

BIOLOGICAL ASSESSMENT – Addendum

AN ASSESSMENT OF POTENTIAL EFFECTS TO THE PROPOSED FEDERALLY THREATENED GREEN FLOATER (*LASMIGONA SUBVIRIDIS*)

For



Complete 540 – Triangle Expressway Southeast Extension Wake, Johnston, & Harnett Counties

STIP Project No. R-2829
State Project No. 6.401080
Federal Aid Project No. STP-0540(21)
WBS No. 35517.1.TA1

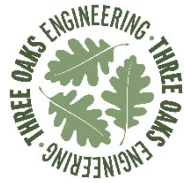
Federal Highway Administration & North Carolina Department of Transportation



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1.0 INTRODUCTION

The North Carolina Department of Transportation (NCDOT), in cooperation with the Federal Highway Administration (FHWA), proposes transportation improvements to the “Complete 540 – Triangle Expressway Southeast Extension” in Wake and Johnston Counties, North Carolina (Appendix A; Figure 1). The proposed roadway is a controlled-access toll road, approximately 27 miles long. The project is divided into three smaller units, of which the R-2829 portion is the subject of this addendum.

This is an addendum for the Biological Assessment (BA) for the Complete 540 project. The FHWA submitted the original BA to the US Fish and Wildlife Service (USFWS) on December 06, 2017 (NCDOT 2017, which was revised in July 2019 as part of reinitiation of Section 7. One of the reasons for the July 2019 reinitiation was to address the Atlantic Pigtoe (*Fusconaia masoni*), Carolina Madtom (*Noturus furiosus*) and Neuse River Waterdog (*Necturus lewisi*), which had been proposed for listing after the original BA was submitted. All three of these species were subsequently listed. The other reasons for the reinitiation were to update baseline information on the previously addressed species (population density information), as well as update the project description to include revised design details. The Biological/Conference Opinion (BCO) was issued by the USFWS on October 15, 2019 (USFWS 2019).

Since issuance of the BCO, an additional species, the Green Floater (*Lasmigona subviridis*) was proposed for Federal Listing Status (Threatened) on July 26, 2023 (USFWS 2023), necessitating this addendum to the existing BA. The BA addendum evaluates the potential effects of the Complete 540 project on federally listed and proposed species and designated Critical Habitat in accordance with Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 (c)). Section 7(a)(2) of the ESA (16 USC 1531-1544 and Section 1536) requires that each Federal agency shall, in consultation with the USFWS, ensure that any action authorized, funded, or carried out by such agency, is not likely to jeopardize the continued existence of an endangered or threatened species, or result in the destruction or adverse modification of Critical Habitat. Since the proposed project includes both funding by FHWA and approval by the U.S. Army Corps of Engineers (USACE) pursuant to the Clean Water Act (CWA), the project is subject to consultation under Section 7 of the ESA. This BA is provided to satisfy the action agencies’ (FHWA and USACE) obligations under Section 7 of the ESA of 1973. FHWA is the lead federal agency for the National Environmental Policy Act (NEPA) and the ESA.

1.1 Statutory Authority of Action

The proposed project is included in the NCDOT’s 2024-2033 State Transportation Improvement Project (STIP), project number R-2829 (I-40 to US/64/US 264 Bypass (I-495)) (Appendix A; Figure 1). NCDOT derives their statutory authority via North Carolina General Statutes (NCGS) 143B-345 and 346 and FHWA derives their statutory authority via 49 US Code (USC) 104.

1.2 Summary of Consultation History

A full summary of the consultation history up to this reinitiation is provided in the 2019 BCO for this project (USFWS 2019).

1.3 Reasons for Reinitiating ESA Section 7 Consultation

The BA addendum includes the following additional information:

- 1) The proposed ESA listing of the Green Floater (Threatened). The proposed listing includes proposed Critical Habitat that overlaps with the R-2829 Action Area in the Neuse River.
- 2) Provides updated species baseline information (from stream surveys) for listed aquatic species in the Action Area.
 - a. Updated freshwater mussel survey results (Appendix B).
 - b. Density estimates of the Green Floater population within the Action Area, which is anticipated to be adversely affected by the proposed Project crossing of the Neuse River (Appendix C).

2.0 PROJECT AND ACTION AREA DESCRIPTION

2.1 Project Description

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, a distance of approximately 27 miles. The R-2829 portion of this larger action runs from I-87/US-64/US-264 north to the Johnston County line near SR 2700 (White Oak Road). The proposed action will improve mobility, reduce forecast traffic congestion on the existing roadway network, and improve system linkage within the project study area. A full description of the larger Complete 540 project is provided in the original BA document (NCDOT 2017).

A more detailed description of the Neuse River crossing construction was developed and revised in July 2024 (NCDOT 2024) as follows:

The project includes the construction of two bridges (one northbound and one southbound) over the Neuse River in conjunction with a six-lane expressway. A temporary work causeway will be placed between the two highway bridges for construction. The highway bridges will be concrete decks supported by concrete beams. The concrete decks are anticipated to be approximately 107,020 square feet (ft²) (1422 ft long and 75.25 ft wide) for the southbound bridge and 89,929 ft² (1422 ft long and 63.25 ft wide) for the northbound bridge. The bottom of the bridge beams would be approximately 40 ft above mean daily flow of the non-tidally influenced Neuse River.

The following refers to construction techniques for piers within the river channel. Fifty-four-in concrete drilled shafts/concrete columns will be used to support a single bridge pier for each of the new highway bridges. Five drilled shafts/columns will be constructed for the southbound bridge pier and four drilled shafts/columns will be constructed for the northbound bridge pier (for a total of 9 concrete piers), which will be aligned parallel to stream flow. Holes will be augured and lined with steel liners. Material removed from the holes will be deposited in an approved off-site upland location. Each shaft will have an approximate permanent impact of 16 ft², and the 2 piers will permanently impact approximately 144 ft². It is estimated that permanent impacts will not exceed 500 ft².

Each pier and the erection of girders will take place from one temporary causeway between the bridges, and also from the riverbanks via cranes. The causeway will be made from cleaned large grade rip rap. There will be a causeway on the north side of the river which will temporarily impact approximately 15,000 ft². The temporary causeway will always leave more than 50% of the river free flowing with no obstructions. It is estimated that approximately 8 prefabricated concrete cross pipes will also be installed under the causeway to maintain river flow. The exact size and number of cross pipes will be determined closer to the time of construction.

Geotechnical drilling may be performed at the project site and may require boring through the substrate. There would be 2 borings of 3-in diameter per bent, for a total of 4 borings. Borings will be performed by advancing a casing to the rock. Split spoon samples will pull material, after which the rock will be cored. Work will be performed from the temporary causeway.

Each pier is expected to take 2 weeks to install and an additional 4 weeks to erect the girders. Total in-water work time is expected to take 25 weeks to complete. In-water work will be done during daylight hours, however, if daytime temperatures are too high, pouring of concrete may be done at night. While not anticipated, some shaft auguring may be done at night.

2.2 Description of Action Area

The Action Area, as defined in 50 CFR 402.02, includes all areas to be affected directly or indirectly by a federal action and not merely the immediate area involved in the action.

For this BA addendum, the Action Area is restricted to the Neuse River portion of the larger action. This is because it is the only area where the Green Floater is believed to be affected by the action. The Action Area for the Green Floater is depicted in Appendix A, Figure 1. The Action Area is 7.1 acres of the Neuse River, which is made up of the width of the Neuse River within the project alignment, plus an additional 400 meter (1,312 ft) downstream and 100 meter (328 ft) upstream buffer to account for the effects that may occur outside of the project footprint.

2.3 Conservation Measures

All conservation measures are outlined in the BA documentation (NCDOT 2017). The conservation measures that are outlined in the original BA are also applicable to the Green Floater. No additional conservation measures or monitoring are proposed.

3.0 SPECIES STATUS FOR GREEN FLOATER

The Green Floater is known to occur within the Action Area in the Neuse River. Targeted aquatic surveys for this project were conducted by Three Oaks' staff and members of the NCDOT Biological Surveys Group (BSG) in the Neuse River on May 03, 2024, and no individuals were found. While this current survey was unsuccessful in locating the Green Floater, recent observations of the species upstream, downstream, and within the Action Area, as well as life history attributes that are discussed in the density estimate (Appendix C) suggest the species' is likely present within the Action Area. Freshwater mussel surveys were also conducted in other streams crossed by the R-2829 Action Area in close proximity to the Green Floater population, the results of which are included in Appendix B. None of these streams were considered likely to support the Green Floater.

