United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
P.O. Box 33726
Raleigh, NC 27636-3726

October 15, 2019

John F. Sullivan, III
Division Administrator
Federal Highway Administration
310 New Bern Avenue, Suite 410
Raleigh, NC 27601

Subject: Biological/Conference Opinion - Revised – Complete 540, Triangle Expressway Southeast Extension in Wake and Johnston Counties, North Carolina (STIP Numbers R-2721, R-2828, R-2829)
FWS Log #: 42420-2010-F-0383-R001

Dear Mr. Sullivan:

This letter transmits the enclosed revised Biological/Conference Opinion (BO) of the U.S. Fish and Wildlife Service (Service) for the Complete 540, Triangle Expressway Southeast Extension (the Action). The North Carolina Department of Transportation, in cooperation with the Federal Highway Administration, proposes to construct an approximately 27 mile long controlled-access toll road (NC 540) in Wake and Johnston Counties, North Carolina. The Service received on July 16, 2019 your letter requesting formal consultation and conference for the Action described in *Biological Assessment - Revised, An Assessment of Potential Effects to Federally Listed and Proposed Species for Complete 540, Triangle Expressway Southeast Extension*. You determined that the Action is likely to adversely affect Dwarf Wedgemussel, Yellow Lance, Atlantic Pigtoe, and proposed critical habitat for Atlantic Pigtoe.

You also determined that the Action is not likely to adversely affect Neuse River Waterdog, Neuse River Waterdog proposed critical habitat, Michaux's Sumac, and Cape Fear Shiner. The Service concurs with these determinations for reasons we explain in Section 3 of the BO.

The enclosed BO answers your request for formal consultation and conference, and concludes that the Action is not likely to jeopardize the continued existence of the species listed above. This finding fulfills the requirements applicable to the Action for completing consultation under §7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended.

The BO includes an Incidental Take Statement that requires the Federal Highway Administration to implement reasonable and prudent measures that the Service considers necessary or appropriate to minimize the impacts of anticipated taking on the listed wildlife species.

Incidental taking of listed wildlife species that is in compliance with the terms and conditions of this statement is exempted from the prohibitions against taking under the ESA.

Reinitiating consultation is required if the Federal Highway Administration retains discretionary involvement or control over the Action (or is authorized by law) when:

a. the amount or extent of incidental take is exceeded;
b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. a new species is listed or critical habitat designated that the Action may affect.

A complete administrative record of this consultation/conference is on file in our office at the letter-head address. If you have any questions about the BO, please contact me by phone at 919-856-4520 x.11 or by email at pete_benjamin@fws.gov.

Sincerely,

Pete Benjamin
Field Office Supervisor

Enclosure

Electronic copy provided to:

Donnie Brew, FHWA, Raleigh, NC
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Roger Rochelle, NCDOT, Raleigh, NC
Chris Murray, NCDOT, Durham, NC
Chad Coggins, NCDOT, Wilson, NC
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Biological/Conference Opinion - Revised

Complete 540, Triangle Expressway Southeast Extension in Wake and Johnston Counties, North Carolina (STIP Numbers R-2721, R-2828, R-2829)

FWS Log #: 42420-2010-F-0383-R001

Prepared by:

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[NAME, TITLE]

10/15/19
Date

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CONSULTATION/CONFERENCE HISTORY

This section lists key events and correspondence during the course of this consultation/ conference. A complete administrative record of this consultation/conference is on file in the U.S. Fish and Wildlife Service's (Service) Raleigh Field Office.

2009-12-08 to **2017-07-12** – Service staff attended multiple agency coordination meetings with North Carolina Department of Transportation (NCDOT) and Federal Highway Administration (FHWA).

2010-02-03 – The Service submitted a letter to NCDOT expressing concerns about potential adverse effects to Dwarf Wedgemussel (DWM).

2011-02-17 – The Service submitted a letter to NCDOT detailing specific concerns about effects to DWM and requesting NCDOT to fund additional studies of the species and its habitat within the Swift Creek Watershed.

2011-03-14 – The Service met with NCDOT, FHWA, and North Carolina Wildlife Resources Commission to discuss DWM issues.

2011-03-16 – NCDOT agreed to conduct additional studies of DWM within Swift Creek Watershed.

2012-01-25 – The Service submitted a letter to NCDOT commenting on alternatives being studied and reiterated concerns for adverse effects to DWM.

2012-06-11 – The Service met with consultants to discuss additional DWM studies.

2015-02-03 – The Service met with FHWA and NCDOT to discuss DWM issues and strategy to improve viability of the species in Swift Creek Watershed via captive propagation.

2015-11-25 – The Service submitted a letter to NCDOT commenting on the Federal Draft Environmental Impact Statement and reiterated concerns about adverse effects on federally listed mussels and the need for captive propagation as part of strategy to maintain viability of species.

2016-05-16 – The Service met with NCDOT to discuss Endangered Species Act Section 7 consultation and captive propagation facility as a conservation measure.

2016-05-17 – DWM Viability Study for Swift Creek Watershed final report completed and reviewed by Service.

2016-08-02 – NCDOT and FHWA agree to fund mussel captive propagation facility as conservation measure.

2017-01-19 – The Service met with NCDOT to discuss captive propagation facility as conservation measure.

2017-05-10 – The Service met with NCDOT and FHWA to discuss development of Biological Assessment (BA).

2017-07-12 – North Carolina State University provides budget proposal to operate mussel propagation facility.

2017-09-13 – The Service provided comments to NCDOT and FHWA on draft BA.

2017-09-28 – The Service met with NCDOT and other stakeholders to discuss mussel propagation facility.

2017-10-04 – The Service met with NCDOT and FHWA to discuss comments on the draft BA.

2017-12-06 – The Service received the final BA and a letter from the FHWA requesting initiation of formal Section 7 consultation for DWM and formal Section 7 conference for the Yellow Lance (YL).

2017-12-21 – The Service provided a letter to the FHWA stating that all information required for initiation of formal consultation and formal conference was either included with their 2017-12-06 letter or was otherwise available.

2018-01-18 – The Service provided the FHWA and NCDOT with a draft Biological/Conference Opinion (BO/CO).

2018-04-03 – The YL was listed as a federally threatened species.

2018-04-10 – The Service provided the FHWA and NCDOT with a final BO.

2018-05-23 – Sound Rivers, Inc.; Center for Biological Diversity; and Clean Air Carolina filed a federal lawsuit against the Service challenging the BO.

2018-10-11 – The Service published a proposed rule to list the Atlantic Pigtoe (AP) as threatened with critical habitat.

2019-02-06 – The Service met with NCDOT, FHWA, and project consultants to discuss revising the BA and reinitiating Section 7 consultation/conference to address additional species.

2019-04-10 – The Service provided comments to NCDOT and FHWA on a draft revised BA.

2019-05-13 – The Service provided comments to NCDOT and FHWA on a draft revised BA.

2019-07-16 – The Service received a revised final BA and letter from the FHWA requesting reinitiation of formal Section 7 consultation for DWM and YL and initiation of formal Section 7 conference for AP and its proposed critical habitat.

2019-08-22 – NCDOT reached a settlement with the plaintiffs in the lawsuit against the Service.

2019-09-11 – The FHWA provided an addendum to the BA regarding the legal settlement.

2019-09-16 – The Service provided FHWA and NCDOT a draft revised BO/CO.

BIOLOGICAL/CONFERENCE OPINION

1. INTRODUCTION

A Biological Opinion (BO) is the document that states the opinion of the U.S. Fish and Wildlife Service (Service) under the Endangered Species Act of 1973, as amended (ESA), as to whether a federal action is likely to:

- jeopardize the continued existence of species listed as endangered or threatened; or
- result in the destruction or adverse modification of designated critical habitat.

A Conference Opinion (CO) is equivalent to a BO, but addresses species that are not yet listed under the ESA and/or proposed critical habitats not yet designated. Therefore, the ESA prohibitions against jeopardizing species, destroying critical habitat, and taking animals do not yet apply. The Service may adopt a CO as a BO if and when the evaluated species/critical habitat are listed/designated and while the action agency's discretion and involvement in the action continue.

The federal action addressed in this BO/CO is the Federal Highway Administration (FHWA) proposed Complete 540, Triangle Expressway Southeast Extension in Wake and Johnston Counties, North Carolina (the Action). The BO considers the effects of the Action on Dwarf Wedgemussel and Yellow Lance. The CO considers the effects of the Action on Atlantic Pigtoe and proposed critical habitat for Atlantic Pigtoe.

The FHWA determined that the Action is not likely to adversely affect Neuse River Waterdog (proposed threatened), Neuse River Waterdog proposed critical habitat, Michaux's Sumac, and Cape Fear Shiner. The Service concurs with these determinations, for reasons we explain in Section 3 of the BO/CO.

A BO/CO evaluates the effects of a federal action along with those resulting from interrelated and interdependent actions, and from non-federal actions unrelated to the proposed Action (cumulative effects), relative to the status of listed/proposed species and the status of designated/proposed critical habitat. A Service opinion that concludes a proposed federal action is *not* likely to jeopardize species and is *not* likely to destroy or adversely modify critical habitat fulfills the federal agency's responsibilities under §7(a)(2) of the ESA.

"*Jeopardize the continued existence*" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02). "*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (50 CFR §402.02).

This BO/CO uses hierarchical numeric section headings. Primary (level-1) sections are labeled sequentially with a single digit (e.g., 2. PROPOSED ACTION). Secondary (level-2) sections

within each primary section are labeled with two digits (e.g., 2.1. Action Area), and so on for level-3 sections. The basis of our opinion for each listed/proposed species and proposed critical habitat is wholly contained in separate level-1 sections that address the status, environmental baseline, effects of the Action, cumulative effects, and conclusion.

2. PROPOSED ACTION

The North Carolina Department of Transportation (NCDOT), in cooperation with the FHWA, proposes improvements to NC 540 in Wake and Johnston Counties, North Carolina. The Complete 540 project is proposed to be a controlled-access toll road extending the existing Triangle Expressway from NC 55 Bypass in Apex to the US 64/US 264 Bypass (I-495) in Knightdale and is approximately 27 miles long. The proposed Action will improve mobility, reduce forecast traffic congestion on the existing roadway network, and improve system linkage within the study area. The Action is comprised of three projects in the NCDOT 2018-2027 State Transportation Improvement Program (STIP R-2721, R-2828, and R-2829) combined together for analysis. The Action will likely be constructed in phases with initial construction tentatively scheduled to begin in fiscal year 2020. The Action will be evaluated here in three components: 1) construction of roadway and stream crossings, 2) operation of roadway facility, and 3) conservation measures.

