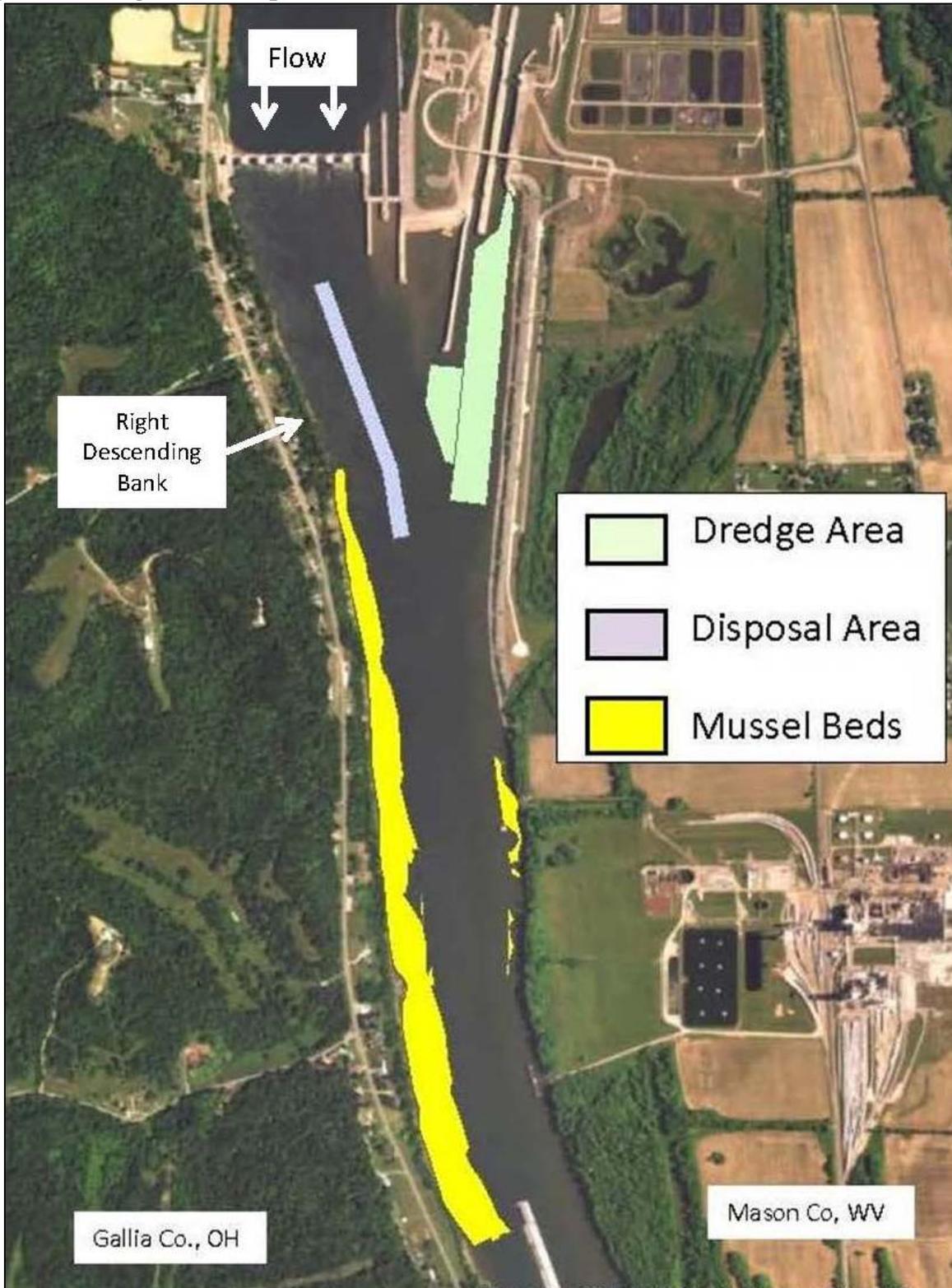
A clamshell or hydraulic dredge is used to remove material at the lower approach of RCB dam. Both Huntington and Louisville Districts share the same contracted, hydraulic dredging equipment. Therefore, the timing of dredging operations directed by the Huntington District is dependent upon the Louisville District. Historically, hydraulic dredging at sites within the Huntington District began in late summer, as Louisville District began their dredging in early June following the elevated spring flows. Once Louisville District completed their maintenance dredging, the hydraulic dredge was shuttled up the Ohio River for Huntington District. Recently, however, the Huntington District has scheduled the use of the hydraulic dredge during the normal early summer flows in order to continue to minimize impacts to mussel beds. Dredging operations at the RCB dam average seven days (range three to 13 days, an average of 1.2 days per 10,000 CY of material). Private contractors run the dredging equipment under the supervision of Corps personnel. Between 2001 and 2015, maintenance dredging at RCB occurred between August and September. The new prioritization strategy began in 2016 when the hydraulic dredge was operated during June.

Maintenance dredging operations consist of two separate activities, which include removal of accumulated sediment from the dredge site and disposal of the dredged material. Removal of accumulated material is accomplished via a cutter head on the hydraulic dredge, which dislodges excess sediment from the river bottom. Once the cutter head loosens material from the river bottom, it is suctioned into a flexible, floating pipe and pumped to the disposal area. During past operations, the discharge pipe has been positioned consistently within the approved area. The pipe is typically positioned approximately 10ft above the water surface elevation. A diffuser on the end of the pipe removes some of the energy on exit.

Mechanical dredging (barge mounted crane with a clam shell bucket) is used for emergency dredging, dredging in small areas, and in circumstances when the disposal site is greater than 2500 ft (760 m) from the dredge site. The clamshell scoops material from the bottom and deposits it onto a barge. Material is transported via barge to the disposal site.

A crane with a toothless clamshell bucket is typically used to scoop material from the barge into the disposal site where material is released at or near the water surface. Additionally, dump

Figure 2. Dredge Area, Disposal Area, and Mussel Beds Downstream of RCB Dam



scows have been employed alongside mechanical dredging. Dump scows function as water borne dump trucks. These 300 cubic yard vessels can be loaded with a clamshell dredge, hauled to the disposal site, and emptied via hydraulically operated split hulls. This type of operation further minimizes the mobilization of dredged material and decreases impacts from turbidity.