3.1 Watershed Conditions Baseline

Baseline watershed conditions were described in BA. Since it was submitted in 2017, some changes/updates to the watershed have occurred, which are listed below.

3.1.1 Regulatory Designations

Under Section 303(d) of the CWA, impaired waters are defined as waters that do not meet water quality standards even after the minimum required levels of pollution control technology have been installed at point sources of pollution. Failure to meet standards may be due to an individual pollutant, multiple pollutants, or unknown causes of impairment. A list of pertinent 2016 303(d) listed streams is provided in the BA document (NCDOT 2017). The listed streams relevant to R-2829 from this list are within the Poplar Creek- Neuse River, Walnut Creek- Neuse River, and Whiteoak Creek HUC 12's (#030202011103, #030202011101, 030202011003) and include the Neuse River, Walnut Creek, and Beddingfield Creek. The most up to date final 303(d) list, which was published in 2022, lists a more up to date reference of all 303(d) listed streams within a five-mile radius of the Project, which is outlined in the Freshwater Mussel Survey Report (NCDOT 2017). These streams include the Neuse River, Walnut Creek, Crabtree Creek, Marsh Creek, Beddingfield Creek, Marks Creek, and UT Swift Creek.

3.1.2 Point Source Pollution

Point source discharge is defined as discharge that enters surface waters through a pipe, ditch, or other well-defined point. Section 402 of the Clean Water Act establishes the National Pollutant Discharge Elimination System (NPDES) permitting program. In North Carolina, the NCDWR is responsible for permitting and enforcement of the NPDES program. NPDES dischargers are divided into two categories: individual and general. General permits are issued for specific activities, including non-contact cooling water discharges, petroleum-based groundwater remediation, sand dredging, and domestic discharges from single family residences. Individual permits are issued on a case-by-case basis for activities not covered under general permits. Individual permits are divided into two classes: major discharges permitted to discharge one million gallons per day or greater and minor discharges permitted to discharge less than one million gallons per day (NCDEQ 2024).

The Freshwater Mussel Survey Report outlines the eighteen NPDES dischargers located within a five-mile radius of the Project (Appendix B, Section 2.2). There are several discharges that drain into tributaries of the Neuse River within two to seven SM upstream of the Neuse River Project crossing.

3.1.3 Non-point Source Pollution

Non-point source (NPS) pollution refers to runoff that enters surface waters through stormwater or snowmelt. There are many types of land use activities that contribute to NPS pollution, including land development, construction activities, animal waste disposal, mining, agriculture, and forestry operations, as well as impervious surfaces such as roadways and parking lots.

The land cover data provided below is updated from what was included in the original BA documentation, which used the 2011 National Land Cover Database (NLCD) (NCDOT 2017). The project is located in an area with considerable agricultural influence, though a majority of the area remains forested. Below is a breakdown of the land cover in the study area (Table 1; NLCD 2019).

Table 1. 2019 Land Cover in the Project Study Area

Land Cover	Sum of Area (acre)	Percent (%)
Mixed Forest	395.4	21.0
Evergreen Forest	392.9	20.8
Deciduous Forest	215.0	11.4
Developed Open Space	187.8	10.0
Cultivated Crops	145.8	7.7
Pasture/Hay	143.3	7.6
Developed, Low Intensity	121.1	6.4
Developed, Medium Intensity	84.0	4.5
Woody Wetlands	84.0	4.5
Grassland/Herbaceous	37.1	2.0
Shrub/Scrub	32.1	1.7
Open Water	24.7	1.3
Developed, High Intensity	22.2	1.1
Total*	1885.4	100

*Rounded totals are sum of actual areas.

3.2 *Green Floater Species Information*

A brief background for the Proposed Federally Threatened Green Floater is provided below as it pertains to this area of the Neuse River Basin. A more detailed description of the species description, life history, habitat/range, and general threats are provided in the Freshwater Mussel Survey Report (Appendix B).

Status: Proposed Threatened

Family: Unionidae

Proposed Listing: July 26, 2023

Critical Habitat: Proposed, see Section 3.2.3

3.2.1 *Environmental Baseline in the Neuse River*

The Green Floater's range is described in the 2021 Species Status Assessment (USFWS 2021) which describes 94 analysis units divided into five Representative Units. The Project is located in the South Atlantic Representative Unit, in the NC Draining Watershed.

Below is an outline of the watersheds within the South Atlantic Representative Unit, with added details for the two analysis units that overlap with the Project (USFWS 2021):

South Atlantic (NC, VA)

1. Lower Chesapeake (VA) – 25 analysis units; 13 Historical, 10 Low, one Medium, one High
2. NC Draining (NC, VA) – 31 analysis units; six Extirpated, five Historical, 13 Low, six Medium, one High

The NC Draining “Watershed” contains several river basins including the Cape Fear, Chowan, Neuse, Roanoke, and Tar/Pamlico. The Neuse River Basin, where the project is located, has an evaluated range including eight HUC10’s, four of which are considered Extirpated. The Swift Creek (HUC10 # 0302020110) analysis unit, where Whiteoak Creek and the UTs to Swift Creek are located, is considered Extirpated, with no evidence of the species presence since 1991. The Green Floater was historically reported from the Neuse River Basin in Orange, Durham, Wake and Johnston counties (Walter 1956). Lea (1863) described *Unio pertenuis* from the Neuse River “six miles east of Raleigh”, which is in the vicinity of the current Poole Road crossing of the river. Johnson (1970) synonymized this species into Green Floater. Walter (1956) collected the Green Floater at several locations in the Neuse River from near Smithfield in Johnston County upstream into Durham County approximately 9.5 miles east-northeast of the city of Durham.

The Walnut Creek-Neuse River (HUC10 # 0302020111) analysis unit, where the remaining Project streams are located, is rated Low. Within this unit, the most recent live Green Floater individual was located in April 2017 by Three Oaks staff at the confluence of Walnut Creek and the Neuse River, and a shell was found near the Crabtree Creek confluence in May 2018 (NCWRC Unpublished Database 2024). A total of 82 live individuals have been found in the analysis unit, all of which were observed after 1999 (USFWS 2021).

3.2.2 Proposed Critical Habitat

The Proposed Critical Habitat for the Green Floater is described in the Species Description (Section 3) of the Freshwater Mussel Survey Report (Appendix B). The Neuse River crossing is within Proposed Critical Habitat Unit 7a, an approximately 16.6 SM reach of the Neuse River that extends from its confluence with Crabtree Creek to a point approximately 0.8 SM downstream of its crossing with NC 42. A map depiction of the Proposed Critical Habitat in relation to the project is located in Appendix B.

When designating Critical Habitat, the USFWS identifies physical and biological features (PBFs), formerly referred to as primary constituent elements, that are essential to the conservation of the species and that may require special management considerations or

protection. The PBFs essential for the conservation of Green Floater are summarized below, with further detail found in USFWS 2023:

1. Stable flow regime with slow-moderate current even during periods of higher flows to provide refugia;
2. Sand and gravel substrates with stable stream channel and banks with minimal sedimentation and erosion;
3. Sufficient food resources (plankton, bacteria, detritus, and dissolved organic matter);
4. Sufficient water and sediment quality to “sustain natural physiological processes for normal behavior, growth, and viability of all life stages...”;
5. Presence of appropriate fish hosts.

Although there are specific sites within the eight units that do not contain all the PBFs, these elements are found consistently throughout the designated river reaches and are present at the sites containing the “healthiest” of the occurrences (USFWS 2023). While the project is located in a somewhat urbanized section of the Neuse River Basin, many if not all of these constituent PBFs are found in the Action Area portion of the river, as reflected by the species being found in past surveys over a relatively wide range within the subject Proposed Critical Habitat Unit (7a).

3.3 General Threats to Species

Threats to the Green Floater are similar to the threats to freshwater mussels that were discussed in the original 2017 BA and the 2019 BA addendum (NCDOT 2017; USFWS 2019). Specific threats to the Green Floater are additionally discussed in the Freshwater Mussel Survey Report (Appendix B).