2.1. Action Area

For purposes of consultation/conference under ESA §7, the 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" (50 CFR §402.02). The "Action Area" described in the July 2019 Revised Biological Assessment (BA) consists of the Future Land Use Study Area (FLUSA) as defined in the Qualitative Indirect and Cumulative Effects Report (H.W. Lochner 2014). The FLUSA covers portions of Wake, Johnston, and Harnett Counties (See Figures 1 and 2 in BA). The FLUSA was initially chosen by FHWA as the Action Area because of the Action's potential to induce land development in the area. However, the FLUSA was developed using National Environmental Policy Act (NEPA) guidelines and not ESA guidelines. ESA guidelines address actions and effects that are "reasonably certain to occur". The NEPA reports used an integrated land use allocation tool and was broad and not focused solely on actions that are reasonably certain to occur (Michael Baker Engineering 2017a,b,c,d) as a result of the proposed action.

Michael Baker Engineering (2017a,b,c,d) completed a Quantitative Indirect and Cumulative Effects (ICE) Report for the Action using a methodology to forecast land use changes between the base year of 2010 and design year 2040. The report determined that development will occur throughout the FLUSA with or without the Action occurring. Michael Baker Engineering (2017d) concluded that the "projected differences in land use between the 2040 No-Build and 2040 Build scenarios are relatively small". The ICE report does not quantitatively address specific responses of federally listed mussels to the expected increased development in either the 2040 No-Build or 2040 Build. Given the high-level of analysis and uncertainty in projecting into the future, it is difficult to ascertain the ecological significance of the relatively small differences in land use between the 2040 No-Build and 2040 Build scenarios. Therefore, the small contribution of potential effects from future induced development attributed to the Action will be

indistinguishable from the numerous effects of development occurring independent of the Action. Thus any potential effects caused by the Action within the FLUSA cannot be meaningfully measured, detected, or evaluated. Furthermore, the three metrics (changes in impervious surface, total suspended solids, and copper) used in the ICE studies as surrogates for threats to mussel species do not readily translate into actual measurable effects in the context of evaluating small changes attributable to the Action among the large changes expected without the Action.

Recently revised Service regulations (84 FR 44976-45018; August 27, 2019) define "effects of the action" as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur **but for** the proposed action and it is **reasonably certain to occur**." Although the ICE report identifies small quantitative differences (between No-Build and Build) in land use and in the metrics used as surrogates for threats to listed mussel species, as previously stated, these differences are likely indistinguishable as **consequences** to the species in light of the large scale changes that will occur independent of the Action. Given this, it is uncertain whether the "but for" test can be satisfied. Additionally, the revised regulations identify remoteness in time and lengthy causal chains involving many steps as considerations in the "but for" test. The ICE report projects out to the year 2040, and approvals for future developments would involve many steps over several years – thus adding to the argument that the "but for" test cannot definitively be met.

The revised regulations apply the "reasonably certain to occur" test not only to effects, but also to activities caused by the proposed action (but not part of the proposed action). The regulations state that the "reasonably certain to occur" test must be based on "clear and substantial information", and they identify "existing plans" and "remaining economic, administrative, and legal requirements necessary" as factors to consider when applying the test. The ICE report does not list specific future development projects or plans, and we are not aware of any specific plans for development that will be caused by the Action. Therefore, the Service cannot define any specific activities or effects from induced development that are "reasonably certain to occur". Furthermore, any such future developments would be subject to many economic, administrative, and legal requirements that further reduce the chance that they are "reasonably certain to occur", or that such developments would result in effects to the evaluated species..

Therefore, since future induced development caused by the proposed action and the potential effects thereof are not reasonably certain to occur, and given the overly expansive extent of the FLUSA and its NEPA-derived ICE studies, the Service has reduced the Action Area to an area where more definable and measurable effects are reasonably certain to occur. This reduced Action Area will include the following:

- Footprint of the road facility and right-of-way (1,240 acres)
- 0.42 mile section of Swift Creek at the new road crossing (0.13 mile within right-of-way + 0.25 mile downstream of right-of-way + 0.04 mile downstream of confluence of a tributary to Swift Creek)
    - 0.25 mile is generally presumed to be the downstream extent of detectable sedimentation effects of bridge crossings on Piedmont streams when appropriate sediment and erosion control best management practices (BMPs) are utilized. NCDOT utilizes state-of-the-art BMPs which prevent sedimentation from

affecting aquatic resources more than 0.25 mile downstream of bridge crossings (David Harris, NCDOT Roadside Environmental Engineer, personal email communication on August 23, 2019). Lotic habitats impacted by sediment are easily recognized and characterized by a fine layer of clay, silt, and sand (Henley et al. 2000). There is no evidence or history of NCDOT projects indicating that effects of sedimentation exceed 0.25 mile in the presence of effective BMPs. For more information on NCDOT BMPs, see Section 2.4.
    - 0.04 mile is included due to a tributary of Swift Creek being crossed 0.21 mile upstream of its confluence with Swift Creek
- Proposed mussel propagation facility located at Historic Yates Mill County Park

No portion of Middle Creek is included in this reduced Action Area because the proposed road crosses the stream several miles upstream of any known occurrences of listed/proposed mussel species. Past and recent surveys have failed to find the species in the vicinity of the crossing. No effects to listed/proposed mussels are expected within Middle Creek.

2.2. Construction of Roadway and Stream Crossings

An approximately 27 mile long controlled-access toll road is proposed to be constructed on new location to extend the existing NC 540 (Triangle Expressway) from its current terminus at NC 55 Bypass in Apex to US 64/US 264 (I-495) in Knightdale. The new road will consist of six lanes, with three 12-foot lanes in each direction of travel, separated by a 70-foot median. The new facility will occupy approximately 1,240 acres within the proposed right-of-way. Interchanges are proposed at the following locations: NC 55 Bypass, Holly Springs Road, Bells Lake Road, US 401, Old Stage Road, NC 50, I-40, White Oak Road, US 70 Business, Rock Quarry Road, Auburn Knightdale Road, Poole Road, and US 64/US 264 Bypass (I-87). The Neuse River, Swift Creek, some tributaries to Swift Creek, and other major streams will be crossed utilizing bridges. Smaller streams will be crossed using culverts. The dual bridges over Swift Creek will be 825 feet long and will completely span the channel (i.e. no bents in the water) and much of the floodplain. The Action will likely be implemented in phases over several years, depending upon availability of funding. Construction is tentatively scheduled to begin in fiscal year 2020. The estimated construction duration for each STIP is approximately:

- R-2721 – 3.0 years
- R-2828 – 3.5 years
- R-2829 – 2.5 years

2.3. Operation of Roadway Facility

Operation of the new roadway facility includes daily vehicular use and routine maintenance activities. Routine maintenance includes, but is not limited to, the following common practices: mowing, tree trimming, bridge painting, minor bridge repair, culvert cleaning/repair, ditch cleaning/reshaping, detention/retention basin cleaning, guardrail replacement, pavement rehabilitation/resurfacing, and right-of-way fence repair.

2.4. Conservation Measures

The following measures will be implemented by NCDOT to minimize and partially offset potential adverse effects to Dwarf Wedgemussel (DWM), Yellow Lance (YL), Atlantic Pigtoe (AP), and proposed AP critical habitat.

Erosion Control Measures

NCDOT will require Design Standards in Sensitive Watersheds [15A NCAC 04B .0124 (b) – (e)], which are erosion and sediment control measures that exceed the standard best management practices (BMPs) (e.g. measures are designed to provide protection from runoff of 25-year storm event). The areas within the Swift Creek Watershed and Middle Creek Watershed will be identified as "Environmentally Sensitive Areas" on the Sedimentation and Erosion Control Plans. By definition, the Environmentally Sensitive Areas will be identified as a 50-foot buffer zone on both sides of the stream measured from top of streambank. Within the identified 50-foot Environmentally Sensitive Areas, the following shall apply:

1. The contractor may perform clearing operations, but not grubbing operations until immediately prior to beginning grading operations.
2. Once grading operations begin in identified Environmentally Sensitive Areas, work shall progress in a continuous manner until complete.
3. Erosion control devices shall be installed immediately following the clearing operation.
4. Seeding and mulching shall be performed on the areas disturbed by construction immediately following final grade establishment.
5. Seeding and mulching shall be done in stages on cut and fill slopes that are greater than 20 feet in height measured along the slope, or greater than 2 acres in area, whichever is less.

All other NCDOT BMPs will be implemented as appropriate (NCDOT 2003, NCDOT 2014, NCDOT 2015). All sedimentation and erosion control measures will be appropriately maintained following NCDOT standards, to ensure proper function of the measures. NCDOT has partnered with North Carolina State University and others to develop and test their current BMPs. For a comprehensive list of research conducted on NCDOT BMP effectiveness, see https://ci.lib.ncsu.edu/profiles/sscram and Appendix B of NCDOT 2014.

Bridge Deck Drainage

The design for all bridges within the Swift Creek Watershed and Middle Creek Watershed will eliminate deck drains into the water bodies they cross. Deck drainage is routed back to the land, thus allowing for some filtering of runoff prior to entering the stream.

Agency Coordination

NCDOT will invite representatives from the Service, North Carolina Wildlife Resources Commission (NCWRC), and other agency personnel to preconstruction meetings for the Action, as well as to preconstruction meetings associated with installation of structures within 0.25 mile of the Swift Creek crossing to ensure compliance with special project commitments.

Stream Crossing Review

During the development of the alternatives for the Action, an interagency field review was held to review stream crossings and determine if the minimum required structure type should be altered to minimize environmental effects. Within Swift Creek Watershed, the crossings of three tributaries to Swift Creek were identified as particularly high-value that warranted larger structures to minimize direct effects. Two proposed culverts were changed to bridges and one proposed bridge was lengthened (to span more of the stream banks and floodplain rather than fill them), resulting in the following net reduction of impacts: 3153 linear feet of stream, 7.56 acres of stream buffers, and 18.57 acres of wetlands (see Table 15 and Figure 12 in revised BA).

Bridging of Swift Creek

The bridges that cross Swift Creek will not have any part of the structure in the stream channel or within 10 feet of the top of either bank. Also, no permanent structures or temporary structures required to build the bridge will be placed within Swift Creek. All permanent and temporary structures will be designed and installed such that they should not result in bank instability or cause significant sediment runoff into Swift Creek.

Hazardous Spill Basins (HSBs)

NCDOT will require construction of two permanent HSBs at the crossing of Swift Creek. Road runoff from approximately 1.3 miles of road facility will be directed to a HSB before being discharged to Swift Creek or tributaries. The HSBs will be designed to contain a spill from a typical tanker truck that may have otherwise flowed directly into these water bodies. NCDOT will implement their standard protocols for upkeep and use of these HSBs.

Preconstruction Survey and Potential Mussel Relocation

NCDOT will conduct a preconstruction survey (just prior to construction) at the Swift Creek crossing and remove mussels from a defined area (salvage area) and relocate them to appropriate habitat within Swift Creek outside of the salvage area (relocation site), or if deemed appropriate after coordination with the Service and NCWRC, federally listed/proposed mussels may be taken into captivity to use as brood stock for propagation efforts. The preconstruction survey will be incorporated into a Mussel Relocation Plan, which will identify the salvage area and relocation site, and be developed in coordination with the Service and NCWRC.