## **Conservation Measures**

Conservation measures are those actions taken to benefit or promote the recovery of the species. These actions taken by the federal agency and/or applicant serve to minimize or compensate for project effects on the species under review and are included as an integral portion of the proposed action.

The Service recognizes that, individually and/or cumulatively, these conservation measures could contribute to the avoidance and minimization of adverse effects to the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox but that these measures do not necessarily eliminate all adverse effects that may result from the proposed actions.

### R.C. Byrd Hydroelectric Project Conservation Measures

In the EA, FERC staff recommended conservation measures for mussels be included in the licenses issued to the applicants in addition to the applicant's proposed measures. The Applicant's and FERC's proposed conservation measures are as follows:

1. Use a physical hydraulic model to determine what effects the project's intake and discharge would have on aquatic species and aquatic habitat.
2. Prepare a contaminated sediment testing and disposal plan.
3. Prepare an erosion and sediment control plan to minimize the impacts of project construction on soils and water quality.
4. Use water trucks to control dust generated by heavy equipment on exposed soil during project construction.
5. Prepare a water control plan to control ground and surface water during construction.
6. Prepare a water quality management plan for controlling sediments during all aspects of work including, but not limited to, land-clearing, all excavation, drilling, fills, road work, and final disposal of sediments collected in sediment basins or behind sediment barriers.
7. Place uncontaminated excess excavated material in a designated spoil pile.

8. Use rip-rap material to stabilize river banks during construction.
9. Construct a temporary cofferdam to isolate the main construction area from the river.
10. Prepare a spill prevention, containment, and counter measure plan to minimize impacts to water quality due to accidental spills of fuels or lubricants during construction and operation of the project.
11. Monitor dissolved oxygen, temperature, and total dissolved gasses upstream and downstream of the proposed powerhouse, one year prior to construction, one year during construction, and one year after construction.
12. Avoid in-water construction from March 15 to June 30 (to the extent practicable) to reduce potential impacts to aquatic species and their habitat.
13. Implement a final freshwater mussel relocation and monitoring plan.
14. Prepare a project operation and compliance monitoring plan.
15. Prepare a site restoration and aesthetics plan, to include measures for avoiding project effects on stream, wetland, riparian, and bottomland hardwood forest habitat, and provide on-site mitigation, wherever feasible, to account for unavoidable losses of these habitats due to project construction.

#### R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program Conservation Measures

1. The Corps will hold annual pre-dredge coordination meetings with members from state, federal and private organizations to review the previous years' dredging program, research and monitoring plan, water quality monitoring results, and mussel surveys.
2. The Corps will continue to seek out beneficial uses for dredged material, when possible.
3. The Corps will monitor the mussel bed downstream of the RCB dam dredging disposal site.
4. The Corps will modify the dredging disposal areas based on new mussel survey data.
5. The Corps will sample and analyze dredged sediment for contaminants every three years.
6. The Corps will limit dredging to areas where it is absolutely necessary to maintain navigation.
7. The Corps has established exclusion zones (1500ft upstream, 500ft downstream, and 500ft to

each side) around the mussel bed downstream of the RCB dam to prohibit barges from mooring or operating in shallow water close to the bed.

8. The Corps will minimize impacts of sediment plumes on mussel beds through choreographed gate operations to steer turbid water to the center of the river channel and away from the downstream mussel bed. The Corps will use mechanical dredging and dump scows, when viable, for additional impact minimization. The sediment deposition within the mussel bed will be monitored during disposal so that adjustments in gate operations can be made in real-time to minimize sediment deposition on the mussel bed.

### **Action Area**

In 50 CFR §402.02 “action area” is defined 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 is not limited to the footprint of the action and should consider the effects to the environment resulting from the action. Within a set action area, all activities that can cause measurable or detectable changes in land, air, and water or to other measurable factors that may elicit a response in the species or critical habitat are considered. The action area is not defined by the range of the species that would be impacted; rather it is defined by the impacts to the environment that would elicit a response in the species (USFWS and NMFS 1998). Therefore, the action area for the Project includes the project footprint and the geographic extent of the area that could be affected by the construction, operation, and maintenance of the facilities either directly, indirectly, or through interrelated or interdependent actions, including the Corps’ maintenance dredging.

The action area for the Project and Corps dredging includes the existing locks and dam to the downstream extent of the sediment plume from in-stream disposal of dredged material from the lower approach to the RCB dam. This action area includes the intake channel located immediately upstream of the powerhouse, intake structures, powerhouse, dam abutment, and tailrace channel located immediately downstream of the powerhouse, the dredging area in the lower approach to the locks, the dredge disposal area, and the downstream area affected by the disposal sediment plume. The dredge disposal plume may carry as far as 11 miles or more downstream of the disposal area depending upon stream flow conditions during the disposal of dredged materials (Corps 2012b; Morrison 2017, pers. comm.). Therefore, the action area encompasses the RDB dam to 11+ miles downstream.

The construction, operation, and maintenance of the Project will result in direct and indirect effects to federally listed mussels in the action area. Those construction, operation, and maintenance activities located on upland facilities are not anticipated to have any effect on the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. Therefore, this BO will only analyze the effects of the construction, maintenance, and operation of the in-water and shoreline features of the Project and the Corps’ maintenance dredging.

## STATUS OF THE SPECIES

This BO covers the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox.

### **Species Descriptions**

#### Fanshell

The fanshell is a federally listed endangered species (55 FR 25591). No critical habitat has been designated for this species. The fanshell was described by Constantine Rafinesque in 1820. The type locality is reported as “Ohio.”

The following description is summarized from Parmalee and Bogan (1998). This mussel may reach up to 2.8 inches in length, and the shape of the shell is rounded, inflated, with the valves thick and solid. The ventral margin is long and broadly rounded. The posterior margin is bluntly angled or slightly truncated. The posterior ridge is well developed producing a sharp angle behind the umbo, becoming rounded toward the ventral-posterior margin; sometimes having a shallow sulcus on the flattened posterior slope. The periostracum is a pale greenish yellow, covered with a pattern of darker green flecks or dots which may appear as rays. The posterior two-thirds of the shell is covered with numerous irregular knobs and rounded pustules which may appear in rows on the center of the valve. Beaks are elevated and full with sculpture consisting of a few indistinct ridges. The left valve has two low, thick divergent, roughened pseudocardinal teeth with two slightly curved, short, heavy lateral teeth. The right valve has a low, triangular, deeply serrated pseudocardinal tooth with a short, low, finely striated lateral tooth with an indication of a second inner, flattened tooth.