3.4 Potential Effects of Roadway Projects on Green Floater and Habitat

Potential effects of roadway projects that were detailed in the original 2017 BA and the 2019 BA addendum documents respectively apply to the Green Floater (NCDOT 2017; USFWS 2019).

4.0 EFFECTS ANALYSIS OF THE ACTION FOR GREEN FLOATER

The effects of the action on the Green Floater are similar to those outlined in the original 2017 BA and the 2019 BA addendum documents respectively for the other subject Federally Protected freshwater mussel species (NCDOT 2017; USFWS 2019).

4.1 Biological Conclusion for Green Floater

The Green Floater is considered to be present in the Neuse River crossing of the Action. While the 2024 survey (Three Oaks/NCDOT BSG) did not observe the species, the abundance of positive survey data is indicative of the species being present over a wide range in this section of the Neuse River. Being that the species' proposed Critical Habitat (see Section 4.2 for more discussion) and NCNHP EO #28706 overlaps with the project crossing, one negative survey result does not mean the species is not present. While it is possible the Green Floater no longer occurs within the Action Area, based on existing survey data, plausible estimates of between 17 and 42 individuals occurring in the Action Area were made using two survey detection probabilities. Information regarding the history of Green Floater occurrence in this section of the Neuse River is provided in Appendix C.

The project is expected to result in potential unavoidable adverse effects to Green Floater. Therefore, the proposed action “**May Affect, Likely to Adversely Affect**” the Green Floater. The changes to the environmental baseline of the population within the Action Area as a result of adverse effects from this project should not preclude the expansion of the Green Floater over its range in the Neuse River. The incorporation of conservation measures (NCDOT 2017) into the project will offset some of the effects. These measures may help further facilitate the expansion of the population. The methodologies used and the results of the analysis that provided an estimate of individuals that may be impacted by the project's activities are provided in Appendix C.

4.2 Biological Conclusion for Green Floater Proposed Critical Habitat

The Neuse River portion of the Action Area is located within Proposed Critical Habitat Unit 7a. This 800-meter section of the river supports the Green Floater and comprises 3.2% of the 25.1 kms contained within the Critical Habitat unit. The adverse physical effects to this habitat (sedimentation, substrate disturbance, etc.) from the proposed action “**May Affect, Likely to Adversely Affect**” Green Floater Proposed Critical Habitat Unit 7a. The project location in relation to Critical Habitat Unit 7a is illustrated in the Freshwater Mussel Species Survey Report (Appendix B). These effects are not anticipated to appreciably diminish the PBFs within the unit, or the ability of the habitat to support the species.

5.0 LITERATURE CITED

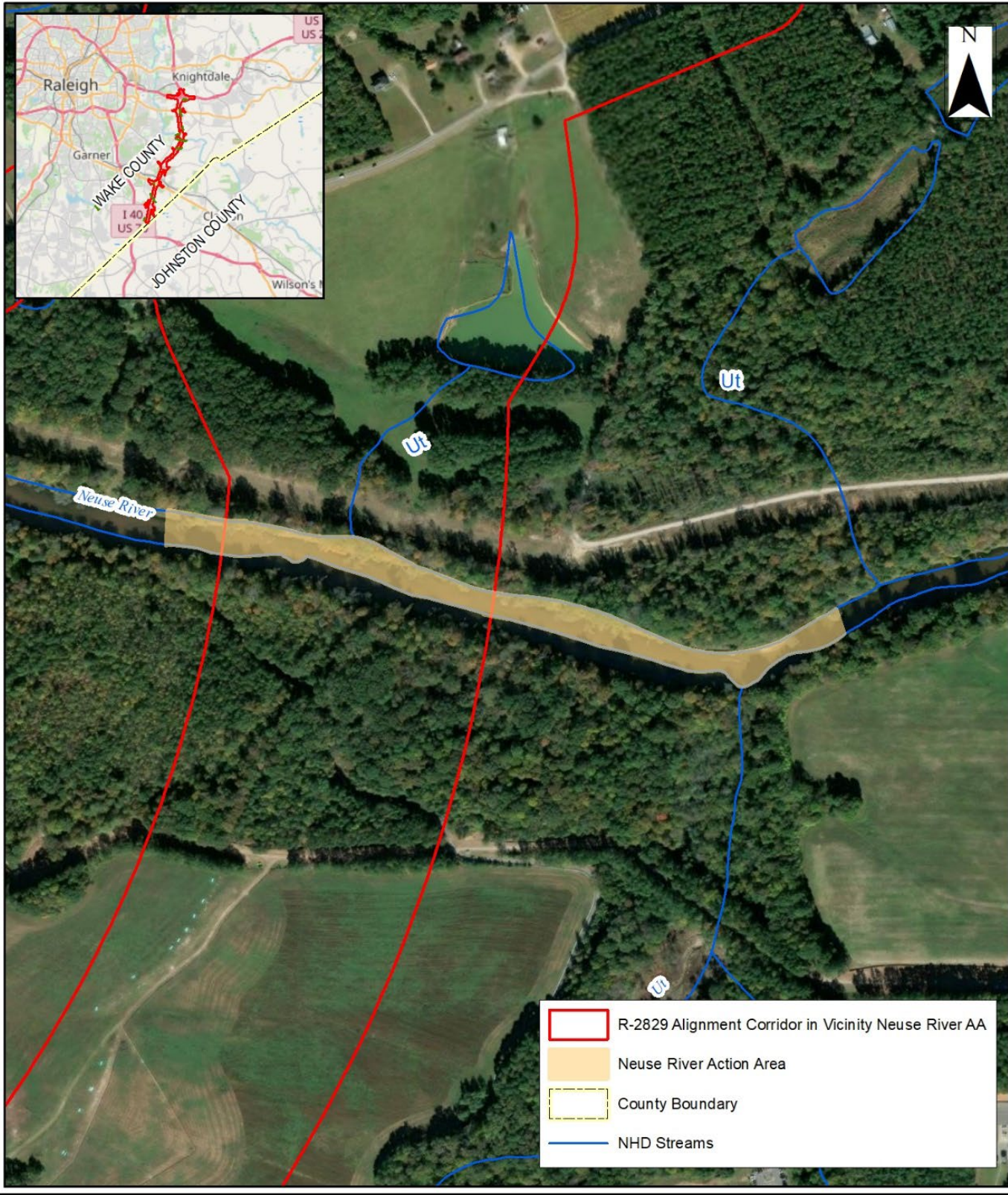
- Johnson, R.I. 1970. The systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the southern Atlantic Slope Region. *Bulletin of the Museum of Comparative Zoology* 140(6): 263-449.
- Lea, I. (1863). Descriptions of the soft parts of one hundred and forty three species and some embryonic forms of Unionidae of the United States. *Jour. Acad. Nat. Sci. Phila.*, ser. 2, 5: 401-456. Also 1863 *Obs. Unio*, 10: 37-92.
- North Carolina Department of Environmental Quality (NCDEQ). 2024. NC OneMap; Active NPDES discharge permits within the state of North Carolina. Accessed June 2024.
- North Carolina Department of Transportation (NCDOT) and Federal Highway Administration (FHWA). 2017. Biological Assessment; An Assessment of Potential Effects to Federally Listed Species for Complete 540 – Triangle Expressway Southeast Extension in Wake, Johnston, and Harnett Counties (STIP Numbers R-2721, R-2828, and R-2829). State Project Nos. 6.401078, 6.401079, and 6.401080. Federal Aid Project Nos. STP-0540(19), STP-0540(20), and STP-0540(21). WBS Nos. 37673.1.TA2, 35516.1.TA2, and 35517.1.TA1. https://xfer.services.ncdot.gov/PDEA/Web/Complete540/final-eis/technical-reports/C540_BA_USFWS_1217.pdf
- North Carolina Department of Transportation (NCDOT). July 2024. Updated Project Description for NC 540 Bridge Crossings over the Neuse River for NMFS Atlantic Sturgeon Additional Consultation Needs. Draft.
- North Carolina Wildlife Resources Commission (NCWRC). 2024. “PAWS” Unpublished Aquatic Species Database.
- United States Fish and Wildlife Service (USFWS). 2019. 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), October 15, 2019. FWS Log # 42420-2010-F-0383-R001. <https://www.ncdot.gov/projects/complete-540/Documents/biological-conference-opinion-october-2019.pdf>
- United States Fish and Wildlife Service (USFWS). 2021. Species Status Assessment Report for the Green Floater (*Lasmigona subviridis*). Version 1.1. <https://ecos.fws.gov/ServCat/DownloadFile/233888>
- United States Fish and Wildlife Service (USFWS). 2023. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Green Floater and Designation of Critical Habitat. 50 CFR 88:142 RIN 1018-BF80. Docket Nos. FWS-R5-ES-2023-0012; FF09E21000 FXES1111090FEDR 234.