DWM Viability Study

NCDOT, in cooperation with the Service, commissioned the DWM Viability Study (Three Oaks 2016) to update the baseline conditions for the DWM. The results obtained were used in the development of this BO/CO and are discussed below. The specific purpose of the DWM Viability Study was threefold:

1. Characterize existing conditions of the Swift Creek Watershed
2. Summarize conservation measures that have been implemented to protect DWM in the Swift Creek Watershed
3. Assess historical trends and future viability of the DWM population and habitat conditions

The study concluded that suitable habitat still exists in Swift Creek and the DWM population there exhibits signs of viability but is vulnerable.

Propagation Facility

An ongoing commitment by several entities in developing the Yates Mill Aquatic Conservation Center (YMACC) has been underway concurrent to the development of the Action. Since 1997, state and federal agencies in North Carolina have worked with local universities and others to develop Atlantic Slope freshwater mussel captive propagation techniques, steadily growing the expertise but lacking full production capacity. Hence, the Service, NCDOT, and the FHWA have been in coordination regarding the logistics of developing a mussel propagation facility in the Raleigh, North Carolina area as a conservation measure to expand current capabilities, apply local expertise, and help offset potential effects to DWM, YL, and AP resulting from the Action.

NCDOT will provide funding to be utilized for the retrofit and upgrade of the existing research facility in the A.E. Finley Center, at the Historic Yates Mill County Park, owned by Wake County and leased and operated by North Carolina State University (NCSU), for the purpose of research and propagation of DWM, YL, AP, and other aquatic species. The retrofitted/upgraded facility will then become the YMACC. The goal of the YMACC is to promote the long-term survival of rare aquatic species in streams throughout eastern North Carolina by producing individuals for population augmentation and/or reintroduction. Wake County will be provided with approximately $2 million in funding for the construction of the retrofit and upgrade to the existing facility in the A.E. Finley Center. Wake County and NCSU will oversee and manage the construction of the new YMACC. In addition, approximately $6 million in funding will be provided to NCWRC's Non-Game Aquatic Species Program. These funds will be used for NCSU's detailed proposal to provide a facility manager and an assistant at the YMACC to oversee the propagation, research, restoration, outreach, and other expenses estimated to operate and maintain the facility for approximately ten years.

NCDOT is not responsible for the construction, management, or success of the facility or its propagation goals. NCDOT has committed to provide funding which is based on the design and construction needs for the facility (through Wake County) and the operations leading to the ability to do mussel restorations (via the Non-Game Aquatic Species Program). This program is intended to benefit federally threatened, endangered, and at-risk aquatic species, and may fund projects such as NCSU's proposal for operation of the YMACC, restocking efforts, surveys, monitoring, land acquisition, or habitat enhancement work by NCSU, NCWRC, and other conservation partners. Initial funding agreements (for approximately $5 million) are in place for the construction and for up to five years of operating and maintaining the facility. The funding agreement for operating and maintaining the facility will be amended for an additional approximately $3 million.

Litigation Settlement

Although most details are yet to be developed, a settlement reached by NCDOT and plaintiffs that ends a federal lawsuit against the Service contains several land acquisition, stream protection, and other mitigation measures as well as research projects which may benefit the DWM and other listed mussels.

2.5. Interrelated and Interdependent Actions

A BO/CO evaluates the effects of a proposed federal action. For purposes of consultation/

conference under ESA §7, the effects of a federal action on listed/proposed species or critical habitat include the direct and indirect effects of the action, plus the effects of interrelated or interdependent actions. "Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on 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).

Although there are currently no designs for borrow pits, haul roads, or staging areas, the Action will invariably require such. These common construction features are generally left to the contractor to determine the need and location. NCDOT will strongly discourage the contractor from choosing borrow/waste site locations, staging areas, equipment storage areas, and refueling areas within 0.25 mile of Swift Creek by putting such language in the project commitments. However, if the contractor opts to pursue borrow or waste sites in these locations, the NCDOT Division Environmental Officer will coordinate with the Service during the approval process of any borrow or waste sites. It is the Service's experience that such sites are generally located so as to avoid additional adverse effects to listed/proposed species. The contractor must follow provisions in the Standard Specifications for Roads and Structures (January 2018) for borrow excavation (Section 230) and disposal of waste and debris (Section 802).

At this time there are no identified utilities within 0.25 mile of Swift Creek which must be relocated due to the Action. However, after additional detailed design, it is possible that limited utility relocation may be necessary.

3. CONCURRENCE

The FHWA determined that the Action is not likely to adversely affect Neuse River Waterdog (proposed threatened), Neuse River Waterdog proposed critical habitat, Michaux's Sumac, and Cape Fear Shiner. The Service concurs with these determinations for the following reasons.

Although the Neuse River Waterdog is known to occur in Swift Creek and Middle Creek, the species is not known to occur in the vicinity of the new road crossings. The closest known occurrences in Swift Creek and Middle Creek are 5.24 stream miles downstream and 13.58 stream miles downstream, respectively. Surveys conducted in February 2019 did not reveal any Neuse River Waterdogs within the Action Area (Three Oaks 2019). Suitable habitat for the species does not occur near the crossing of Middle Creek.

Proposed critical habitat for Neuse River Waterdog in Swift Creek and Middle Creek occurs approximately 3.1 miles and 13.5 miles downstream of the Action Area. Given the distance from proposed critical habitat, adverse effects are not anticipated.

There are only two known occurrences of Michaux's Sumac within the FLUSA utilized in the BA, but there are no known occurrences in the Service's reduced Action Area. Surveys for Michaux's Sumac were performed within the footprint of the proposed road in 2013 and 2017. No specimens were observed.

The Cape Fear Shiner only occurs within the Cape Fear River Basin. Given that the alignment of the Action occurs within the Neuse River Basin only, there will be no construction related or operational effects to the Cape Fear Shiner.

This concurrence concludes consultation/conference for the listed/proposed species named in this section, and these are not further addressed in this BO/CO. The circumstances described in the Reinitiation Notice of this BO that require reinitiating consultation for the Action, except for exceeding the amount or extent of incidental take, also apply to these species.

4. DWARF WEDGEMUSSEL

4.1. Status of Dwarf Wedgemussel

This section summarizes the best available data about the biology and current condition of the Dwarf Wedgemussel (DWM, *Alasmidonta heterodon*) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list DWM as endangered on March 14, 1990 (55 FR 9447- 9451).

4.1.1. Description of DWM

The DWM is a small bivalve, rarely exceeding 45 mm in length. Clean young shells are usually greenish-brown with green rays. As it ages, the shell color becomes obscured by diatoms or mineral deposits and appears black or brown. The shell is thin but does thicken somewhat with age, especially toward the anterior end. The anterior end is rounded while the posterior end is angular forming a point near the posterio-ventral margin (USFWS 2017b).

4.1.2. Life History of DWM

The DWM occurs in small creeks to deep rivers in stable habitat with substrates ranging from mixed sand, pebble and gravel, to clay and silty sand. In the southern portion of its range, it is often found buried under logs or root mats in shallow water (USFWS 1993); whereas in the northern portion of its range, it may be found in firm substrates of mixed sand, gravel or cobble, or embedded in clay banks in water depths of a few inches to greater than 20 feet (Fichtel and Smith 1995, Gabriel 1995 and 1996, Nedeau and Werle 2003, Nedeau 2004a and 2004b, Nedeau 2006).

The DWM's reproductive cycle is typical of other freshwater mussels, requiring a host fish on which its larvae (glochidia) parasitize and metamorphose into juvenile mussels. The following species have been confirmed as host fish for the DWM: Tessellated Darter (*Etheostoma olmstedi*), Johnny Darter (*E. nigrum*), Fantail Darter (*E. flabellare*), Chainback Darter (*Percina nevisense*), Roanoke Darter (*P. roanoka*), Mottled Sculpin (*Cottus bairdi*), Slimy Sculpin (*C. cognatus*), Atlantic Salmon (*Salmo salar*), Pirate Perch (*Aphredoderus sayanus*), Redbreast Sunfish (*Lepomis auritus*), Green Sunfish (*L. cyanellus*), Bluegill (*L. macrochirus*), Bluehead Chub (*Nocomis leptocephalus*), Highfin Shiner (*Notropis altipinnis*), Swallowtail Shiner (*Notropis procne*), White Shiner (*Luxilus albeolus*), and Pinewoods Shiner (*Lythrurus matutinus*) (Michaelson and Neves 1995, White 2007, Levine *et al*. 2011). The DWM is not a long-lived

species as compared to other freshwater mussels; life expectancy is estimated at 10 to 12 years (Michaelson and Neves 1995).

4.1.3. Numbers, Reproduction, and Distribution of DWM

The DWM is found in Atlantic Coast drainage streams and rivers of various sizes and moderate current. It currently ranges from New Hampshire to North Carolina. Historically, the DWM range extended north to New Brunswick, Canada. North Carolina's Neuse River Basin tributaries have apparently always represented the southern end of the range of the species. The DWM has been documented in 16 major drainages (Table 4.1.3), comprising approximately 70 sites. However, at least 45 of these sites are based on less than five individuals or solely on relic shells (USFWS 2007, USFWS 2013).

Viable populations (i.e. containing a sufficient number of reproducing adults to maintain genetic variability and in which annual recruitment is adequate to sustain a stable population, USFWS 1993) in the northeastern United States include the Ashuelot River in New Hampshire and the Flat Brook in New Jersey. The Connecticut River in New Hampshire and Vermont, the Farmington River in Connecticut, Paulins Kill in New Jersey, and the Neversink River in New York may harbor viable populations, but more survey work is needed (USFWS 2013). Because of the qualitative survey methods used to assess the populations, it is not possible to estimate the number of individuals in these populations at this time. However, recent surveys indicate that DWM numbers may be declining at some locations in the Connecticut River and Ashuelot River (Biodrawversity LLC 2013, Biodrawversity LLC et al. 2014).

Although remaining populations from New Jersey south to North Carolina are much smaller, the Upper Tar River and Upper Fishing Creek in North Carolina are thought to harbor viable populations. Other populations in North Carolina, Virginia, and Maryland appear to be declining as evidenced by low densities, lack of reproduction, or inability to relocate any DWM in follow-up surveys (USFWS 2013). The DWM population in Swift Creek appears potentially viable (Three Oaks 2016) but with a high risk of local extirpation due to low population abundance and lack of dispersal (Smith et al. 2015).

Table 4.1.3 DWM major drainages.