#### Pink Mucket Pearly Mussel

The pink mucket is a federally listed endangered species (41 FR 24062). No critical habitat has been designated for this species. The pink mucket pearly mussel was described by Thomas Say in 1831. The type locality is the Muskingum River, Ohio.

The following description is summarized from Parmalee and Bogan (1998). This mussel may reach up to 4.5 inches in length, and the shape of the shell is almost square or orbicular and somewhat inflated, especially in females. The anterior margins are evenly rounded, while the dorsal and ventral margins are slightly curved. The posterior margin of the female shell is slightly rounded to straight, while that of the male bluntly pointed or rounded. A posterior ridge, well defined in males, is distinct along the dorsal margin. The two valves slightly gape along the anterior margin. Beaks are located in the anterior third of the shell, and in young individuals beaks are marked by faint, scarcely looped ridged. The periostracum color varies from a light yellow (in juveniles) or yellowish brown to dark brown and is occasionally marked with broken fine to fairly wide dark green rays. The left valve has two large triangular pseudocardinal teeth separated from two strong, slightly curved lateral teeth by a short, broad interdentum. The right valve has one large triangular pseudocardinal tooth with one lateral tooth that is large and slightly curved.

### Sheepnose

The sheepnose is a federally listed endangered species (77 FR 14914). No critical habitat has been designated for this species. The sheepnose was described by Constantine Rafinesque in 1820. The type locality is the Falls of the Ohio River near Louisville, Kentucky and adjacent Indiana.

The following description is summarized from Oesch (1984) and Parmalee and Bogan (1998). This medium sized mussel reaches nearly 5.5 inches in length, and the shape of the shell is elongate ovate, moderately inflated, with the valves thick and solid. The anterior end of the shell is rounded and the posterior is truncate to bluntly pointed. The posterior ridge is gently rounded and flattened ventrally, and there is generally a row of large, broad tubercular swelling on the center of the shell extending from the beak to the ventral margin. A shallow sulcus lies between the posterior ridge and central swellings. Beaks are high and located near the anterior margin. In young individuals the periostracum is often light yellow to yellowish brown, becoming darker with age. The beak cavity is shallow to moderately deep and generally white in color. The right valve contains a large triangular pseudocardinal tooth and the lateral teeth are heavy, long and slightly curved.

### Snuffbox

The snuffbox is a federally listed endangered species (77 FR 8632). No critical habitat has been designated for this species. The snuffbox was described by Constantine Rafinesque in 1820. The type locality is the Falls of the Ohio River near Louisville, Kentucky and adjacent Indiana.

The following description of the snuffbox is summarized from Oesch (1984) and Parmalee and Bogan (1998). The snuffbox is a small to medium-sized mussel that reaches at least 3.5 inches in length. Sexual dimorphism is pronounced with males achieving greater lengths. The shape of the shell is somewhat triangular (females), oblong, or ovate (males) with the valves solid, thick, and very inflated. The beaks are located somewhat anterior of the middle, swollen, turned forward and inward, and extended above the hingeline. Beak sculpture consists of three or four faint double-looped bars. The anterior end of the shell is rounded and the posterior end is truncated, highly so in females. The posterior ridge is prominent, being high and rounded, while the posterior slope is widely flattened. The posterior ridge and slope in females is covered with fine ridges and grooves, and the posteroventral shell edge is finely toothed. The periostracum (external shell surface) is generally smooth and yellowish or yellowish-green in young individuals becoming darker with age. Green squarish, triangular, or chevron-shaped marks cover the umbo but become poorly delineated stripes with age. The left valve has two high, thin triangular, emarginate pseudocardinal teeth (the front tooth being thinner than the back tooth) and two short, strong, slightly curved, and finely striated lateral teeth. The right valve has a high, triangular pseudocardinal tooth with a single short, erect, and heavy lateral tooth.

## Life History

These freshwater mussels are filter-feeding species from the Unionidae family with a diet likely consisting of a mixture of algae, detritus, bacteria, and microscopic zooplankton. Most mussels, including these species, have separate sexes. Age at sexual maturity is highly variable among and within species. However, the age at sexual maturity for each of these species is not known. Fertilization success for these species is influenced by mussel density and flow conditions.

All of these species are difficult to detect in many of the streams where they remain, with portions of their populations occurring below the substrate surface. Sparsely distributed juveniles and/or subadults, indicative of successful reproduction, are even more difficult to detect than adults.

### Fanshell

The following life history information is from the species Recovery Plan (USFWS 1991), 5-year reviews (USFWS 2009), and Parmalee and Bogan (1998). Females are considered to be long-term brooders. They become gravid in the fall and hold their glochidia in their marsupia until spring or summer when they spawn. Nine host fish have been identified: mottled sculpin (*Cottus bairdi*), banded sculpin (*Cottus carolinae*), greenside darter (*Etheostoma blennioides*), snubnose darter (*Etheostoma simoterum*), banded darter (*Etheostoma zonale*), tangerine darter (*Percina aurantiaca*), blotchside logperch (*Percina burtoni*), logperch (*Percina caprodes*), and Roanoke darter (*Percina roanoka*).

The fanshell inhabits medium to large rivers of the Ohio River basin. It buries itself in coarse sand or gravel in deep water of moderate or swift currents.

The fanshell is currently known to occur in 14 rivers, all of them in the Ohio River basin. There are recent records since 2000 of live fanshell from the Ohio River in the portion of the river that borders Ohio and West Virginia, specifically the Belleville and Racine Pools. Fanshell are rarely observed, but a small population must still persist in the Ohio River based on these recent detections. The fanshell may occur elsewhere in the Ohio River; however, more extensive and thorough mussel surveys are needed to provide better insight into the fanshell's status in the Ohio River.