United States Geological Survey (USGS) National Land Cover Database (NLCD). 2019. Multi-Resolution Land Characteristics (MRLC) Consortium, 2019 Dataset.
<https://www.usgs.gov/centers/eros/science/national-land-cover-databas>

Walter, W.M. 1956. Mollusks of the upper Neuse River Basin, North Carolina. *Jour. Elisha Mitchell Sci. Sco.*, 72:262-274.

Appendix A:

Figure 1



	R-2829 Alignment Corridor in Vicinity Neuse River AA
	Neuse River Action Area
	County Boundary
	NHD Streams

Prepared By:



Prepared For:



Biological Assessment Addendum

R-2829:
Complete 540
Green Floater Addendum
Action Area Map

Wake County, North Carolina

Date: June 2024

Scale: 0 100 200 Feet

Job No.: 23-310

Drawn By: TDH

Checked By: TED

Figure

1

Appendix B:

2024 R-2829 Freshwater Mussel Survey Report

Aquatic Species Survey Report

Targeted Green Floater Surveys for R-2829 section of Complete 540 –
Triangle Expressway Southeast Extension
TIP: R-2829
Wake County, North Carolina



Neuse River During Freshwater Mussel Survey

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Appendix A:

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Figure 2: Green Floater NCNHP Element Occurrences and Proposed Critical Habitat

Figure 3: 303(d) Listed Streams and NPDES Discharges

Appendix B: Qualifications of Contributors

1.0 INTRODUCTION

North Carolina Department of Transportation (NCDOT) proposes to complete the I-540; Triangle Expressway Southeast Extension in Wake County, North Carolina (TIP: R-2829, Appendix A, Figures 1-1 and 1-2). The U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Consultation (IPaC) system lists the Dwarf Wedgemussel (*Alasmodonta heterodon*, DWM), Atlantic Pigtoe (*Fusconaia masoni*, AP), Yellow Lance (*Elliptio lanceolata*, YL), Neuse River Waterdog (*Necturus lewisi*, NRWD), and Carolina Madtom (*Noturus furiosus*, CMT) as Federally Protected aquatic species that could potentially be affected by activities in this location, as accessed in June 2024 (USFWS 2024). Consultation for these species has previously been completed (USFWS 2016). IPaC additionally indicates that the Green Floater (*Lasmigona subviridus*) is a species that may be affected by activities in this location (USFWS IPaC 2024). In July 2023, the Green Floater was proposed for Federal Protection under the Endangered Species Act (ESA), and therefore, surveys targeting this species are required as part of the Biological Assessment (BA) Addendum.

Table 1 lists the nearest element occurrence (EO) in approximate stream miles (SM) for Green Floater relative to the Project. Data is according to the NC Natural Heritage Program database (NCNHP 2024) most recently updated in April 2024 (Appendix A, Figure 2)

Table 1. Nearby Element Occurrence

Species Name	EO ID	EO Waterbody	Distance from crossing (SM)	First Observed	Last Observed	EO Status*	Figure
Green Floater	28706	Neuse River	In PSA	July 2010	May 2018	C	2

C – NCNHP Current; PSA – Project Study Area

As part of the federal permitting process that requires an evaluation of potential project-related effects to federally protected species, Three Oaks was contracted by NCDOT to update the survey baseline and conduct surveys targeting the Green Floater.

2.0 WATERS IMPACTED

The Project crosses several streams of various sizes. The Project is located in the Upper Neuse (HUC 8 # 03020201) Subbasin of the Neuse River Basin. Named streams crossed by the Project include White Oak Creek and the Neuse River. The project occurs in two HUC 10 watersheds: Swift Creek (HUC 10 # 0302020110) and Walnut Creek-Neuse River (HUC 10 # 0302020111). White Oak Creek, its UTs, and the UTs to Swift Creek evaluated as part of this report are located in the Swift Creek Watershed. The remaining streams evaluated in this report are within the Walnut Creek-Neuse River Watershed, including the Neuse River and two associated UTs that drain to the Neuse River upstream and downstream respectively, near the SR 2555 (Auburn Knightdale Road) crossing of the Neuse River.

From the White Oak Creek Project crossing, White Oak Creek flows approximately 3.0 SM before reaching Lake Austin, an impoundment located upstream of the NC 42 crossing of White

Oak Creek. From the outflow of Lake Austin, White Oak Creek flows an additional 1.0 SM before reaching its confluence with Swift Creek. Swift Creek reaches its confluence with the Neuse River approximately 27.1 SM downstream of the Neuse River Project crossing.

2.1 303(d) Classification

There are eight 303(d) listed streams indicated on the 2022 303(d) list of impaired streams within a five-mile radius of the study area, including the Neuse River and several of its tributaries (NC Division of Water Resources [NCDEQ] 2022) (Appendix A, Figure 3). Table 2 below provides the details of these listed streams.

Table 2. NCDEQ 303(d) Listed Streams within a Five-Mile Radius of the Study Area

Stream Name	Closest Named Study Area Stream Crossing	Distance and Direction from Crossing (SM)*	Reason for Listing
Neuse River	Neuse River	At Crossing	PCB Fish Tissue Advisory; Copper
Walnut Creek	Neuse River	2.9 US	Copper
Crabtree Creek	Neuse River	4.2 US	PCB Fish Tissue Advisory
Marsh Creek	Neuse River	9.8 US	Benthos
Neuse River	Neuse River	3.8 DS	Copper; Zinc
Beddingfield Creek	Neuse River	3.7 DS	Benthos
Marks Creek (Lake Myra)	Neuse River	7.0 DS	Benthos
UT Swift Creek	White Oak Creek	> 10 DS	Benthos

*US – Upstream; DS - Downstream

2.2 National Pollutant Discharge Elimination System (NPDES) Discharges

There are eighteen NPDES dischargers located within a five-mile radius of the study area, listed below in Table 3 (Appendix A; Figure 3, NCDEQ 2024).

Table 3. NPDES Dischargers within 5 miles of Study Area

Discharger Name*	Permit #	Closest Named Study Area Stream Crossing	Distance and Direction from Crossing (SM)	Discharger Classification	Discharging Waterbody
Cross Creek Mobile Estates	NC0056391	Neuse River	1.8 US	Minor	UT Neuse River (North)
Bonlee Feed Mill	NCG500314	Neuse River	2.9 US	Minor	UT Neuse River (North)
Knightdale Estates MHP WWTP	NC0040266	Neuse River	2.4 US	Minor	UT Neuse River (North)
6212 Shirley Street	NCG550441	Neuse River	3.0 US	Minor	Walnut Creek
6208 Shirley Street	NCG550438	Neuse River	3.0 US	Minor	Walnut Creek
Neuse River Village WWTP	NC0038784	Neuse River	3.3 US	Minor	Neuse River
Barclay Downs WWTP	NC0040606	Neuse River	5.2 US	Minor	Neuse River
6132 Knightdale Boulevard	NCG551223	Neuse River	6.7 US	Minor	UT Neuse River
Beachwood WWTP	NC0060577	Neuse River	6.8 US	Minor	Neuse River
Neuse River Resource Recovery Facility	NC0029033	Neuse River	1.1 DS	Major	Neuse River
Kings Grant Subdivision WWTP	NC0062219	Neuse River	3.5 DS	Minor	UT Poplar Creek
Ashley Hills WWTP	NC0051322	Neuse River	4.5 DS	Minor	Poplar Creek
Cottonwood / Baywood WWTP	NC0065706	Neuse River	5.1 DS	Minor	Poplar Creek
1105 Pine Trail	NCG550925	Neuse River	6.3 DS	Minor	UT Beddingfield Creek
801 Louise Lane	NCG550336	Neuse River	6.5 DS	Minor	UT Beddingfield Creek
Willowbrook WWTP	NC0064378	Neuse River	6.8 DS	Minor	UT Beddingfield Creek
Dempsey E. Benton WTP	NC0088285	White Oak Creek	> 10 DS	Major	Mahlers Creek
Sam's Branch WRF	NC0025453	White Oak Creek	> 10 DS	Major	Little Creek
3008 U.S. Highway 70	NCG551048	White Oak Creek	> 10 DS	Minor	Little Creek