State	Major Drainage*	County
NH	Upper Connecticut River	Coos, Grafton, Sullivan, Cheshire
VT	Upper Connecticut River	Essex, Orange, Windsor, Windham
MA	Middle Connecticut River	Hampshire, Hampden
CT	Lower Connecticut River	Hartford
NY	Housatonic River	Dutchess
NY	Middle Delaware	Orange, Sullivan, Delaware
NJ	Middle Delaware	Warren, Sussex
PA	Upper Delaware River	Wayne
MD	Choptank River	Queen Anne's, Caroline
MD	Lower Potomac River	St. Mary's, Charles
MD	Upper Chesapeake Bay	Queen Anne's

VA	Middle Potomac River	Stafford
VA	York River	Louisa, Spotsylvania
VA	Chowan River	Sussex, Nottoway, Lunenburg
NC	Upper Tar River	Granville, Vance, Franklin, Nash
NC	Upper Fishing Creek	Warren, Franklin, Nash, Halifax
NC	Upper Contentnea Creek	Wilson, Nash, Johnston
NC	Upper Neuse River (including Swift Creek)	Johnston, Wake, Orange

* The 16 major drainages identified in Table 4.1.3 do not necessarily correspond to the original drainages identified in the Recovery Plan (USFWS 1993), although there is considerable overlap.

4.1.4. Conservation Needs of and Threats to DWM

Human activity has significantly degraded DWM habitat causing a general decline in populations and a reduction in distribution of the species. Some factors responsible for the decline of the DWM include: 1) impoundment of river systems, 2) pollution, 3) alteration of riverbanks, 4) siltation, and 5) extreme weather events (e.g. floods and drought) (USFWS 1993, USFWS 2013).

Damming and channelization of rivers throughout the DWM's range have resulted in the elimination or alteration of much mussel habitat (Watters 2001). Domestic and industrial pollution was the primary cause for mussel extirpation at many historical sites. Mussels are known to be sensitive to a variety of heavy metals, inorganic salts, and ammonia (Wang et al. 2017). Mussel die-offs have been attributed to chemical spills, agricultural waste run-off, and low dissolved oxygen levels.

Because freshwater mussels are relatively sedentary and cannot move quickly or for long distances, they cannot easily escape when silt is deposited over their habitat. Siltation has been documented to be extremely detrimental to mussel populations by degrading substrate and water quality, increasing exposure to other pollutants, and by direct smothering of mussels (Ellis 1936, Marking and Bills 1980). In Massachusetts, a bridge construction project decimated a population of DWM by accelerated sedimentation and erosion (Smith 1981).

Extreme weather events like flooding and drought have had an impact on DWM. Surveys in 2006 indicated that the DWM population in the Neversink River (formerly one of the most robust populations of DWM) was adversely affected by flood events, and it remains to be seen if this population can rebound. Drought also appears to have adverse effects on DWM populations. This is evident in the upper Tar River watershed in North Carolina, where severe population declines followed a substantial drought in 2007 (USFWS 2013).

Most DWM populations are small and geographically isolated from each other. This isolation restricts exchange of genetic material among populations and reduces genetic variability within populations (USFWS 1993). Recent studies investigating the range-wide phylogeographic structure of DWM indicate that the low degree (or absence) of gene flow between and within drainages suggests that individual host fish do not move between drainages, nor do they exhibit effective movement (resulting in gene flow) within drainages (USFWS 2013).

4.2. Environmental Baseline for DWM

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the DWM, its habitat, and ecosystem within the Action Area. The environmental baseline is a "snapshot" of the species' condition in the Action Area at the time of the consultation, and does not include the effects of the Action under review.

4.2.1. Action Area Numbers, Reproduction, and Distribution of DWM

The DWM was first discovered in Swift Creek in 1991. During DWM monitoring surveys required for the nearby Dempsey Benton Water Treatment Plant, a single DWM was observed within the Action Area in 2007 (The Catena Group 2008). Additionally, three individuals (one in 1996 and two in 1998) were found less than a mile downstream of the Action Area. No DWM were observed during surveys conducted on February 7, 2019 and March 25, 2019. Three Oaks (2019) estimates that 0-17 adult DWM occur within the Action Area, with the most likely number being 0-2 individuals. However, due to the low detection rate of DWM and the inherent nature of sampling methods, it is not possible to know the exact number of DWM within the Action Area.

4.2.2. Action Area Conservation Needs of and Threats to DWM

In order to reclassify the DWM to threatened status, the DWM Recovery Plan (USFWS 1993) requires a viable population be present in Swift Creek. Smith et al. (2015) concluded that the top three factors limiting the persistence of DWM in Swift Creek are:

1. Unsuitable physical habitat
2. Allee effect (high risk of demographic extirpation due to low population abundance and lack of dispersal)
3. Low water quality because of contaminants

Unsuitable physical habitat within the Action Area can arise from several sources including alterations in stream flow, channel instability, loss of riparian buffers, and degradation from all-terrain vehicle use within the channel (Three Oaks 2016). The Swift Creek Watershed has experienced rapid urbanization in recent years with an associated increase in impervious surface. The correlation of increasing urbanization within a watershed and decreasing water quality is well documented (Garie and McIntosh 1986, Crawford and Lenat 1989, Kemp and Spotila 1997, Paul and Meyer 2001). An increase in impervious surface leads to higher stormwater peak discharges which, in turn, lead to channel instability and scouring of the channel and banks. As erosion rates increase, sedimentation of DWM habitat increases. Increased impervious surface also leads to decreases in infiltration and base flow (groundwater flow), thus lowering water levels within streams. Periods of drought also contribute to lower water levels within Swift Creek. Stream gauge data on Swift Creek indicates that the stream has experienced periodic episodes of low flow throughout the period of record (Three Oaks 2016).

The DWM Viability Study (Three Oaks 2016) concluded that the mussel fauna of the Swift Creek Watershed is subject to multiple stressors which may threaten future viability. While further analysis of population and habitat trends would allow for a more definitive conclusion,

the results of this study point to a population that is vulnerable to extirpation. Changes in the watershed have happened in a relatively short period of time, and the overall mussel fauna appears to have declined in conjunction with these changes. However, through the Neuse 01 Regional Watershed Plan, the Swift Creek Watershed is being targeted for conservation/ mitigation efforts (NCDEQ 2016).

While it is apparent that habitat has been degraded in the Action Area, relatively stable areas with heterogeneous substrate still exist within Swift Creek. In general, the Swift Creek Watershed is a dynamic stream system where hydrogeomorphic changes have occurred. The channel dimensions and substrate composition in any given area have been adjusting to this change and will continue to do so until a dynamic equilibrium has been reached. As long as areas of suitable habitat continue to be present within the stream, and there are sufficient dispersal mechanisms to facilitate recruitment, the DWM has a realistic chance of persisting in the stream. (Three Oaks 2016).

The North Carolina DWM Work Group concluded that population augmentation through captive propagation is an essential component of management strategies to ensure DWM persistence in North Carolina (Smith et al. 2015). This is especially true with the population in Swift Creek where the Allee effect (high risk of demographic extirpation due to low population abundance and lack of dispersal) is one of the major limiting factors of population viability. Though a cooperative program between the NCWRC and NCSU is actively propagating some imperiled mussel species, the current capacity is insufficient to meet the needs. There is an ongoing commitment in developing a Swift Creek DWM population augmentation plan and acquiring the capacity or funds needed to implement this plan (Three Oaks 2016).

In summary, there is still some high-quality stream habitat present within or near the Action Area, yet there are also some water quality concerns. Despite an urbanizing watershed, the DWM still persists within Swift Creek at a low population level. There appears to have been a possible levelling off in the decline of DWM, and the population appears to have some level of recent recruitment. When considering this information, and with active management, it can be concluded that the DWM will likely persist into the future within the Swift Creek Watershed. Captive propagation and population augmentation, along with increased habitat protection, is vital to this future persistence.

4.3. Effects of the Action on DWM

This section analyzes the direct and indirect effects of the Action on the DWM, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action, but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in section 2 of this BO/CO.

4.3.1. Effects of Construction of Roadway and Stream Crossings on DWM

Swift Creek will be completely spanned by bridges with no permanent or temporary in-stream fill-related impacts. Some small tributaries to Swift Creek will also be crossed either by bridge or

culvert; however, all but one are too far upstream to produce detectable effects to DWM within Swift Creek. DWM are not known to occur within any of the small tributaries in the vicinity of the Action Area, and habitat within the tributaries is generally absent. Since the dual bridges over Swift Creek will not involve any permanent or temporary fill in the channel, there is no anticipated DWM habitat loss or disturbance associated with fill for this crossing.

The greatest construction related concern is prolonged erosion/sedimentation from the construction area in close proximity to Swift Creek. A major storm event could erode soil from within the disturbed area and wash it into the stream, causing harm to DWM by interfering with respiration, feeding, or spawning and otherwise degrading habitat for DWM and their host fish. However, to avoid or minimize the potential siltation effects, NCDOT has developed stringent erosion and sediment control measures (see Section 2.4) which greatly minimize sediment entering the stream. Assuming the proper installation and maintenance of these erosion control measures and full implementation of all conservation measures, the probability of effects from sedimentation leading to mortality is low. Except in the most extreme and rare circumstances, it is the Service's experience that the modern erosion control methods employed by NCDOT are effective at minimizing sediment entering a stream. Also, contractor compliance with sediment and erosion control measures in the Piedmont is high (NCDOT 2019), and NCDOT has measures in place to preclude grossly negligent contractors from future contracts (Benjamin Dewit, NCDOT Roadside Environmental Field Operations Engineer, personal email communication on August 26, 2019). However, given the small size and cryptic nature of DWM, any effects would be difficult to detect and measure. Although as many as 17 individuals potentially could be present, Three Oaks (2019) estimates that up to two individuals are likely present in the Action Area. Thus we estimate that up to two DWM may be harmed.

4.3.2. Effects of Operation of Roadway Facility on DWM

With the exception of Swift Creek, none of the other stream crossings occur within occupied DWM habitat. The presence of new roadway surface at or near Swift Creek could expose the DWM population to increased roadway runoff. The most common contaminants in highway runoff are heavy metals, inorganic salts, hydrocarbons, and suspended solids that accumulate on the road surface as a result of regular highway operation and maintenance activities (FHWA 2016). Mussels are known to be among the most sensitive forms of aquatic life to toxicity from some heavy metals and inorganic salts (Wang et al. 2017). However, NCDOT has committed to eliminating deck drainage directly into any waterbody within the Action Area and to maintain the local discharge to pre-construction conditions. These actions will reduce the potential for adverse effects to DWM (URS Corporation 2012).

Over time there is the potential for a traffic accident involving toxic chemicals to occur. Toxic chemical spills can be devastating to mussels (USFWS 2017a). It is not possible to accurately predict when or where toxic spills may occur. However, NCDOT has committed to constructing two hazardous spill basins adjacent to the Swift Creek crossing (see Section 2.4) to minimize the potential for adverse effects to DWM. In addition, in the event of a toxic spill that adversely affected the DWM population, NCDOT's funding for the captive propagation facility would help provide the potential for restocking of the population after clean up occurred.

4.3.3. Effects of Conservation Measures on DWM

While most of the conservation measures described in Section 2.4 are designed to minimize adverse effects to DWM, the captive propagation facility is a substantial and proactive measure that would not only partially offset adverse effects to the DWM within the Action Area, but would be a significant tool in furthering the recovery of the species.