### Pink Mucket Pearly Mussel

The following life history information is from the species Recovery Plan and 5-Year Review (USFWS 1985; USFWS 2009). Females are considered to be long-term brooders. They become gravid in the fall and hold their glochidia in their marsupia until spring or summer when they spawn. Host fish include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), sauger (*Sander canadense*), spotted bass (*Micropterus punctulatus*), walleye (*Sander vitreus*), and white crappie (*Pomoxis annularis*).

The pink mucket is found in medium to large rivers in habitats ranging from silt to boulders,

rubble, gravel, and sand substrates. It is most often found in moderate to swift currents.

The pink mucket is currently known from 16 rivers in the Ohio River basin, lower Missouri River system, and lower Mississippi River sub-basin. In the Ohio River mainstem, there are recent records of live pink mucket in the Belleville Pool, R.C. Byrd Pool, Greenup Pool, and Racine Pool. Pink muckets are occasionally, but rarely, observed in these pools. The pink mucket may occur elsewhere in the Ohio River; however, more extensive and thorough mussel surveys are needed to provide better insight into the pink mucket's status in the Ohio River.

### Sheepnose

The following life history information is from Butler (2002). Females are thought to be short-term brooders, with most reproduction taking place in early summer with glochidial release presumably occurring later in the summer. Little is known regarding host fishes of the sheepnose. The sauger is the only known natural host, but others must be available.

The sheepnose is primarily a larger-stream species. It occurs primarily in shallow shoal habitats with moderate to swift currents over coarse sand and gravel. Habitats with sheepnose may also have mud, cobble, and boulders. Specimens in larger rivers may occur in deep runs.

Extant populations of the sheepnose are known from 26 streams in the upper and lower Mississippi River sub-basins (including the lower Missouri River system), and Ohio River basin. There are recent records of sheepnose in the upper Ohio River in the Belleville, Racine, Greenup, Meldahl, and Markland Pools.

### Snuffbox

The following life history information is from Butler (2007). Females are considered to be long-term brooders. They become gravid in the fall and hold their glochidia in their marsupia until spring or summer when they spawn. Host fish include logperch, blackside darter (*Percina maculata*), rainbow darter (*Etheostoma caeruleum*), Iowa darter (*Etheostoma exile*), blackspotted topminnow (*Fundulus olivaceus*), mottled sculpin, banded sculpin, Ozark sculpin (*Cottus hypselurus*), largemouth bass, and brook stickleback (*Culaea inconstans*). Hornyhead chub (*Nocomis biguttatus*) is a potential host. Logperch is widely considered to be the best host for the snuffbox.

The snuffbox is found in small to medium-sized creeks to larger rivers and in lakes. It occurs in swift currents of riffles and shoals and wave-washed lakeshores over gravel and sand with occasional cobble and boulders, and generally burrows deep into the substrate except when spawning or attracting a host.

Extant populations are known from 78 streams in the upper and lower Great Lakes sub-basins, upper and lower Mississippi River sub-basins, lower Missouri River system, Ohio River basin, and White River system. In the Ohio River mainstem, single live and freshdead specimens have been reported from just below the Belleville Locks and Dam in 2001 and 1995, respectively.

## ENVIRONMENTAL BASELINE

The Environmental Baseline analyzes the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and the ecosystem within the action area. In order to assess the potential for the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox to occur within the action area, the Service must formulate reasonable assumptions. These assumptions must be made in order to analyze the potential effects of the actions. It is important to note that the Service has been mandated by Congress to provide the benefit-of-the-doubt to federally listed species (H.R.Conf. Report No. 697, 96th Cong., 2d Session, 1979). That is to say, the Service must err on the conservative side (the side of the species) when making reasoned assumptions.

### **Status of the Fanshell, Pink Mucket Pearly Mussel, Sheepnose, and Snuffbox in the Action Area**

ESI's (2000) compilation of unionid surveys for the Greenup Pool indicated that the closest unionid bed downstream of the RCB dam was located along the RDB between ORM 282.5 – 284.5. The combined historical surveys included in ESI's 2000 report indicate that 6,584 live or freshdead specimens of 30 species have been collected from this area. ESI (2000) also reports that a total of 33 species have been reported from the Greenup Pool, including 5 individual pink mucket pearly mussel and 64 individual sheepnose.

There have been eight mussel surveys conducted around the RCB dam (ORM 278.8 – 281) since 2001. All but one of these surveys, the 2009 survey, were conducted in support of the Corps' Ohio River navigation maintenance dredge program. The 2009 survey was an investigation conducted for the R.C. Byrd Hydroelectric Project. All of these surveys show that a diverse mussel community exists along the RDB downstream of the RCB dam (Table 2). These surveys have identified 27 live species in this reach of the Ohio River.

A small concentration of mussels is known to occur between 200 m and 500 m upstream of the RCB dam on the RDB (EA 2010; LEC 2013). Ten species of mussels have been documented in this area, none of which are federally listed. EA (2010) reported an average mussel density upstream of the dam as 0.1 mussel/m<sup>2</sup>. EA (2010) reported finding only a few scattered individuals of two unlisted species upstream of the dam along the left descending bank (LDB).

A mussel bed also occurs along the LDB downstream of the RCB dam between ORM 280.0 and 280.5 (LEC 2016). Twelve live species (none federally listed) have been documented in this bed with a relatively low average density of 1.5 mussels/m<sup>2</sup> (LEC 2016). The habitat along the LDB is not as suitable for mussels as it is along the RDB and is unlikely that any federally listed mussels occur in the downstream LDB mussel bed (LEC 2012; LEC 2016).