WWTP = Wastewater Treatment Plant; WTP = Water Treatment Plant; WRF = Water Reclamation Facility

**US = Upstream; DS = Downstream

3.0 TARGET SPECIES DESCRIPTIONS

3.1 Green Floater (*Lasmigona subviridis*)

3.1.1 Species Characteristics



The Green Floater was described by Conrad (1835) from the Schuylkill River in Lancaster County, PA. This small mussel species has a thin, slightly inflated, subovate shell that is narrower in front and higher behind (Ortmann 1919). Adult Green Floater average approximately 55 mm (2.2 in), though they may grow as large as 70 mm (2.8 in) (Watters et. al. 2009). The dorsal margin forms a blunt angle with the posterior margin. The shell is dull yellow or tan to brownish green, usually with concentrations of dark green rays (Bogan 2017).

The Green Floater is a relatively short-lived (three to four years), fast-growing freshwater mussel species that is hermaphroditic to facilitate reproductive capability, a trait that is rare in freshwater mussels (Kat 1983; Haag 2012). The species is a long-term brooder, with larval development lasting several months. Spawning for the species occurs in late summer to early fall. In addition to the ability to release glochidia to attach to fish hosts, the Green Floater is capable of directly metamorphosing glochidia without using a fish host (Haag 2012).

3.1.2 Distribution, Habitat Requirements, and Status

The Green Floater occurs along the Atlantic slope from the Savannah River in Georgia north to the Hudson River in New York, as well as in the “interior” basins (New, Kanawha, and Watauga Rivers) of the Tennessee River basin. It has experienced major declines throughout its entire range. Genetic analysis was completed for the Green Floater, which determined phylogenetic relationships between populations in Pennsylvania, West Virginia, Maryland, Virginia, and NC (King et al. 1999). This analysis showed that there is very low genetic diversity between populations as a result of a lack of gene flow. However, haplotypes were shared between populations from this wide range, indicating that previously the species was dispersed much more widely and has become “bottlenecked” over time (King et al. 1999).

The Green Floater occurs in small size streams to large rivers, in quiet waters such as pools, or eddies, with gravel and sand substrates. In sand to gravel substrate, juvenile Green Floater may bury themselves up to 38 cm (15 in) to establish a foothold, while adults tend to bury shallower, being observed up to 13 cm (5 in) (USFWS 2021 citing personal communication with A. Barber and P. Lord). Their ability to reproduce without a host fish is advantageous for survival, although using a fish host will more readily allow the species to be carried upstream. Additionally, they may be washed downstream in fast-flowing currents or flood events (Strayer 1999).

The current status of the Green Floater was determined based on an accumulation of data along with recommendations from state agencies and other partners (USFWS 2021). An overall

condition for each occupied HUC 10 watershed was calculated as a surrogate to population condition because there is no biologically meaningful method to distinguish populations across the entire Green Floater range (USFWS 2021). The condition of each HUC 10 was evaluated using a combination of habitat quality, length of occupied habitat, and the following numerical indications of species abundance: the number of live individuals found over entire data record, number of live individuals found since 1999, number of shells found over entire data record, the most recent year a live individual was found, and the most recent year a shell was found. The condition for each HUC 10 watershed was rated as either Extirpated, Historical/Unknown (Historical), Low, Medium, or High (USFWS 2021).

From 1999-2019, a total of 94 currently occupied analysis units were identified, which were divided into five Representative Units (Mid-Atlantic, South Atlantic, Mississippi, Great Lakes, and Gulf). Eighty-five additional analysis units were identified as either Extirpated or Historical, where no Green Floater has been observed since 1999 (USFWS 2021). Of the 179 total analysis units, nearly half are rated as either presumed extirpated or historical, meaning that the Green Floater has not been observed in these localities after 1999. The difference between these two ratings is that extirpated analysis units have had enough surveys conducted to conclude that the Green Floater is no longer present. Historical analysis units either lack survey data entirely or have only had one survey per year. Of the remaining 94 analysis units, 68 percent are rated Low, 25 percent are rated Medium, and seven percent are rated High. The Project is located in the South Atlantic Representative Unit, in the NC Draining Watershed.

Below is an outline of the watersheds within the South Atlantic Representative Unit, with added details for the two analysis units that overlap with the Project (USFWS 2021):

South Atlantic (NC, VA)

1. Lower Chesapeake (VA) – 25 analysis units; 13 Historical, 10 Low, one Medium, one High
2. NC Draining (NC, VA) – 31 analysis units; six Extirpated, five Historical, 13 Low, six Medium, one High

The NC Draining “Watershed” contains several river basins including the Cape Fear, Chowan, Neuse, Roanoke, and Tar/Pamlico. The Neuse River Basin, where the project is located, has an evaluated range including eight HUC10’s, four of which are considered Extirpated. The Swift Creek (HUC10 # 0302020110) analysis unit, where White Oak Creek and the UTs to Swift Creek are located, is considered Extirpated, with no evidence of the species located since 1991. The Walnut Creek-Neuse River (HUC10 # 0302020111) analysis unit, where the remaining Project streams are located, is rated Low. Within this unit, the most recent live Green Floater individual was located in April 2017, by Three Oaks staff at the confluence of Walnut Creek to the Neuse River, with a shell found near the Crabtree Creek confluence in May 2018 (NCWRC Unpublished Database 2020). 82 total live individuals have been found in the analysis unit, all of which were observed after 1999 (USFWS 2021).

3.1.3 Threats to Species

The cumulative effects of several factors, including sedimentation, point and non-point discharge, stream modifications (impoundments, channelization, etc.) have contributed to the decline of this species throughout its range. Green Floater populations are generally small in numbers and restricted to short reaches of isolated streams. The low numbers of individuals and the restricted range of most of the surviving populations make them extremely vulnerable to extirpation from a single catastrophic event or activity, as demonstrated with another vulnerable species, the Dwarf Wedgemussel (*Alasmidonta heterodon*) (Strayer et al. 1996). Catastrophic events may consist of natural events such as flooding or drought, as well as human influenced events such as toxic spills associated with highways, railroads, or industrial-municipal complexes.

Siltation resulting from substandard land-use practices associated with activities such as agriculture, forestry, and land development has been recognized as a major contributing factor to degradation of mussel populations. Siltation has been documented to be extremely detrimental to mussel populations by degrading substrate and water quality, increasing potential exposure to other pollutants, and direct smothering of mussels (Ellis 1936, Marking and Bills 1979). Sediment accumulations of less than one inch have been shown to cause high mortality in most mussel species (Ellis 1936). As freshwater mussels like the Green Floater are forced to close their siphons in turbid stream conditions caused by siltation, they are more likely to die off from starvation or suffocation (USFWS 2021 citing Ellis 1936). While sewage treatment effluent has been documented to significantly affect the diversity and abundance of mussel fauna (Goudreau et al. 1988). Goudreau et al. (1988) found that recovery of mussel populations may not occur for up to two miles below points of chlorinated sewage effluent.

The impact of impoundments on freshwater mussels has been well documented (USFWS 1992a, Neves 1993). Construction of dams transforms lotic habitats into lentic habitats, which results in changes in aquatic community composition. The changes associated with inundation adversely affect both adult and juvenile mussels, as well as fish community structure, which could eliminate possible fish hosts for upstream transport of glochidia. Muscle Shoals on the Tennessee River in northern Alabama, once the richest site for naiads (mussels) in the world, is now at the bottom of Wilson Reservoir and covered with 19 feet of muck (USFWS 1992b). Loss of and fragmentation of suitable habitat associated with dams are identified as threats to the long-term viability of the Green Floater (USFWS 2021).