Propagation Facility

Captive propagation of freshwater mussels is becoming an increasingly useful tool in the management and restoration of freshwater mussel populations, building upon recommendations to pursue augmentation and reintroduction as management strategies for these imperiled animals (National Native Mussel Conservation Committee 1998, Neves 2004). The Allee effect (high risk of demographic extirpation due to low population abundance and lack of dispersal) has been recognized as one of the major limiting factors of DWM population viability in the Swift Creek Watershed (Smith et al. 2015). If the Allee effect is causing unsustainable recruitment for the DWM, the release of propagated individuals to augment the existing population may increase viability given the apparent leveling off in population declines for DWM and other mussel species (Three Oaks 2016). Propagated DWM would be placed into suitable habitat where conditions would allow the likelihood of success.

Numerous imperiled freshwater mussel species have been successfully propagated and released into the wild for various projects in the United States (Virginia Tech News 2010, Kentucky Department of Fish and Wildlife Resources 2013, USFWS 2015, Clinch-Powell Clean Rivers Initiative 2016, USFWS 2019a,b,c). Several freshwater mussel species have been propagated (Eads et al. 2007, Levine et al. 2011, Levine 2012) and successfully released in North Carolina (NCWRC 2015, Tar River Land Conservancy 2015, Fraley et al. 2017, Hoch et al. 2017). To date there have not been any DWM population augmentation or reintroduction efforts using captive propagation in North Carolina, but the species has successfully been propagated, and the methodology is currently being refined at NCSU (Beck and Neves 2001, Levine et al. 2011).

As stated in the DWM Viability Report (Three Oaks 2016), the DWM Workgroup for North Carolina concluded that propagation/augmentation was the highest priority management action for the Swift Creek population. Also, the long-term maintenance of captive held "ark" populations is a vital conservation strategy for critically imperiled mussels (Rachael Hoch, Conservation Aquaculture Coordinator for NCWRC, Marion, NC. Personal email communication on December 28, 2017). Thus, in addition to augmenting the Swift Creek Watershed DWM population, developing the propagation facility will allow for the establishment of an "ark" population of the DWM for the Neuse River Basin, and ultimately for other North Carolina streams in the species range, to maintain the genetic stock.

Although a mussel propagation facility currently exists in western North Carolina, there is no eastern North Carolina analogue. Due to limitations in capacity, and given the distance from DWM habitats, the mussel propagation facility in western North Carolina is unable to meet the needs for propagation of DWM and other eastern North Carolina mussels. Therefore, the beneficial effect of NCDOT's commitment to fund the propagation facility fulfills an urgent need in the conservation and recovery of DWM in the Swift Creek Watershed and beyond.

Potential Mussel Relocation
NCDOT has committed to conduct a preconstruction survey (just prior to construction) at the Swift Creek crossing and remove mussels from a defined area (where they could potentially be affected by sedimentation). The removed mussels would then either be relocated to appropriate habitat within Swift Creek or taken into captivity to use as brood stock for propagation. The extent of this survey and potential relocation has yet to be determined, but will be limited to the reach of stream that is deemed most susceptible to the potential for sedimentation effects. Based on past survey history, the probability of encountering DWM within such a survey is low. However, if DWM are collected, the relocation or taking into captivity would qualify as harassment to the species.

Litigation Settlement
A settlement reached by NCDOT and plaintiffs that ends a federal lawsuit against the Service contains several land acquisition, stream protection, and other mitigation measures as well as research projects which may benefit the DWM and other listed mussels. However, these measures will not increase or reduce the Action's take of the species. Since the details of these measures have yet to be developed, they are not part of our analysis of the effects.

4.3.4. Effects of Interrelated and Interdependent Actions on DWM

At this time, the locations of potential borrow/waste sites, staging areas, equipment storage areas, and refueling areas have not been selected. Activities at these locations have the potential to adversely affect DWM through sedimentation/erosion and introduction of toxic compounds into streams within the Swift Creek Watershed. As discussed in Section 2.5, NCDOT will strongly discourage the contractor from choosing borrow/waste site locations, staging areas, equipment storage areas, and refueling areas within 0.25 mile of Swift Creek. However, if the contractor opts to pursue borrow or waste sites in these locations, the NCDOT Division Environmental Officer will coordinate with the Service during the approval process of any borrow or waste sites. In addition, NCDOT standard guidance for borrow/fill sites provide another layer of environmental protection for waterbodies. These sites will also be reviewed through interagency meetings. Staging areas are required to be identified by the contractor and reviewed by NCDOT, the Service, and other regulatory agencies. Therefore, adverse effects to DWM from the use of borrow/waste sites, staging areas, equipment storage areas, and refueling areas are extremely unlikely to occur (discountable).

4.4. Cumulative Effects on DWM

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

Although the Quantitative Indirect and Cumulative Effects (ICE) Report (Michael Baker Engineering 2017a,b,c,d) developed for the much broader FLUSA addressed future development as a cumulative effect, the analysis was performed utilizing the NEPA definition for cumulative

impacts (40 CFR § 1508.7) and not the ESA definition for cumulative effects. Furthermore, the ICE Report does not list specific future development projects and does not differentiate between future projects with a federal nexus and those with no federal nexus. Presumably, most such development projects would have a federal nexus via a requirement for a Section 404 Clean Water Act permit. For reasons described in Section 2.1, the Service is not using the FLUSA as the Action Area, and thus our consideration of potential cumulative effects is narrowed to a smaller area where potential effects would be more definable and measurable and are reasonably certain to occur. Accordingly, we are not aware of any non-federal actions in the Action Area that may affect DWM. Therefore, there are no cumulative effects relevant to formulating our opinion for the Action.

4.5. Conclusion for DWM

In this section, we summarize and interpret the findings of the previous sections for the DWM (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Viable and relatively larger populations of DWM occur in portions of the northeastern United States. Other populations from New Jersey south to North Carolina are smaller and appear to be declining. The DWM Recovery Plan (USFWS 1993) requires a viable population be present in Swift Creek in order for the species to be reclassified to threatened status.

Smith et al. (2015) concluded that the top three factors limiting the persistence of DWM in Swift Creek are 1) unsuitable physical habitat, 2) Allee effect (high risk of demographic extirpation due to low population abundance and lack of dispersal), and 3) low water quality from contaminants. The DWM Viability Study (Three Oaks 2016) concluded that there are several stressors to DWM in the Swift Creek Watershed, directly and indirectly related to urbanization of the watershed. While the DWM population has declined since urbanization began, the decline appears to have possibly leveled off, and there is evidence of recruitment of DWM within the past few years.

Three Oaks (2019) estimates that 0-17 DWM occur in Swift Creek within the Action Area, with the most likely number being 0-2 individuals. Swift Creek will be completely spanned by bridges with no permanent or temporary in-stream fill-related impacts. While there is potential for construction related erosion/siltation effects on DWM, NCDOT has developed stringent erosion and sediment control measures which greatly minimize sediment entering the stream. Assuming the proper installation and maintenance of these erosion control measures, the probability of effects from siltation leading to mortality is low. These potential effects are not expected to have a meaningful impact on DWM reproduction, numbers, or distribution within its overall range or

within the Action Area. Therefore, these direct effects will not reduce appreciably the likelihood of the survival and recovery of the DWM.

The DWM Viability Study (Three Oaks 2016) and the North Carolina DWM Work Group concluded that aggressive management, particularly through captive propagation and the ability to augment the existing population in the future, is considered to be the best practice to improve the viability of the DWM population in the Swift Creek Watershed. Therefore, the commitment of NCDOT to fund the propagation facility fulfills an urgent need in the conservation and recovery of DWM in the Action Area and beyond.

After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the DWM.

5. YELLOW LANCE

5.1. Status of Yellow Lance

This section summarizes the best available data about the biology and current condition of Yellow Lance (YL, *Elliptio lanceolata*) throughout its range that are relevant to formulating an opinion about the Action. The Service published its decision to list YL as threatened on April 3, 2018 (83 FR 14189-14198). The Service also recently completed a Species Status Assessment Report for the YL (USFWS 2017c), and much of the information contained in that document is incorporated by reference into this BO/CO.

5.1.1. Description of YL

The YL is a bright yellow mussel with a shell more than twice as long as it is tall, usually not more than 86 mm (3.4 inches) in length. Its shell is composed of two hinged valves which are joined by a ligament. The outermost layer of the shell has a waxy appearance with brownish ridges known as "growth rests" that formed during an intermediate stage of growth when the ridge area was the edge of the shell. The lustrous inner layer is usually an iridescent blue color, and sometimes has white or salmon color on the shorter end of the shell from where the foot extends (the anterior). The longer end of the shell from where the siphons extend (the posterior) is distinctly rounded. YL has interlocking hinge "teeth" on the inside of the shell to help keep the two valves in proper alignment (USFWS 2019d)

5.1.2. Life History of YL

The YL is a sand-associated species often found buried deep in clean, coarse to medium sand, although it can sometimes be found in gravel substrates. The YL often are moved with shifting sand and eventually settle in sand at the downstream end of stable sand and gravel bars. This species depends on clean, moderate flowing water with high dissolved oxygen and is found in medium-sized rivers to smaller streams.

The life cycle of the YL, like most freshwater mussels, is complex, relying on host fish for successful reproduction. Their eggs develop into microscopic larvae (glochidia) within the gills of the female mussel. The female expels glochidia into the water where they must attach to gills or fins of a fish to continue developing. Each mussel species has specific host fish species that are needed by the glochidia to keep growing and transform into juveniles. After a few weeks, they drop off and settle on the river bottom where they grow into adults.

Like many freshwater mussels, the YL grows rapidly during the first few years of life and slows down with age. In the laboratory, the YL reaches sexual maturity around three years old. Once the YL reaches maturity, the females release stringy clumps of glochidia in mucous. The clumps are likely eaten by minnows so the glochidia can attach to the minnow's gills and fin scales. At least two species of minnow are confirmed to host YL development in a laboratory setting, the White Shiner (*Luxilus albeolus*) and Pinewoods Shiner (*Lythrurus matuntinus*). Biologists have developed ways to propagate YL under controlled laboratory conditions.

Like other freshwater mussels, YL are suspension feeders that eat algae and other tiny particles, such as leaf debris, that they filter out of the water. Juveniles likely pedal-feed in the sediment, whereas adults filter-feed from the water column. For more detailed information on the life history of YL, see USFWS (2017c).

5.1.3. Numbers, Reproduction, and Distribution of YL

The YL has a historical range from the Patuxent River Basin in Maryland to the Neuse River Basin in North Carolina. For the current range, the YL Species Status Assessment Report (USFWS 2017c) delineates populations by using the eight river basins that YL has historically occupied. This includes the Patuxent, Potomac, Rappahannock, York, James, Chowan, Tar, and Neuse River basins in Maryland, Virginia, and North Carolina. Because the river basin level is at a very coarse scale, populations were further delineated using management units (MUs). MUs were defined as one or more HUC10 watersheds that species experts identified as most appropriate for assessing population-level resiliency. Of eight historical populations, six are known to have had a YL occurrence in the last 12 years, though the majority of those occurrences were limited to a single location within the river basin.