**Table 2. Mussel data for the survey area downstream of R.C. Byrd Locks and Dam along the right descending bank (Source: Lewis Environmental Consulting, LLC 2016).**

Scientific Name	USACE	USACE	USACE	AMP OH	USACE	USACE	USACE	USACE
	2001	2005	2007	2009	2011	2012	2014	2016
<i>Actinonaias ligamentina</i>			X	X		X	X	X
<i>Amblema plicata</i>	X	X	X	X	X	X	X	X
<i>Ellipsaria lineolata</i>		X	X	X	X	X	X	X
<i>Elliptio crassidens</i>	X	X	X	X	X	X	X	X
<i>Elliptio dilatata</i>			X					
<i>Fusconaia ebena</i>		X			X	X		
<i>Fusconaia flava</i>							X	
<i>Lampsilis cardium</i>	X	X	X	X	X	X	X	X
<i>Lampsilis ovata</i>				X			X	X
<i>Lampsilis siliquoidea</i>			X				X	X
<i>Lampsilis teres</i>		X		X	X	X	X	WD
<i>Lasmigona complanata</i>	X	X	X	X	X	X	X	
<i>Lasmigona costata</i>				X				
<i>Leptodea fragilis</i>			X	X	X	X	X	WD
<i>Ligumia recta</i>		X	X	X	X	X	X	X
<i>Megalonaias nervosa</i>	X	X	X	X	X	X	X	X
<i>Obliquaria reflexa</i>	X	X	X	X	X	X	X	X
<i>Plethobasus cyphus*</i>				X	X		WD	X
<i>Pleurobema cordatum</i>		X		X	X	X	X	X
<i>Pleurobema sintoxia</i>						X	X	
<i>Potamilus alatus</i>	X	X	X	X	X	X	X	X
<i>Quadrula metanevra</i>		X	X	X	X	X	X	X
<i>Quadrula pustulosa</i>	X	X	X	X	X	X	X	X
<i>Quadrula quadrula</i>		X	X	X	X	X	X	X
<i>Tritogonia verrucosa</i>			X					
<i>Truncilla donaciformis</i>								X
<i>Truncilla truncata</i>				X	X		WD	X
<b>Total # Live Species</b>	<b>8</b>	<b>15</b>	<b>17</b>	<b>20</b>	<b>18</b>	<b>18</b>	<b>20</b>	<b>18</b>
<b>Species Diversity</b>	<b>1.630728</b>	<b>2.28052</b>	<b>2.08314</b>	<b>1.87883</b>	<b>1.97362</b>	<b>2.14735</b>	<b>2.07095</b>	<b>1.86827</b>
<b>Evenness</b>	<b>0.7842143</b>	<b>0.84213</b>	<b>0.73526</b>	<b>0.62717</b>	<b>0.68283</b>	<b>0.74293</b>	<b>0.69130</b>	<b>0.64638</b>

\*Federally Endangered

WD = species present as weathered dead shell only

Note: 2011 and 2016 were quadrat-only surveys.

The sheepsnose was encountered live during the 2009, 2011, 2016 surveys and as a weathered dead relic shell in 2014 (LEC 2016). All of these individuals were found in the downstream bed along the RDB below ORM 280.0. No fanshell, pink mucket pearly mussel, or snuffbox have been collected during these surveys, though pink mucket pearly mussel and sheepsnose records do exist downstream of this area in a mussel bed along the LDB between ORM 282.5 to 284.5 (ESI 2000). In addition, in 2016 a fanshell recovery project was initiated by translocating 99 adult fanshell from the Licking River in Kentucky to ORM 284.0. This site will be monitored for the next several years to determine survival (Clayton 2017, pers. comm.).

Snuffbox records in recent years in the Ohio River are quite rare and have been restricted to the Belleville Pool, though records do indicate that a small population of this species persists in the river. The smaller size of the snuffbox and the tendency for them to be buried deeply in the substrate may also cause them to be overlooked or underrepresented during surveys.

As with the snuffbox, the fanshell, pink mucket pearly mussel, and sheepsnose are also difficult to detect as portions of their populations can occur below the substrate surface. Therefore, qualitative population estimates must take into account the possibility that individuals are buried and qualitative estimates likely underestimate the number of individuals. In addition, where federally listed mussels occur in low population densities, population estimates may have large margins of error due to undetected mussels. Sparsely distributed juveniles and/or subadults, indicative of successful reproduction, are even more difficult to find than adults. Successful recruitment of fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox populations are difficult to detect when densities are very low and/or when survey efforts are inadequate to detect rare species. Therefore, populations with densities near or below the detection rate may not be practically assessed with quantitative techniques. Difficulty in detecting fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox can result in poorly defined information about the species' distribution and abundance in streams where the species is known to occur. Although fanshell, pink mucket pearly mussel, and snuffbox were not detected during the surveys in the mussel bed between ORM 279.8 and 281.0 along the RDB, their potential presence in this area cannot be ruled out based on this rationale. Similarly, pink mucket pearly mussel and sheepsnose have been documented in the mussel bed along the LDB between ORM 282.5 to 284.5 but fanshell and snuffbox may also occur in this bed, in addition to the 99 adult fanshell that were translocated to ORM 284.0 in 2016.

Based on the lower habitat quality and limited density and diversity of mussels upstream of the RCB dam, it is not likely that fanshell, pink mucket pearly mussel, sheepsnose, or snuffbox occur in this area. Nor is it likely that these federally listed mussels occur in the bed along the LDB between ORM 280.0 and 280.5 downstream of the dam for the same reasons. Therefore, it is assumed that the fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox only occur in the mussel bed along the RDB downstream of the RCB dam starting at ORM 279.8 and in the mussel bed along the LDB between ORM 282.5 and 284.5.

The mussel bed along the RDB of the river starts approximately 800 m downstream of the dam (Figure 2). Mussel surveys have determined that the bed continues for at least 2000 m (1.25 miles) downstream, although the total extent of the bed has not been delineated. The bed likely extends for some distance further downstream based on the fact that moderate to high mussel densities occur at the downstream extent of the survey area (Lewis 2017, pers. comm.).

During the most recent mussel survey in 2016, 602 live mussels of 18 species were encountered during quantitative sampling in a 400 m by 50 m portion of the bed along the RDB, including one live sheepsnose (Table 2). The number of individuals collected per quadrat (quadrat = 0.25 m<sup>2</sup>) ranged from 0 to 16. Estimated density of mussels within the quadrats ranged from 0 to 64 mussels per m<sup>2</sup>, and averaged 11.63 mussels per m<sup>2</sup> within the area sampled. During the survey, mussels tended to be denser in the quadrats located closest to the shoreline with the majority of the mussels being found within 50 m of the bank, with lower densities in the quadrats toward the navigation channel (LEC 2016). The ages of mussels collected in 2016 ranged from 1 – 30 years old with an average age of 8.1 years old. Of the 602 mussels collected, 21.2% (n=128) were juveniles ( $\leq 5$  years old) (LEC 2016). The area surveyed in 2016 was approximately 20,000 m<sup>2</sup>.