The introduction of exotic species such as the Asian Clam (*Corbicula fluminea*) and Zebra Mussel (*Dreissena polymorpha*) has also been shown to pose significant threats to native freshwater mussels. The Asian Clam is now established in most of the major river systems in the United States (Fuller and Powell 1973), including 83 % of the watersheds still supporting surviving populations of the Green Floater and the USFWS anticipate periodic impacts where green floaters are sharing habitat and competing for food resources with Asian Clams and may be affected by reduced DO and ammonia (USFWS 2021). Other exotic species that have been identified as potential threats to the Green Floater include Rusty Crayfish (*Faxonius rusticus*), which is native to parts of Illinois, Kentucky, and Ohio, but invasive in the mid and south

Atlantic part of the Green Floater’s range, Didymo (*Didymosphenia geminata*), a highly invasive alga, and Hydrilla (*Hydrilla verticillata*) an invasive aquatic vascular plant that occurs in 20 % of the watersheds within the range of the Green Floater (USFWS 2021).

Concern has been raised over competitive interactions for space, food and oxygen with this species and native mussels, possibly at the juvenile stages (Neves and Widlak 1987, Alderman 1995). The Zebra Mussel, native to the drainage basins of the Black, Caspian, and Aral Seas, is an exotic freshwater mussel that was introduced into the Great Lakes in the 1980s and has rapidly expanded its range into the surrounding river basins, including those of the South Atlantic slope (O’Neill and MacNeill 1991). This species competes for food resources and space with native mussels and was expected to contribute to the extinction of at least 20 freshwater mussel species throughout most of the eastern United States (USFWS 1992b). The Zebra Mussel is currently present in 12.5 percent of waters occupied by the Green Floater, though none of these are in North Carolina (USFWS 2021).

3.1.4 Proposed Critical Habitat

On July 26, 2023, the Green Floater was petitioned to be listed as a Federally Threatened Species under the ESA with Section 4(d) Rule and Critical Habitat Designation. In accordance with Section for the ESA, Critical Habitat for listed species consists of:

- (1) The specific areas within the geographical area occupied by the species at the time it is listed, in which are found those physical or biological features (constituent elements) that are:
 - a. essential to the conservation of the species, and
 - b. which may require special management considerations or protection
- (2) Specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the Act, upon a determination by the Secretary that such areas are “essential for the conservation of the species.”

The Proposed Critical Habitat for the Green Floater spans from New York to North Carolina and is separated out by watershed, with multiple sub-units within each watershed. Should the Critical Habitat Units outlined in the proposal documentation (USFWS 2023) remain as proposed, Critical Habitat Unit 7a would overlap with the Neuse River crossing of the Project. Below is a detailing of Proposed Critical Habitat Unit 7.

- Unit 7. Neuse-Pamlico Watershed (NC). A total of 75 river mi (120.7 river km) consisting of four subunits:
 - 7a. 16.6 river mi (25.1 river km) of the Neuse River in Johnson and Wake counties, NC.
 - 7b. 33.8 river mi (54.4 river km) of the Eno River in Durham and Orange counties, NC.
 - 7c. 19.2 river mi (30.9 river km) of the Flat River in Durham and Person counties, NC.

- 7d. 5.4 river mi (8.6 river km) of the Little River (Neuse-Pamlico) in Wake County, NC.

The Neuse River crossing of the Project is within Proposed Critical Habitat Unit 7a. Unit 7a extends from the confluence of the Neuse River with Crabtree Creek to a point approximately 0.8 SM downstream of the NC 42 Neuse River crossing (Appendix A; Figure 2).

4.0 SURVEY/HABITAT ASSESSMENT EFFORTS

Surveys and habitat assessments for the several stream crossings were completed over multiple days with different survey teams. The dates and survey team personnel for each of these efforts are provided below.

4.1 Survey Methodology

A total of seven distinct surveys were conducted, targeting the Green Floater, as shown in Appendix A, Figures 1-1/1-2. Methodologies utilized during the survey efforts are described below.

Areas of appropriate habitat were searched, concentrating on the stable habitats preferred by the target species. The survey team spread out across the creek into survey lanes, focusing on the banks where habitat was most accessible. Visual surveys were conducted using viewscopes and mask and snorkel. Tactile methods were employed, particularly in streambanks under submerged rootmats. All freshwater bivalves were recorded and returned to the substrate. Timed survey efforts provided Catch Per Unit Effort (CPUE) data for each species. Relative abundance for freshwater snails and freshwater clam species were estimated using the following criteria:

- (VA) Very abundant > 30 per square meter
- (A) Abundant 16-30 per square meter
- (C) Common 6-15 per square meter
- (U) Uncommon 3-5 per square meter
- (R) Rare 1-2 per square meter
- (P-) Ancillary adjective “Patchy” indicates an uneven distribution of the species within the sampled site.

4.2 Habitat Assessments Methodology

In addition to the seven freshwater mussel surveys, habitat assessments were completed for an additional 29 streams potentially impacted by the project that were ultimately deemed not to contain habitat for the Green Floater. The habitat assessment methodology was a combination of desktop evaluation of aerial and topographic maps and field visits walking within or along the respective channels. During the field evaluations general characteristics of the channels were recorded, including channel dimensions and conditions, substrate composition, and hydrology. If, during the field assessments, evidence of freshwater mussels or Asian Clams was observed, full surveys were performed.

5.0 SURVEY RESULTS

5.1 Neuse River

The Neuse River was surveyed in the vicinity of the SR 2555 (Auburn-Knightdale Road) crossing, extending from approximately 400 meters (1,312 feet) downstream of the project crossing corridor to 100 meters (328 feet) upstream, for a total length of approximately 900 meters (2,950 feet).

5.1.1 Neuse River Conditions

The Neuse River ranged from 130 to 160 feet wide with banks exhibiting moderate erosion averaging six to eight feet in height with some undercutting. Survey efforts were concentrated along the banks where the most abundant Green Floater habitat was present in the form of shallow slow-flowing runs and slack-water. The remainder of the channel consisted of a long run with unconsolidated sand and silt. There was a wooded buffer present along both banks of the river that ranged from approximately 125 feet on the left descending bank to nearly 1,000 feet from the right descending bank.

5.1.1.2 Survey Results: Neuse River 240503.1ted

The survey was conducted on May 3, 2024, by Three Oaks personnel Tim Savidge (Permit ES0034), Tom Dickinson (Permit ES00343), Trevor Hall, Nathan Howell, and NCDOT Biological Survey Group personnel Anne Burroughs and Matt Haney. A total of 29.7 person hours (phr) of mussel survey time was spent in the reach during which seven freshwater mussel species were observed (Table 4). Other mollusk species located included the Asian Clam and a Fingernail Clam species (*Sphaeriidae* sp.).

Table 4. Freshwater Mollusks in Neuse River (240503.1ted)

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
<i>Alasmidonta undulata</i>	Triangle Floater	12	0.4/hr
<i>Elliptio complanata</i>	Eastern Elliptio	1,515	51.0/hr
<i>Elliptio congarea</i>	Carolina Slabshell	42	1.4/hr
<i>Elliptio roanokensis</i>	Roanoke Slabshell	341	11.5/hr

Scientific Name	Common Name	# live	Abundance/ CPUE
<i>Elliptio</i> sp. cf. <i>icterina</i>	Variable Spike	34	1.1/hr
<i>Lampsilis radiata</i>	Eastern Lampmussel	68	2.3/hr
<i>Strophitus undulatus</i>	Creeper	1	0.03/hr
Freshwater Snails and Clams			Relative Abundance
<i>Corbicula fluminea</i>	Asian Clam	~	VA
Sphaeriidae sp.	Fingernail Clam	~	U

5.2 Unnamed Tributary (UT) to Neuse River-from the north

The UT originates near the proposed I-540 interchange with I-87/US 264 and flows south into Neuse River upstream of the Auburn/Knightdale Road crossing. The UT parallels or is within the Project corridor for its entire length and there are more than a dozen tributaries that feed the stream along its course. The headwaters of the UT near the I-87/US 264 interchange occur within a large marsh wetland complex influenced by beaver activity and do not provide suitable habitat for the target mussel species. Below this area, portions of the stream are suitable for freshwater mussels. Mussel surveys were conducted in three distinct reaches: Upper (near SR 1007 (Poole Road) crossing), Middle, and Lower. Habitat conditions varied widely between and within these three reaches. The conditions and survey results are presented below.