<u>Patuxent River Basin in Maryland</u> – This population contains one MU, the Patuxent MU. Five YL were collected prior to 1965, one individual was collected in 2015, and one relic shell was collected in 2016. In 2018, 23 individuals were found over 6+ kilometers of the Hawlings River.

<u>Potomac River Basin in Maryland/Virginia</u> – This population contains one MU, the Potomac MU. One specimen has been documented from a pre-1970 survey.

<u>Rappahannock River Basin in Virginia</u> – This population contains one MU, the Rappahannock River Subbasin MU. Many surveys have documented the presence of YL in this MU, with an occasional observation of upwards of 50 individuals. The species was first seen in the late 1980s, and it has been observed most recently in 2011 in the Rappahannock River, although very few (3) individuals were seen during that survey.

York River Basin in Virginia – This population contains one MU, the York MU. Several surveys document the presence of YL in this MU – presumably first seen in 1973, and as recent as 2007 in the South Anna River, although only one individual was observed during that survey.

James River Basin in Virginia – This population contains one MU, the Johns Creek MU. YL was first seen in this MU in 1984, and last observed in 2004, where one effort observed 31 individuals. YL is assumed to still be present despite the lack of recent occurrences.

Chowan River Basin in Virginia – This population contains two MUs, the Nottoway River Subbasin MU and the Meherrin River MU. Several surveys in the Nottoway River Subbasin have noted the presence of YL (one with as many as 781 individuals, although the identity of some specimens is in question). The species has been seen as recently as 2011 in the Nottoway River, albeit in extremely low (5) numbers.

Tar River Basin in North Carolina – This population contains four MUs; the Upper/Middle Tar River MU, the Lower Tar River MU, the Sandy-Swift Creek MU, and the Fishing Creek Subbasin MU. Many survey efforts have documented the presence of YL over the years; the species was first seen in 1966 in the Tar River, and it has been documented as recently as 2017 in Shocco Creek (RK&K 2017). Surveys in the mainstem Tar in 1990 documented upwards of 100 live individuals; most other surveys have documented between 25 and 31 individuals, and the most seen in recent (2014) surveys has been 25 live individuals. Similarly, in the late 1980s and early 1990s, Swift Creek surveys documented hundreds (342 in one instance) of shells, and recent surveys in 2015 and 2016 documented 53 and 45 live individuals, respectively.

Neuse River Basin in North Carolina – This population contains one MU, the Middle Neuse Tributaries MU. The YL was first seen in 1991, and most recently one individual was seen in 2015. Most surveys report very low numbers observed (usually only one live individual or just shell material), although one effort in 1994 (Swift Creek) documented 18 live individuals. There have been recent (2014-2016) intensive surveys in the Swift Creek watershed, and only one YL has been observed.

For more detailed information regarding the current condition of YL populations across its range, see USFWS (2017c).

5.1.4. Conservation Needs of and Threats to YL

The conservation needs of and threats to YL are very similar to those of the DWM described in Section 4.1.4. However, for additional detailed information, see USFWS (2017c).

5.2. Environmental Baseline for YL

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the YL, its habitat, and ecosystem within the Action Area. The environmental baseline is a “snapshot” of the species’ health in the Action Area at the time of the consultation, and does not include the effects of the Action under review.

5.2.1. Action Area Numbers, Reproduction, and Distribution of YL

The YL was first discovered in Swift Creek in 1991. One individual was found in the Action Area in 1998. Additionally, four individuals (three in 1998 and one in 2011) were found less than a mile downstream of the Action Area. Surveys conducted on February 7, 2019 and March 25, 2019 failed to find the species. Also, habitat for the species in these most recent surveys was found to be less than optimal. Three Oaks (2019) estimates that 0-1 adult YL occur within the Action Area. Due to the inherent nature of sampling methods, it is not possible to know the exact number of YL within the Action Area.

5.2.2. Action Area Conservation Needs of and Threats to YL

The Action Area conservation needs of and threats to the YL are similar to those of the DWM described in Section 4.2.2.

5.3. Effects of the Action on YL

This section analyzes the direct and indirect effects of the Action on the YL, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action, but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in section 2 of this BO/CO.

5.3.1. Effects of Construction of Roadway and Stream Crossings on YL

The construction related effects of the Action on YL in Swift Creek are very similar to those of the DWM described in Section 4.3.1. Three Oaks (2019) estimates that up to one YL is likely present in the Action Area. Thus we estimate that up to one YL may be harmed.

5.3.2. Effects of Operation of Roadway Facility on YL

The effects of the operation of the roadway facility on YL are very similar to those of the DWM described in Section 4.3.2.

5.3.3. Effects of Conservation Measures on YL

The effects of the conservations measures on YL are very similar to those of the DWM described in Section 4.3.3.

5.3.4. Effects of Interrelated and Interdependent Actions on YL

The effects of interrelated and interdependent actions on YL are very similar to those of the DWM described in Section 4.3.4.

5.4. Cumulative Effects on YL

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

The cumulative effects on YL are the same as those of the DWM described in Section 4.4.

5.5. Conclusion for YL

In this section, we summarize and interpret the findings of the previous sections for the YL (status, baseline, effects, and cumulative effects) relative to the purpose of a BO under §7(a)(2) of the ESA, which is to determine whether a federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Of eight historical populations of YL occurring in Maryland, Virginia, and North Carolina, six are known to have had records in the last 12 years (USFWS 2017c). Although the catch per unit effort has declined since the 1990s, the YL is thought to still be present in the Swift Creek Watershed in very low numbers (Three Oaks 2016). Three Oaks (2019) estimates that 0-1 YL occur within the Action Area. The conclusion for YL is otherwise very similar to that of the DWM described in Section 4.5. After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the YL.

6. ATLANTIC PIGTOE

6.1. Status of Atlantic Pigtoe

This section summarizes best available data about the biology and current condition of Atlantic Pigtoe (AP, *Fusconaia masoni*) throughout its range that are relevant to formulating an opinion about the Action. The Service published a proposed rule to list AP as threatened on October 11, 2018 (83 FR 51570-51609). The Service also recently completed a Species Status Assessment Report for the AP (USFWS 2017d), and much of the information contained in that document is incorporated by reference into this CO.

6.1.1. Description of AP

The AP is a freshwater mussel with a chunky, rhombus shaped shell, similar in appearance to a pig's hoof/toe. There is a distinct posterior ridge. The outer surface of the shell is yellow to dark

brown and parchment-like, while the inner layer is iridescent blue to salmon, white, or orange. Although larger specimens exist, the AP rarely exceeds two inches in length. Young individuals may have greenish rays across the entire shell surface. When collected fresh, the interior surface (nacre) in the shell tends to be salmon colored and sometimes iridescent. AP has interlocking hinge "teeth" on the inside of the shell to help keep the two valves in proper alignment (USFWS 2019e).

6.1.2. Life History of AP

The preferred habitat of the AP is coarse sand and gravel, and rarely in silt and detritus. Historically, the best populations existed in small creeks to larger rivers with excellent water quality, where flows were sufficient to maintain clean, silt-free substrates.

The life cycle of the AP, like most freshwater mussels, is complex, relying on host fish for successful reproduction. Male AP release their sperm into the water column where it is siphoned in by the females. Once fertilization has taken place in the gills of the female mussel, mature microscopic glochidia (larva) are released where they must attach themselves to the gills and/or fins of fish hosts to continue developing. AP are tachytictic (short term) breeders that usually release their larvae by July or August (USFWS 2019e).

AP have specific host fish that are needed by the glochidia to keep growing to ultimately transform into juveniles. After a few weeks of living as parasites, they drop off and settle on the stream bottom where they grow into adults. Host fish for the AP include the Rosefin Shiner (*Lythrurus ardens*), Creek Chub (*Semotilus atromaculatus*), Longnose Dace (*Rhynichthys cataractae*), White Shiner (*Luxilus albeolus*), Satinfin Shiner (*Cyprinella analostana*), Bluehead Chub (*Nocomis leptocephalus*), Rosyside Dace (*Clinostomus funduloides*), Pinewoods Shiner (*Lythrurus matutinus*), Swallowtail Shiner (*Notropis procne*), and Mountain Redbelly Dace (*Chrosomus oreas*). The time period for glochidia to develop varies between 30 to-60 days and depends on the host fish (USFWS 2019e).

Like all freshwater mussels, AP are known as suspension feeders because they eat algae, bacteria, and other microscopic matter they filter out of the water. Juveniles likely pedal-feed in the sediment, whereas adults filter-feed from the water column (USFWS 2019e).

6.1.3. Numbers, Reproduction, and Distribution of AP

The AP's historical range included all major river basins in the Atlantic coastal drainages from the James River Basin in Virginia south to the Altamaha River Basin in Georgia. The AP has been documented from multiple physiographic provinces, from the foothills of the Appalachian Mountains through the Piedmont and into the Coastal Plain, in streams ranging in size from < 1 meter wide up to some of the largest Atlantic Slope rivers within the species' range.

For the current range, the AP Species Status Assessment Report (USFWS 2017d) delineates populations using the 12 river basins that AP has historically occupied. This includes the James, Chowan, Roanoke, Tar, Neuse, Cape Fear, Pee Dee, Catawba, Edisto, Savannah, Ogeechee, and Altamaha River basins. Of 12 historical populations, seven populations within Virginia and

North Carolina have observations in the last 12 years, though the majority of occurrences were limited to a single location within the river basin. The AP is presumed extirpated from the southern portion of the range in South Carolina and Georgia. Most of the remaining populations are small and fragmented, only occupying a fraction of reaches that were historically occupied. This decrease in abundance and distribution has resulted in largely isolated contemporary populations.

Because the river basin level is at a very coarse scale, the seven extant populations were further delineated using management units (MUs). MUs were defined as one or more HUC10 watersheds that species experts identified as most appropriate for assessing population-level resiliency. For more detailed information regarding the status of each population and MU, see pages 13-26 and Table 3-2 of the AP Species Status Assessment Report (USFWS 2017d).

6.1.4. Conservation Needs of and Threats to AP

The conservation needs of and threats to AP are very similar to those of the DWM described in Section 4.1.4. However, for additional detailed information, see USFWS (2017d).

6.2. Environmental Baseline for AP

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the AP, its habitat, and ecosystem within the Action Area. The environmental baseline is a "snapshot" of the species' health in the Action Area at the time of the consultation, and does not include the effects of the Action under review.