The exact number of individual fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox occurring in the action area is unknown. The upper limit of the mussel bed along the RDB begins near ORM 279.8 and is known to extend to ORM 281.0 and likely some distance further downstream. The density of mussels throughout the bed varies, though an estimate of sheepsnose in the portion of the bed surveyed in 2016 can be calculated. The 20,000 m<sup>2</sup> area surveyed in 2016 recorded an average density of 11.63 mussels/m<sup>2</sup> (LEC 2016). With an average density of 11.63 mussels/m<sup>2</sup>, this 20,000 m<sup>2</sup> area has an estimated 232,600 mussels (11.63 x 20,000 = 232,600). Sheepsnose account for 0.166% (1 of 602) of live mussels found during the 2016 survey. At a density of 0.166%, there are an estimated 386 sheepsnose within the area surveyed in 20,000 m<sup>2</sup> area surveyed in 2016.

While the number of sheepsnose in the 2016 survey area can be estimated, an estimate of the number of federally listed mussels found throughout the rest of the bed cannot be meaningfully calculated. The 2016 survey was designed to target a particularly high mussel density portion of the bed, specifically where sheepsnose have been detected, and thus the density in that area is not representative of the density in the entire bed (Johnson 2017, pers. comm.). Fanshell, pink mucket pearly mussel, and snuffbox were not detected during any of the previous mussel surveys at RCB dam. Therefore, we assume the densities of these species to be very low in the bed.

A concise summary of surveys from 1999-2000 between ORM 282.5 and 284.5 was provided by the Corps (2012b). That summary states that the overall mussel density in the mussel bed along the LDB ranges from 3.5 to 7.2/m<sup>2</sup> but no specific data is available to estimate the potential density of fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox in the mussel bed. Based on the rarity of these species in the upstream bed and elsewhere in the Ohio River, the density of these species is considered to be low.

## EFFECTS OF THE ACTION

This BO evaluates the anticipated effects of the Project on the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. Potential direct and indirect effects to these four species are anticipated from construction and operation of the Project. The construction and operation of the Project will also affect the Corps' ability to protect the mussels during disposal of sediments from maintenance dredging of the lower RCB dam approach. Therefore, this BO also evaluates the potential effects of the Corps' maintenance dredging on these mussels.

### **Direct Effects**

#### R.C. Byrd Hydroelectric Project

Direct effects of the proposed Project on the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox could include harassment, harm, and mortality from habitat modifications such as changes in flow and dissolved oxygen concentrations due to construction, increased turbidity, and sediment deposition which could bury mussels. These effects could also restrict mussel respiration (e.g. suffocation due to inability to purge sediments from gills), limit feeding (e.g. starvation due to inability to eliminate sediments), and interfere with reproduction (e.g. abortion from stress, host fish absence during critical reproductive periods).

No federally listed mussels are likely to be found within the 800 m (0.50 mile) area downstream from the RCB dam. Therefore, it is unlikely that any mortality of fanshell, pink mucket pearly mussel, sheepnose, or snuffbox would occur directly from the hydrologic changes during construction and operation of the project. The increase in sedimentation during construction could result in harm by affecting mussel respiration, feeding, and reproduction. The applicant has committed to preparing an erosion and sediment control plan to minimize the impacts of project construction on water quality. Therefore, it is unlikely that the direct effects from sedimentation during construction would be significant enough to result in the death of the federally listed mussels.

The applicant is proposing to develop a freshwater mussel relocation and monitoring plan in advance of project construction. Mussels are generally absent from the immediate project construction area and no federally listed mussels are likely to be in this area. Therefore, performing a mussel relocation in advance of initiating in-water project construction would be unnecessary to minimize direct effects on the fanshell, pink mucket pearly mussel, sheepnose, or snuffbox. However, monitoring of mussels would help assess the status of mussel bed following the Project construction and during operation. Additionally, any fanshell, pink mucket pearly mussel, sheepnose, and snuffbox that are collected in the action area during monitoring activities would incur take in the form of harassment from collection and handling.

## R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program

Dredging and disposal of dredge material could directly affect fanshell, pink mucket pearly mussel, sheepnose, and snuffbox due to the direct placement of dredge material on mussels, the movement of the dredge material within the mussel bed, increasing turbidity within the mussel bed, settling of sediment onto mussels, and releasing contaminants associated with dredge material. The increased turbidity and sediment deposition could bury mussels, restrict mussel respiration, limit feeding, and interfere with reproduction.

Since 2005, the Corps has been utilizing choreographed gate operations (steering currents) during dredging to flush cleaner water over the mussel bed on the RDB while also steering turbid water from dredging and disposal activities to the center of the river channel and away from the mussel bed. Gate operations for steering currents are flow dependent. If steering currents are applicable, gates 7 and 8 are primarily used. Through 2010, this configuration alone was used to develop steering currents during dredging operations. However, gate 6 also adds beneficial flows for steering currents and the Corps has used a combination of all three gates since 2011. The Corps' monitoring efforts of the mussel bed between ORM 279.8 and 281.0 from 2001 to 2016 has documented that the steering currents have been effective at minimizing deposition of sediments in this reach and thus have been effective at minimizing potential adverse effects to fanshell, pink mucket pearly mussel, sheepnose, and snuffbox in this area (LEC 2016). Because the mussel bed extends for an unknown distance downstream beyond the monitored area, and due to the sediment plume extending well downstream of ORM 281, it is possible that short term impacts to mussels from sedimentation could be occurring downstream of ORM 281.

The maximum downstream distance that the dredging/disposal turbidity plume travels has not been determined and it likely varies during each dredging event based on the current river conditions. In 2009, the Corps reported tracking the plume for 11 miles downstream of the RCB dam 3, 5, and 8 days after the start of dredging (Corps 2012b). In 2010, the Corps (2012b) observed the plume 6.1 miles downstream of the RCB dam. Morrison (2017 pers. comm.) reported the dredging sediment plume at five (5) miles downstream during dredging and that the plume extended much further downstream than five miles. Morrison (2017 pers. comm.) also reported that in addition to the sediment plume at this distance, fine sediment was also observed sitting on the substrate. Based on these observations, it appears likely that mussels could be affected by dredging sedimentation for several miles downstream for up to a week or more after dredging, though the distance and duration likely varies between years due to river conditions.