5.2.1 UT to Neuse River from the north Upper Segment Habitat Conditions

This section of the UT Neuse River was approximately 15 to 25 feet in width, with a wetted width that was, on average, approximately half of that full channel width. Banks exhibited moderate erosion with evidence of deposition in the stream in the form of large sand/gravel bars throughout the evaluated reach, ranging from three to five feet in height. The reach consisted of unconsolidated sand runs with short riffle breaks, and occasional small pools that were filled with depositional material. As such, substrate was dominated by sand throughout the reach, with clay in the undercut banks. The stream was running clear during the survey with moderate flow throughout and averaged six to 12 inches in depth. A wide wooded buffer was present along the right descending bank, with a thin wooded buffer flanked by residential land use.

5.2.1.1 UT to Neuse River from the north Upper Segment Survey Results: 240516.Itws

The survey was conducted on May 16, 2024, by Tim Savidge and Trevor Hall. A total of 1.63 phr of mussel survey time was spent in the reach during which no freshwater mussel species were observed (Table 5). The Asian Clam and Pointed Campeloma were the only mollusk species encountered.

Table 5. Freshwater Mollusks in UT to Neuse River- North Upper Segment

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
None	~	0	0.0/hr

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Snails and Clams			Relative Abundance
<i>Campeloma decisum</i>	Pointed Campeloma	~	P-U
<i>Corbicula fluminea</i>	Asian Clam	~	C

5.2.2 UT to Neuse River from the north Middle Segment Habitat Conditions

This section of the UT Neuse River was similar in size and with similar banks to the upper reach. The reach consisted of runs with associated pool habitat that were dominated by fine sand and silt, with short riffle sections that had gravel and other larger substrates (pebble/cobble) present in small patches. The stream was running clear during the survey, with low to moderate flow throughout. A moderate wooded buffer was present with agricultural land use surrounding the forested corridor.

5.2.2.1 UT to Neuse River from the north Middle Segment Survey Results: 240521.3tws

The survey was conducted on May 21, 2024, by Tim Savidge and Trevor Hall. A total of 1.26 phr of mussel survey time was spent in the reach during which one freshwater mussel species was observed, along with the Asian Clam and Pointed Campeloma (Table 6).

Table 6. Freshwater Mollusks in UT to Neuse River-north Middle Segment

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
<i>Elliptio complanata</i>	Eastern Elliptio	2	1.58/hr
Freshwater Snails and Clams			Relative Abundance
<i>Campeloma decisum</i>	Pointed Campeloma	~	U
<i>Corbicula fluminea</i>	Asian Clam	~	C

5.2.3 UT to Neuse River from the north Lower Segment Habitat Conditions

This segment extended from the confluence with the Neuse River to a point approximately 1,900 feet upstream. The Project alignment crosses the stream in this survey segment. The reach also included approximately 60 feet along the left descending bank of the Neuse River below the confluence, associated with the sediment delta coming from the UT.

The stream in this reach flowed through a series of impoundments created by several beaver dams, within the channel and adjacent floodplain. The main channel ranged from 25 to 35 feet wide, though in more ponded sections the wetted area was up to 150 feet wide, with the flow being carried by smaller braided channels. The dominant substrate within the inundated areas was dominated by mud and organic material; however, there was a consistent band of coarse sand and pebble of varying width that correlated to areas that maintained flow. Areas of boulder and cobble were also scattered throughout the reach, mainly at the base of the floodplain and the

adjacent forested slopes. Apart from a cleared corridor that intersects the stream near the confluence with the Neuse River, a moderate wooded buffer is present along both sides of the stream, with a mixture of rural residential and agricultural land uses. An approximately 60-foot-long section of the channel consists of rip rap that is associated with a ford crossing of the stream approximately 250 upstream of the confluence with the Neuse River.

5.2.3.1 UT to Neuse River from the north Lower Segment Survey Results: 240603.Itws

The survey was conducted on June 03, 2024, by Tim Savidge and Nancy Oberle of Three Oaks. A total of 4.87 phr of mussel survey time was spent in the reach during which four freshwater mussel species were observed (Table 7). Ten of the 34 Eastern *Elliptio* and the one Carolina Slabshell found occurred within the Neuse River portion of the survey. The Carolina Slabshell individual was found at the mouth of the UT.

Table 7. Freshwater Mollusks in UT to Neuse River-north Lower Segment

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
<i>Elliptio complanata</i>	Eastern <i>Elliptio</i>	34	7.0/hr
<i>Elliptio congaraea</i>	Carolina Slabshell	1	0.2/hr
<i>Lampsillis radiata</i>	Eastern Lampmussel	1	0.2/hr
<i>Utterbackia imbecellis</i>	Paper Pondshell	10	2.1/hr
Freshwater Snails and Clams			Relative Abundance
<i>Campeloma decisum</i>	Pointed <i>Campeloma</i>	~	C
<i>Corbicula fluminea</i>	Asian Clam	~	C

5.3 Unnamed Tributary (UT) to Neuse River-from the south

The UT originates north of the alignment interchange with Rock Quarry Road and flows northeast into the Neuse River downstream of the alignment crossing of the river. The project alignment crosses the UT in the vicinity of the proposed interchange with Battle Bridge Road.

5.3.1 UT to Neuse River-from the south Habitat Conditions

This UT to the Neuse River ranged from 10 to 15 feet wide, with banks averaging six feet tall that exhibited moderate to severe erosion, with bank stabilization present in some sections of the stream near the Neuse River Trail greenway that crosses the stream in the downstream portion of the surveyed reach. In-stream habitat consisted of very shallow riffles and runs, with limited pools. Water depth averaged only a few inches over the majority of the reach. The substrate consisted of unconsolidated sand and gravel with a mixture of gravel, cobble, pebble, and sand in the riffle areas. The stream was flowing clear in the upper portion of the survey reach; however, the lower portion was slightly turbid, but not to the extent to limit surveys. The turbidity was due to a tributary to the stream from the southeast that is not within the project corridor. A moderate wooded buffer was present along both sides of the stream, with a Wake County Convenience Center, Battle Bridge Road, and open fields surrounding the wooded corridor.

5.3.2 UT to Neuse River-from the south Survey Results: 240516.2tws

The survey was conducted on May 16, 2024, by Tim Savidge and Trevor Hall. A total of 1.0 phr of mussel survey time was spent in the reach during which no freshwater mussel species were observed (Table 8). The Asian Clam was the only mollusk species encountered.

Table 8. Freshwater Mollusks in UT to Neuse River-south

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
None	~	0	0.0/hr
Freshwater Snails and Clams			Relative Abundance
<i>Corbicula fluminea</i>	Asian Clam	~	P-U

5.4 White Oak Creek

The project crossing is located approximately 0.5 miles southeast of the intersection of SR 2555 (Raynor Road) and Hein Drive/Bricksteel Lane. White Oak Creek originates in Auburn near the I-40/I-70 Business interchange, flowing in a generally southeasterly direction before reaching its confluence with Swift Creek 1.5 miles southeast of the NC 42 crossing of Swift Creek.

5.4.1 White Oak Creek Habitat Conditions

White Oak Creek in this reach ranged from 20 to 30 feet wide with banks averaging four to seven feet tall that exhibited moderate erosion. Habitat over a majority of the reach consisted of long runs with deeper pools (three to five feet deep), with occasional small riffle breaks. Substrate throughout the reach was dominated by sand and silt, with larger rocky substrates (gravel, pebble, cobble) present in riffles and other fast-moving sections of stream. The stream was moderately turbid during the survey, which was likely contributed to by a development on the right descending side of the creek that was observed to actively be contributing turbid water to the creek via a piped outlet. Upstream of the pipe, the stream was visibly clearer, though it remained slightly turbid. A wide forested buffer was present on the left descending side of the creek, with a large new development present on the right descending side, though a forested buffer remained present averaging 50 to 100 feet in width.

5.4.2 White Oak Creek Survey Results: 240521.1tws

The survey was conducted on May 21, 2024, by Tim Savidge and Trevor Hall. A total of 5.16 phr of mussel survey time was spent in the reach during which one live species was observed (Table 9). Other mollusk species located included the Asian Clam and Pointed Campeloma.