6.2.1. Action Area Numbers, Reproduction, and Distribution of AP

The AP was first discovered in Swift Creek in 1991. Nine individuals were found between 2007 and 2010 in Swift Creek within the Action Area. Additionally, nine individuals (four in 1998, one in 2010 and four in 2011) were found less than 1.0 mile downstream of the Action Area, and one AP was found less than 1.0 mile upstream of the Action Area in 1998 (NCWRC Unpublished Aquatics Species Database). More recently, four individual AP were observed during surveys on February 7 and March 25, 2019. One of the individuals found on February 7, and then again on March 25, was originally found and tagged on August 8, 2010. Three Oaks (2019) estimates that 4-25 adult AP occur within the Action Area, with the most likely number being 4-12 individuals. Due to the inherent nature of sampling methods, it is not possible to know the exact number of AP within the Action Area.

6.2.2. Action Area Conservation Needs of and Threats to AP

The Action Area conservation needs of and threats to the AP are very similar to those of the DWM described in Section 4.2.2.

6.3. Effects of the Action on AP

This section analyzes the direct and indirect effects of the Action on the AP, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action, but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in Section 2 of this BO/CO.

6.3.1. Effects of Construction of Roadway and Stream Crossings on AP

The construction related effects of the Action on AP in Swift Creek are very similar to those of the DWM described in Section 4.3.1. Although as many as 25 individuals could be present, Three Oaks (2019) estimates that up to 12 individuals are likely present in the Action Area. Thus we estimate that up to 12 AP may be harmed.

6.3.2. Effects of Operation of Roadway Facility on AP

The effects of the operation of the roadway facility on AP are very similar to those of the DWM described in Section 4.3.2.

6.3.3. Effects of Conservation Measures on AP

The effects of the conservations measures on AP are very similar to those of the DWM described in Section 4.3.3.

6.3.4. Effects of Interrelated and Interdependent Actions on AP

The effects of interrelated and interdependent actions on AP are very similar to those of the DWM described in Section 4.3.4.

6.4. Cumulative Effects on AP

For purposes of consultation under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future federal actions that are unrelated to the proposed action are not considered, because they require separate consultation under §7 of the ESA.

The cumulative effects on AP are the same as those of the DWM described in Section 4.4.

6.5. Conclusion for AP

In this section, we summarize and interpret the findings of the previous sections for the AP (status, baseline, effects, and cumulative effects) relative to the purpose of a CO under §7(a)(2) of the ESA, which is to determine whether a federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or
b) result in the destruction or adverse modification of designated critical habitat.

"Jeopardize the continued existence" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR §402.02).

Of 12 historical AP populations, seven populations within Virginia and North Carolina have observations in the last 12 years. AP are still observed in Swift Creek, with observations within the Action Area as recent as 2019. The conclusion for AP is otherwise very similar to that of the DWM described in Section 4.5. After reviewing the current status of the species, the environmental baseline for the Action Area, the effects of the Action and the cumulative effects, it is the Service's biological opinion that the Action is not likely to jeopardize the continued existence of the AP.

7. PROPOSED ATLANTIC PIGTOE CRITICAL HABITAT

7.1. Status of Atlantic Pigtoe Proposed Critical Habitat

This section summarizes best available data about the current condition of all proposed units of critical habitat for Atlantic Pigtoe (AP, *Fusconaia masoni*) that are relevant to formulating an opinion about the Action. The Service published its proposed rule to designate critical habitat for AP on October 11, 2018 (83 FR 51570-51609).

7.1.1. Description of AP Proposed Critical Habitat

Proposed critical habitat for AP is comprised of approximately 542 river miles in 16 units. All of the units are currently occupied by the species and contain all of the physical and biological features (PBFs) essential to the conservation of the species. See Table 3 of 83 FR 51570-51609 for more detailed information on individual units.

The proposed critical habitat provides the following PBFs essential to the conservation of the AP (83 FR 51570-51609).

1. Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (*i.e.,* channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).

2. Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species is found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.

3. Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.

4. The presence and abundance of fish hosts necessary for recruitment of the AP.

7.1.2. Conservation Value of AP Proposed Critical Habitat

The current distribution of the AP is much reduced from its historical distribution. We anticipate that recovery will require continued protection of existing populations and habitat, as well as ensure there are adequate numbers of mussels in stable populations and that these populations occur over a wide geographic area. This strategy will help to ensure that catastrophic events, such as the effects of hurricanes (e.g. flooding that causes excessive sedimentation, nutrients, and debris to disrupt stream ecology), cannot simultaneously affect all known populations. Rangewide recovery considerations, such as maintaining existing genetic diversity and striving for representation of all major portions of the species' current range, were considered in formulating this proposed critical habitat. All of the units are currently occupied by the species and contain all of the PBFs essential to the conservation of the species (83 FR 51570-51609).

7.1.3. Conservation Needs for AP Proposed Critical Habitat

The features essential to the conservation of the AP may require special management considerations or protections to reduce the following threats: (1) urbanization of the landscape, including land conversion for urban and commercial use, infrastructure (roads, bridges, utilities), and urban water uses (water supply reservoirs, wastewater treatment, etc.); (2) nutrient pollution from agricultural activities that impact water quantity and quality; (3) significant alteration of water quality; (4) improper forest management or silviculture activities that remove large areas of forested wetlands and riparian systems; (5) culvert and pipe installation that creates barriers to movement; (6) impacts from invasive species; (7) changes and shifts in seasonal precipitation patterns as a result of climate change; and (8) other watershed and floodplain disturbances that release sediments or nutrients into the water. Management activities that could ameliorate these threats include: use of best management practices designed to reduce sedimentation, erosion, and bank side destruction; protection of riparian corridors and leaving sufficient canopy cover along banks; moderation of surface and ground water withdrawals to maintain natural flow regimes; increased use of stormwater management and reduction of stormwater flows into the systems; and reduction of other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water (83 FR 51570-51609).

7.2. Environmental Baseline for AP Proposed Critical Habitat

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of proposed critical habitat for AP within the Action Area. The environmental baseline is a "snapshot" of the condition of the PBFs that are essential to the conservation of the species within proposed critical habitat of the Action Area at the time of the conference, and does not include the effects of the Action under review.

7.2.1. Action Area Conservation Value of AP Proposed Critical Habitat

Of the total 542 river miles of critical habitat proposed for the AP, 0.42 mile occurs within the Action Area (or about 0.08%). Proposed critical habitat within the Action Area falls within Unit 13. This unit contains all four PBFs essential to the conservation of the AP.

7.2.2. Action Area Conservation Needs for AP Proposed Critical Habitat

See page 51585 of 83 FR 51570-51609 for the conservation needs of Unit 13 of proposed critical habitat.

7.3. Effects of the Action on AP Proposed Critical Habitat

This section analyzes the direct and indirect effects of the Action on proposed critical habitat for AP, which includes the direct and indirect effects of interrelated and interdependent actions. Direct effects are caused by the Action and occur at the same time and place. Indirect effects are caused by the Action, but are later in time and reasonably certain to occur. Our analyses are organized according to the description of the Action in section 2 of this BO/CO.

7.3.1. Effects of Construction of Roadway and Stream Crossings on AP Proposed Critical Habitat

There is potential for erosion/sedimentation from the construction area in close proximity to Swift Creek. A major storm event could erode soil from within the disturbed area and wash it into the stream, potentially affecting PBF 1 (depositing silt on substrates), PBF 3 (degrading water and sediment quality), and PBF 4 (excluding fish hosts). However, to avoid or minimize such effects, NCDOT has developed stringent erosion and sediment control measures (see Section 2.4) which greatly minimize sediment entering the stream. Assuming the proper installation and maintenance of these erosion control measures and full implementation of all conservation measures, the probability of adverse effects to proposed critical habitat is low. Except in the most extreme and rare circumstances, it is the Service's experience that the modern erosion control methods employed by NCDOT are effective at minimizing sediment entering a stream. The effects of any residual sedimentation not intercepted by erosion control measures would likely be minor and temporary in nature.

7.3.2. Effects of Operation of Roadway Facility on AP Proposed Critical Habitat

The presence of new roadway surface at or near Swift Creek could expose proposed critical habitat to increased roadway runoff. The most common contaminants in highway runoff are heavy metals, inorganic salts, hydrocarbons, and suspended solids that accumulate on the road surface as a result of regular highway operation and maintenance activities (FHWA 2016). These contaminants could affect PBF 3 (degrading water and sediment quality) and PBF 4 (harming fish hosts). However, NCDOT has committed to eliminating deck drainage directly into any waterbody within the Action Area and to maintain the local discharge to pre-construction conditions. These actions will reduce the potential for adverse effects to proposed critical habitat.

Over time there is the potential for a traffic accident involving toxic chemicals to occur which could also similarly affect PBF 3 and PBF 4. It is not possible to accurately predict when or where toxic spills may occur. However, NCDOT has committed to constructing two hazardous spill basins adjacent to the Swift Creek crossing (see Section 2.4) to minimize the potential for adverse effects.

7.3.3. Effects of Conservation Measures on AP Proposed Critical Habitat

Most of the conservation measures described in Section 2.4 are designed to minimize adverse effects to proposed AP critical habitat.

7.3.4. Effects of Interrelated and Interdependent Actions on AP Proposed Critical Habitat

At this time, the locations of potential borrow/waste sites, staging areas, equipment storage areas, and refueling areas have not been selected. Activities at these locations have the potential to adversely affect proposed critical habitat by erosion/sedimentation and introduction of toxic compounds into Swift Creek. As discussed in Section 2.5, NCDOT will strongly discourage the contractor from choosing borrow/waste site locations, staging areas, equipment storage areas, and refueling areas within 0.25 mile of Swift Creek. However, if the contractor opts to pursue borrow or waste sites in these locations, the NCDOT Division Environmental Officer will coordinate with the Service during the approval process of any borrow or waste sites. In addition, NCDOT standard guidance for borrow/fill sites provide another layer of environmental protection for waterbodies. These sites will also be reviewed through interagency meetings. Staging areas are required to be identified by the contractor and reviewed by NCDOT, the Service, and other regulatory agencies. Therefore, adverse effects to proposed critical habitat from the use of borrow/waste sites, staging areas, equipment storage areas, and refueling areas are extremely unlikely to occur (discountable).

7.4. Cumulative Effects on AP Proposed Critical Habitat

For purposes of consultation/conference under ESA §7, cumulative effects are those caused by future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. Future federal actions that are unrelated to the proposed action are not considered, because they require separate consultation/conference under §7 of the ESA.

We are not aware of any non-federal actions in the Action Area that may affect proposed AP critical habitat. Therefore, cumulative effects are not relevant to formulating our opinion for the Action.

7.5. Conclusion for AP Proposed Critical Habitat

In this section, we summarize and interpret the findings of the previous sections for AP proposed critical habitat (status, baseline, effects, and cumulative effects) relative to the purpose of a CO under §7(a)(2) of the ESA, which is to determine whether a federal action is likely to:

a) jeopardize the continued existence of species listed as endangered or threatened; or

b) result in the destruction or adverse modification of designated critical habitat. "*Destruction or adverse modification*" means a direct or indirect alteration that appreciably diminishes the value of designated critical habitat as a whole for the conservation of a listed species (50 CFR §402.02).