In response to the recent downstream sedimentation observances and resource agency concerns, the Corps has begun to schedule the hydraulic dredge to coincide with summertime higher flows in June and July. This allows the Corps to dispose during conditions that allow for continual removal of deposited sediments. Additionally, the Corps has begun monitoring for dissolved oxygen, turbidity, and sedimentation at a downstream location (ORM 284) that is known as a significant mussel resource.

Maintenance dredging occurs annually in the lower approach to RCB dam locks, typically in late

summer. Emergency dredging occurs almost every year and is conducted in the spring. The fanshell, pink mucket pearly mussel, sheepnose, and snuffbox are all spring/summer spawners. Therefore, the sediment plume from spring and summer dredging could temporarily interfere with these mussels' ability to visually attract host fish and complete their reproductive cycles.

Sediment samples were collected and analyzed from the RCB dam lower approach in 2005, 2006, 2007, 2008, 2010, and 2015. In general, sediment was clean and did not exceed water quality or sediment quality standards or background levels with the exceptions of some metals, primarily aluminum, iron, and manganese. Calculated mixing zones for these metals indicated that any released metals would be quickly diluted to background levels (Corps 2012b; Corps 2016). Therefore, no adverse effects to the fanshell, pink mucket pearly mussel, sheepnose, or snuffbox are anticipated from the release of contaminants during maintenance dredging.

## **Indirect Effects**

### R.C. Byrd Hydroelectric Project

Indirect effects of the proposed actions on the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox include mortality, harm, and harassment from the redistribution of sediments due to changes in flow regimes during project operation. Fanshell, pink mucket pearly mussel, sheepnose, and snuffbox may be injured or killed due to the decreased ability to respire and feed as a result of the redistribution of sediments. Operation activities may also change fish host behavior and/or presence which could impact the ability of glochidia to attach to the fish at the proper time when released from female mussels. This could affect the long-term recruitment and reproductive potential of this population resulting in reduced recruitment.

An increase in shear velocity could occur due to the operation of the Project. Any shear velocity changes would likely only occur downstream of the RCB dam and may be primarily restricted to a few hundred meters downstream, though possibly extending to the upstream portion of the mussel bed along the downstream RDB. Therefore, any increase in shear velocity may only have a slight effect, if any, on fanshell, pink mucket pearly mussel, sheepnose, and snuffbox.

Most significantly, construction and operation of the Project could interfere with the Corps' ability to effectively utilize steering currents during maintenance dredging to minimize adverse effects to mussels from sediment deposition.

### R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program

Indirectly, the construction and operation of the Project may affect the Corps' ability to effectively utilize steering currents to avoid adversely affecting the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox during the disposal of dredge material during channel maintenance dredging of the lower approach to the R.C. Byrd locks. Ineffective steering

currents could increase the deposition of sediments on the mussel bed between ORM 279.8 and 281.0, thus increasing the magnitude of adverse effects previously described for dredging in the Direct Effects section.

## **Cumulative Effects**

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. This section analyzes the added impact from cumulative effects.

The Service is unaware of any other tribal, state, local, or private actions presently occurring or that are reasonably certain to occur in the future, which would destroy, modify or curtail the mussel habitat within the action area. Therefore we do not anticipate significant cumulative effects from the proposed actions, combined with other reasonably foreseeable non-federal actions.

## **Summary of Effects**

### R.C. Byrd Hydroelectric Project

Direct and indirect effects to fanshell, pink mucket pearly mussel, sheepnose, and snuffbox from the Project include harm, and harassment from changes in flow regimes and dissolved oxygen, increased turbidity, and sediment deposition during construction and operation. Effects on individuals will be most severe in the upstream most portion of the mussel bed along the RDB. The most significant effect anticipated from the Project is that indirectly, it may interfere with the Corps' ability to effectively utilize steering currents during maintenance dredging to minimize adverse effects to mussels from sediment deposition.

### R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program

Dredging and disposal of dredge material could directly affect fanshell, pink mucket pearly mussel, sheepnose, and snuffbox due to the direct placement of dredge material on mussels, the movement of the dredge material within the mussel bed, increasing turbidity within the mussel bed, and settling of sediment onto mussels. The increased turbidity and sediment deposition could bury mussels, restrict mussel respiration, limit feeding, and interfere with reproduction. Currently, the Corps manipulates the RCB dam gate operations to steer water currents in a manner that moves sediments away from the mussel bed along the RDB during dredging disposal to avoid these adverse effects. The construction and operation of a hydroelectric powerhouse in Gate 8 of the RCB dam could impair the Corps' ability to effectively use steering

currents to minimize effects to mussels by eliminating one of the two gates primarily utilized for steering. Indirectly, the Project will increase the likelihood that maintenance dredging will cause fanshell, pink mucket pearly mussel, sheepnose, and snuffbox to be killed or harmed from sediment deposition during dredge disposal.

Indirectly, the Project could result in the loss of an entire mussel bed between ORM 279.8 and 281.0 if steering currents become wholly ineffective due to the loss of one of the key gates currently utilized for this purpose. Though rarely encountered during Ohio River surveys, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox are not restricted to the upper Greenup Pool near the RCB dam. All of these species may occur in other mussel beds within the Greenup Pool and in other Ohio River dam pools. Populations of all of these species also occur in a number of other streams, though not in high densities in the majority of them. Therefore, the loss of all the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox in the first 2000 meters of the mussel bed in the Ohio River would not result in a reduction of these species' numbers, reproduction, and distribution to an extent that would appreciably reduce the likelihood of their overall survival and recovery in the wild.

## CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed actions, and the cumulative effects, it is our biological opinion that the R.C. Byrd Hydroelectric Project and the Corps' Navigation Channel Dredging Maintenance Project, as proposed, are not likely to jeopardize the continued existence of the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. No critical habitat has been designated for these species; therefore, none will be affected.

## INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). 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 taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

#### AMOUNT OR EXTENT OF TAKE

Within the the mussel bed along the RDB downstream of the RCB dam, there is an unknown density of fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. The downstream extent of this bed is unknown, as only the first 2000 m of this bed has been surveyed. Another mussel bed exists further downstream between ORM 282.5 and 284.5 with a density of mussels between 3.5 to 7.2 mussels/m<sup>2</sup>. However, no specific data is available to estimate the density of fanshell, pink mucket pearly mussels, sheepnose, or snuffbox in this bed. Based on the lower overall mussel density, fanshell, pink mucket pearly mussel, sheepnose, and snuffbox numbers in this bed are expected to be lower.

Because the final design of the Project and hydraulic and hydrologic modeling for the Project have not yet been completed, there is a high level of uncertainty about how much direct take of the fanshell, pink mucket pearly mussel, sheepnose, and snuffbox will occur during construction and operation of the Project. We expect that direct take from the construction and operation of the Project will be in the form of harm and harassment to an undeterminable number of individuals and is not likely rise to the level of mortality.

At this time we do not know to what extent the Corps will be able to utilize steering currents to move the dredged materials away from the mussels during construction and operation of the R.C. Byrd Hydroelectric Project. Therefore, we assume the worst case scenario that steering currents will be ineffective and that over time, the first 2000 m of the mussel bed along the RDB downstream of the RCB dam could be degraded from sediment deposition to such an extent that it becomes unsuitable to support fanshell, pink mucket pearly mussel, sheepnose, and snuffbox. This includes the mortality of all fanshell, pink mucket pearly mussel, sheepnose, and snuffbox in this bed between ORM 279.8 and 281.0.

Because the action area extends to at least 11 miles downstream of the RCB dam, we do not believe it is possible to estimate what the total amount of take is throughout the downstream extent of the action area. However, it is logical to assume that the level of take will decrease with distance from the Project and dredging/disposal area. While the total amount of take of fanshell, pink mucket pearly mussel, sheepnose, and snuffbox is undeterminable, we anticipate that lethal take could only occur within the bed along the RDB between ORM 279.8 and 281.0. We do not anticipate lethal take to occur in any mussel beds below ORM 281.0.

## **EFFECT OF THE TAKE**

In the accompanying BO, the Service determined that the level of anticipated take from the Project and the Corps' navigation channel maintenance dredging is not likely to result in jeopardy to the fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox. No critical habitat will be affected. Therefore, the Project in conjunction with the Corps' navigation channel maintenance dredging will not result in adverse modification of critical habitat since no critical habitat has been designated for these species.

## **REASONABLE AND PRUDENT MEASURES**

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the impacts of incidental take of fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox during the construction and operation of the R.C. Byrd Hydroelectric Project:

1. FERC must ensure that the proposed actions will occur as designed, planned, and documented in the EA or as required by the Corps under their Section 408 approval process.
2. FERC must ensure that the licensee implements all of the applicant's proposed conservation measures as described in the EA and included on pages 17-19 of this BO, with additional clarifications provided in Terms and Conditions 1-3.

The Service believes the following reasonable and prudent measure (RPM) is necessary and appropriate to minimize the impacts of incidental take of fanshell, pink mucket pearly mussel, sheepsnose, and snuffbox during the construction and operation of the Corps' navigation channel maintenance dredging:

3. The Corps must implement all of the conservation measures included in the 2012 BA.

## **TERMS AND CONDITIONS**

### **R.C. Byrd Hydroelectric Project Terms and Conditions**

In order to be exempt from the prohibitions of section 9 of the ESA, FERC must require that the licensee complies with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are non-discretionary.

1. FERC must ensure that the licensee implements a post-construction monitoring plan for

mussels. Monitoring should occur at years one, three, and five following construction of the project. The final plan must be submitted to the Service and the West Virginia Division of Natural Resources for approval. Mussel monitoring must be conducted by a federal and state permitted malacologist.

2. FERC must ensure that the licensee develops a Service-approved sediment transport model to assist in developing the final project design that maximizes the Corps' ability to use steering currents to minimize impacts to mussels during dredging operations.

3. FERC shall require that the licensee avoid the use of rip-rap material for bank stabilization as much as possible and implement bioengineering techniques in lieu of rip-rap where applicable and consistent with the Corps' final approved design.

#### R.C. Byrd Locks and Dam Navigation Channel Maintenance Dredge Program Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures. These terms and conditions are non-discretionary.

4. The Corps must work with the licensee to develop an Operating Agreement that allows the Corps to utilize steering currents during dredging to protect federally listed mussels to the maximum extent possible.

5. The Corps must continue to utilize steering currents to minimize sediment deposition on mussel beds to the maximum extent possible.

6. The Corps must continue to monitor sediment deposition during dredging so that adjustment in gate operations can be made in real-time to minimize sediment deposition on mussels.

7. The Corps must continue to monitor the mussel bed downstream of RCB dam. Those monitoring needs will be determined annually at the Huntington District's Annual Dredge Partnering Meeting.

### **CONSERVATION RECOMMENDATIONS**

Section 7(a)(1) of the ESA directs federal agencies to use 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 the adverse effects of a proposed action on listed species or critical habitat, to help carry out recovery plans, or to develop information.

The Corps, FERC, and/or licensee should consider implementing the following conservation recommendations:

1. The Corps, FERC and/or licensee could provide financial assistance to the Ohio Division of Wildlife and West Virginia Division of Natural Resources to assist with statewide mussel conservation and recovery activities.
2. The Corps, FERC and/or licensee could provide funding to carry out a comprehensive mussel study of the Ohio River.
3. The Corps could seek out upland disposal sites for placement of dredged materials from Ohio River maintenance dredging.
4. The licensee could monitor dissolved oxygen, temperature, and total dissolved gasses upstream and downstream of the powerhouse for the life of the project and ensure that the project meets the Ohio Water Standards for the protection of aquatic life.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the conservation recommendations carried out.

### **REINITIATION NOTICE**

This concludes formal consultation for FERC's actions outlined in FERC's request received February 6, 2017 and the Corps' request received February 27, 2017. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over an action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded. Specifically, if after three years of post-construction mussel monitoring, it appears that lethal take of federally listed mussels is likely occurring below ORM 281.0 due to the disposal of dredged material, we suggest that formal consultation be reinitiated by FERC and the Corps; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such a take must cease pending reinitiation.

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