Of the total 542 river miles of proposed critical habitat for the AP, 0.42 mile (0.08%) occurs within the Action Area. Some adverse effects to proposed critical habitat may occur from the input of sediment into Swift Creek, thus potentially affecting PBF numbers 1, 3, and 4. However, implementation of conservation measures as part of the Action will greatly minimize these effects. All such effects are expected to minor and temporary, and thus will not appreciably diminish the value of the PBFs.

After reviewing the current status of the proposed critical habitat, the environmental baseline for the Action Area, the effects of the Action, and the cumulative effects, it is the Service's conference opinion that the Action is not likely to destroy or adversely modify proposed critical habitat for AP.

8. INCIDENTAL TAKE STATEMENT

ESA §9(a)(1) and regulations issued under §4(d) prohibit the take of endangered and threatened fish and wildlife species without special exemption. The term "take" in the ESA means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (ESA §3). In regulations at 50 CFR §17.3, the Service further defines:

- "harass" 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;"
- "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering;" and
- "incidental take" as "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Under the terms of ESA §7(b)(4) and §7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited, provided that such taking is in compliance with the terms and conditions of an incidental take statement (ITS).

The Action considered in this BO/CO includes a conservation measure to potentially collect and then either relocate or take into captivity for propagation efforts listed/proposed mussels in the vicinity of the crossing of Swift Creek as described in Section 2.4. Through this statement, the Service authorizes this conservation measure as an exception to the prohibitions against trapping, capturing, or collecting listed species. This conservation measure is referenced in a Reasonable and Prudent Measure below, and we provide Terms and Conditions for its implementation.

For the exemption in ESA §7(o)(2) to apply to the Action considered in this BO/CO, the FHWA must undertake the non-discretionary measures described in this ITS, and these measures must

become binding conditions of any permit, contract, or grant issued for implementing the Action. The FHWA has a continuing duty to regulate the activity covered by this ITS. The protective coverage of §7(o)(2) may lapse if the FHWA fails to:

- assume and implement the terms and conditions; or
- require a permittee, contractor, or grantee to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit, contract, or grant document.

In order to monitor the impact of incidental take, the FHWA must report the progress of the Action and its impact on the species to the Service as specified in this ITS.

8.1. Amount or Extent of Take

This section specifies the amount or extent of take of listed wildlife species that the Action is reasonably certain to cause, which we estimated in the "Effects of the Action" section(s) of this BO/CO.

8.1.1. DWM

The Service anticipates that the Action is reasonably certain to cause incidental take of individual DWM consistent with the definition of harm resulting from the construction of the roadway and stream crossings (see Sections 4.3.1). However, we believe that incidental take for this species is difficult to determine. Incidental take that occurs due to sub-lethal levels of siltation or water quality degradation which temporarily disrupt movement, breeding, feeding, or sheltering of adult and juvenile DWM or larval glochidia are likely not detectable or measurable. Incidental take that occurs as harm resulting in injury or death from larger amounts of siltation or water quality degradation would also be difficult to determine. Actual habitat degradation may be detectable, but knowing whether a specific degradation actually affected the species would be difficult to determine. Spent shells may be collected, but attributing the cause of mortality would be very difficult. Since Three Oaks (2019) estimates that the most likely number of adult DWM occurring in the Action Area is 0-2 individuals, we estimate that up to two adult DWM will incur incidental take.

8.1.2. YL

The Service anticipates that the Action is reasonably certain to cause incidental take of individual YL consistent with the definition of harm resulting from the construction of the roadway and stream crossings (see Sections 5.3.1). However, we believe that incidental take for this species is difficult to determine. Incidental take that occurs due to sub-lethal levels of siltation or water quality degradation which temporarily disrupt movement, breeding, feeding, or sheltering of adult and juvenile YL or larval glochidia are likely not detectable or measurable. Incidental take that occurs as harm resulting in injury or death from larger amounts of siltation or water quality degradation would also be difficult to determine. Actual habitat degradation may be detectable, but knowing whether a specific degradation actually affected the species would be difficult to determine. Spent shells may be collected, but attributing the cause of mortality would be very difficult. Since Three Oaks (2019) estimates that the most likely number of adult YL occurring in the Action Area is 0-1 individuals, we estimate that up to one adult YL will incur incidental take.

8.1.3. AP

The Service anticipates that the Action is reasonably certain to cause incidental take of individual AP consistent with the definition of harm resulting from the construction of the roadway and stream crossings (see Sections 6.3.1). However, we believe that incidental take for this species is difficult to determine. Incidental take that occurs due to sub-lethal levels of siltation or water quality degradation which temporarily disrupt movement, breeding, feeding, or sheltering of adult and juvenile AP or larval glochidia are likely not detectable or measurable. Incidental take that occurs as harm resulting in injury or death from larger amounts of siltation or water quality degradation would also be difficult to determine. Actual habitat degradation may be detectable, but knowing whether a specific degradation actually affected the species would be difficult to determine. Spent shells may be collected, but attributing the cause of mortality would be very difficult. Since Three Oaks (2019) estimates that the most likely number of adult AP occurring in the Action Area is 4-12 individuals, we estimate that up to 12 adult AP will incur incidental take.

8.2. Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures (RPMs) are necessary or appropriate to minimize the impact of incidental take caused by the Action on DWM, YL, and AP.

RPM 1. Funding Propagation Facility. After receiving Section 404 Clean Water Permit for the Action, NCDOT will transfer necessary funding for the propagation facility described in Section 2.4 in accordance with the terms of the funding agreements among NCDOT, NCWRC, and Wake County.

RPM 2. Mussel Relocation. NCDOT will conduct a preconstruction mussel survey at the Swift Creek crossing (just prior to construction) and potentially relocate or take into captivity DWM, YL, and AP. This measure is part of the proposed Action described in Section 2.4.

8.3. Terms and Conditions

In order for the exemption from the take prohibitions of §9(a)(1) and of regulations issued under §4(d) of the ESA to apply to the Action, the FHWA must comply with the terms and conditions (T&Cs) of this statement, provided below, which carry out the RPMs described in the previous section. These T&Cs are mandatory. As necessary and appropriate to fulfill this responsibility, the FHWA must require any permittee, contractor, or grantee to implement these T&Cs through enforceable terms that are added to the permit, contract, or grant document.

T&C 1. Funding to Wake County (RPM 1). After receiving a Section 404 Clean Water Act permit for the Action from the US Army Corps of Engineers, NCDOT will begin reimbursing Wake County for the construction of the Yates Mill Aquatic Conservation Center (approximately $1,958,936) in accordance with the terms of the funding agreement between NCDOT and Wake County.

T&C 2. Funding to NCWRC (RPM 1). After receiving a Section 404 Clean Water Act permit for the Action from the US Army Corps of Engineers, NCDOT will transfer approximately $6,082,124 to the NCWRC Non-Game Aquatic Species Fund in accordance with the terms of the funding agreement between NCDOT and NCWRC (as to be amended). These funds will be used for North Carolina State University's detailed proposal to operate the facility, including a facility manager and assistant at the Yates Mill Aquatic Conservation Center to oversee the operation of the facility for propagation of DWM, YL, and other mussels.

T&C 3. Mussel Relocation and/or Captivity (RPM 2). Prior to conducting the preconstruction survey, NCDOT must coordinate with the Service regarding the extent of the survey and to determine whether DWM, YL, or AP will be relocated or taken into captivity for propagation purposes. If DWM, YL, or AP are to be relocated, a relocation plan must be submitted to and approved by the Service.

8.4. Monitoring and Reporting Requirements

In order to monitor the impacts of incidental take, the FHWA or NCDOT must report the progress of the Action and its impact on the species to the Service as specified in the incidental take statement (50 CFR §402.14(i)(3)). This section provides the specific instructions for such monitoring and reporting (M&R). As necessary and appropriate to fulfill this responsibility, the FHWA must require any permittee, contractor, or grantee to accomplish the monitoring and reporting through enforceable terms that are added to the permit, contract, or grant document. Such enforceable terms must include a requirement to immediately notify the FHWA and the Service if the amount or extent of incidental take specified in this ITS is exceeded during Action implementation.

M&R 1. Erosion Control Measures Failure. Our effects analysis is based on the premise that measurable sedimentation effects do not occur more than 400 meters downstream of bridge replacement projects in Piedmont streams. In the event that visible sediment loss from the Action is observed at the Swift Creek bridges, a review of turbidity levels will be made immediately upstream and downstream 400 meters (0.25 mile) to determine if sedimentation effects are occurring beyond the Action Area. If visual observation of turbidity levels downstream appear to be elevated beyond upstream observations, the project inspector will contact the Division Environmental Officer. If determined that project-related sedimentation is occurring beyond 400 meters, the amount or extent of incidental take specified in this ITS has been exceeded and the Service must be contacted immediately.

9. CONSERVATION RECOMMENDATIONS

§7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by conducting conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary activities that an action agency may undertake to avoid or minimize the adverse effects of a proposed action, implement recovery plans, or develop information that is useful for the conservation of listed species. The Service offers the

following recommendations that are relevant to the listed species addressed in this BO/CO and that we believe are consistent with the authorities of the FHWA.

1. Prioritize Section 404 Clean Water Act mitigation projects that will help conserve habitat for DWM, YL, and AP populations.
2. Provide funding for additional surveys for DWM, YL, and AP outside of the Action Area.
3. After the mussel propagation facility is functional, provide additional funding for DWM, YL, and AP augmentations throughout their range in North Carolina.

10. REINITIATION NOTICE

Formal consultation for the Action considered in this BO is concluded. Reinitiating consultation is required if the FHWA retains discretionary involvement or control over the Action (or is authorized by law) when:

a. the amount or extent of incidental take is exceeded;
b. new information reveals that the Action may affect listed species or designated critical habitat in a manner or to an extent not considered in this BO;
c. the Action is modified in a manner that causes effects to listed species or designated critical habitat not considered in this BO; or
d. a new species is listed or critical habitat designated that the Action may affect.

In instances where the amount or extent of incidental take is exceeded, the FHWA is required to immediately request a reinitiation of formal consultation.

Formal conference for the Action considered in this CO is concluded. The FHWA may submit a written request to the Service to confirm the CO as a BO issued through formal consultation if the FHWA retain discretionary involvement or control over the Action when species addressed in the CO are listed, or when proposed critical habitat addressed in the CO is designated. This request should advise the Service of any new information about the Action or its effects on such species or critical habitats that is relevant to adopting the CO as a BO, including the amount or extent of any taking of species that the Action has caused before the effective date of a listing decision.

The incidental take statement provided for non-listed species in a CO does not become effective until such species are listed and the CO is adopted as a BO. At that time, the Service will review the Action to determine whether modifying the opinion and incidental take statement to reflect new information is appropriate. If the Service finds no significant changes in the Action as proposed or in the information used during the conference, the Service will confirm the CO as a BO for the Action, which shall conclude formal consultation. Thereafter, the FHWA shall request to reinitiate formal consultation under the same four circumstances listed above.

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