Table 9. Freshwater Mollusks in White Oak Creek

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
<i>Elliptio complanata</i>	Eastern Elliptio	73	14.14/hr

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Snails and Clams			Relative Abundance
<i>Campeloma decisum</i>	Pointed Campeloma	~	P-C
<i>Corbicula fluminea</i>	Asian Clam	~	P-C

5.5 UT to White Oak Creek

The UT to White Oak Creek reaches its confluence with White Oak Creek just upstream of the upper extent of the White Oak Creek survey reach (Section 5.4). The UT flows approximately 600 feet from an impounded marsh complex before reaching its confluence with White Oak Creek, which was the extent of the surveyed reach, as suitable habitat was not present within and above the marsh.

5.5.1 UT to White Oak Creek Habitat Conditions

The evaluated section of UT White Oak Creek drains out of a large marsh/ponded wetland complex created by multiple beaver dams. In the flowing section of the stream the channel was eight to 10 feet wide, with steep sloping banks averaging seven feet high. The substrate consisted of sand and mud, over hardpan clay. In-stream habitat consisted of a series of fast-moving runs with occasional scour pools and grade breaks. A wide forested buffer was present along both sides of the stream, with a mix of residential and commercial development around the forested corridor. The marsh wetland complex at the upstream extent of the reach had no discernable channel and was not evaluated further, as it did not provide potentially suitable habitat for the target species.

5.5.2 UT to White Oak Creek Survey Results: 240521.2tws

This survey was conducted on May 21, 2024, by Tim Savidge and Trevor Hall. A total of 1.76 phr of mussel survey time was spent in the reach during which one Eastern Elliptio shell was found (Table 10). Other mollusk species located included the Asian Clam, Pointed Campeloma, and a species of Physid Snail.

Table 10. Freshwater Mollusks in UT to White Oak Creek

Scientific Name	Common Name	# live	Abundance/ CPUE
Freshwater Mussels			CPUE
<i>Elliptio complanata</i>	Eastern Elliptio	1 shell	0.0/hr
Freshwater Snails and Clams			Relative Abundance
<i>Campeloma decisum</i>	Pointed Campeloma	~	P-R
<i>Corbicula fluminea</i>	Asian Clam	~	P-R
<i>Physella</i> sp.	Physid Snail	~	P-R

6.0 HABITAT ASSESSMENT RESULTS

Many the streams within the Project that were evaluated are small headwater channels that were determined to not provide potential habitat for the Green Floater due to their small size as they have the potential to experience periods of interrupted flow and lack suitable substrate sorting. These streams were eliminated from further consideration. A few of the streams evaluated were large enough in size to support a freshwater mussel fauna; however, they were determined to not be suitable for the Green Floater for various other reasons and thus, full surveys were not conducted. The conditions of these streams and the reasons why they were considered unsuitable are described below.

6.1 Headwaters of Unnamed Tributary (UT) to Neuse River-from the north

The UT to Neuse River arises just northeast of the proposed intersection of I-87/US 264 and the Project alignment. The UT was evaluated on May 16, 2024 and is characterized as a braided channel flowing through a marsh/swamp wetland system created by multiple beaver dams. Seven small drainages join the UT within the proposed interchange area. The main channel ranged between eight to 10 feet wide, with banks two feet high or less. The substrate consisted of thick mud covered with large amounts of detritus and woody debris. Emergent vegetation was prevalent in open areas and there was little discernable flow. Due to the lack of flow and sediment sorting, this section of the UT to Neuse River from the north was determined to not provide suitable habitat for the Green Floater.

6.2 UT to White Oak Creek

The UT to White Oak Creek was evaluated on May 21, 2024, by Tim Savidge and Trevor Hall. This reach is located at the US 70 Business crossing of the UT, approximately 0.9 SM upstream of the surveyed reach (results outlined in Section 5.6).

This section of the UT White Oak Creek appears to have been straightened, with a nearly straight channel lined with steep-sloping mud banks and no discernable flow. The substrate was dominated by mud and silt, with heavy accumulations of detritus larger woody debris. The stream was deemed to not contain appropriate habitat for the Green Floater due to the stagnant conditions, as well as lack of unsuitable substrate.

6.3 UTs to Swift Creek

There are five small UTs that intersect the Project corridor near its southern terminus that join a UT to Swift Creek just downstream of the corridor. A portion of this UT to Swift Creek was evaluated for Green Floater Habitat on May 16, 2024, by Tim Savidge and Trevor Hall.

The UT to Swift Creek was six to 10 feet wide with steep-sloping banks averaging seven feet tall that were severely eroded. In-stream habitat consisted of a series of moderately high gradient runs and step pools, with short riffles created by rock outcrops, or log jams. Substrates varied, with large cobble with interstitial gravel in swift sections, to unconsolidated sand in the runs/pools. The stream was clear with moderate flow, though there were some riffle sections in lower gradient areas with little to no discernible flow as they were mostly dry. The stream(s) was deemed to not contain habitat for the Green Floater due to its small size, susceptibility to interruptions in flow, high gradient and channel instability.

7.0 DISCUSSION/CONCLUSIONS

These efforts provide updated aquatic species survey data and habitat assessment for the R-2829 section of the I-540 Southeastern Extension Project. The Green Floater was not located during any of the surveys conducted in the Neuse River or the evaluated tributaries. However, the Green Floater has been observed upstream, downstream, and within the project crossing in the Neuse River, and the EO is considered “Current”. While surveys did not locate the species as part of these efforts, the species is likely present in this portion of the Action Area.

The Neuse River portion of the Action Area is located within Proposed Critical Habitat Unit 7a, and physical effects to this habitat (sedimentation, substrate disturbance, etc.) from the proposed action may occur.

While the species currently does not have a Federal Listing, it has been proposed and may receive a Federal Listing (Threatened) in the near future. Should the species receive a Federal Listing under the ESA, a recommended biological conclusion for the Green Floater and Green Floater Critical Habitat is provided below. The USFWS is the regulating authority for Section 7 Biological Conclusions and as such, it is recommended that they be consulted regarding their concurrence with the finding of this document. The federal action agency, or its nonfederal designee (NCDOT) should render a biological conclusion for the species.

Recommended Biological Conclusion Green Floater: May Affect Likely to Adversely Affect

Recommended Biological Conclusion Green Floater Critical Habitat: May Affect Likely to Adversely Affect

8.0 LITERATURE CITED

- Alderman, J. M. 1995. Monitoring the Swift Creek Freshwater mussel community. Unpublished report presented at the UMRCC symposium on the Conservation and Management of Freshwater Mussels II Initiative for the Future. Rock Island, IL, UMRCC.
- Bogan, A.E. 2017. Workbook and Key to the Freshwater Bivalves of North Carolina. North Carolina Freshwater Mussel Conservation Partnership, Raleigh, NC 115 pp, 11 color plates.
- Conrad, T.A. 1835. Monography of the Family Unionidae, or naiades of Lamarck, (fresh water bivalve shells) of North America, illustrated by figures drawn on stone from nature. J. Dobson, 108 Chestnut Street, Philadelphia, Pennsylvania. 1:1-12, plates 1-5.
- Ellis, M. M. 1936. Erosion Silt as a Factor in Aquatic Environments. *Ecology* 17: 29-42.
- Fuller, S. L. H. and C. E. Powell. 1973. Range extensions of *Corbicula manilensis* (Philippi) in the Atlantic drainage of the United States. *Nautilus* 87(2): 59.
- Goudreau, S. E., R. J. Neves, and R. J. Sheehan. 1988. Effects of Sewage Treatment Effluents on Mollusks and Fish of the Clinch River in Tazewell County, Virginia. USFWS: 128 pp.
- Haag, W. R. 2012. North American freshwater mussels: natural history, ecology, and conservation. Cambridge University Press.
- Kat, P.W. 1983. Sexual selection and simultaneous hermaphroditism among the Unionidae (Bivalvia: Mollusca). *Journal of Zoology London* 201:395-416.
- King, T.L., M.S. Eackles, B. Gjetvaj, and W.R. Hoeh. 1999. Intraspecific phylogeography of *Lasmigona subviridis* (Bivalvia: Unionidae): conservation implications of range discontinuity. *Molecular Ecology* 8: 565-578.
- Marking, L.L., and T.D. Bills. 1979. Acute effects of silt and sand sedimentation on *freshwater mussels*. Pp. 204-211 in J.L. Rasmussen, ed. *Proc. of the UMRCC symposium on the Upper Mississippi River bivalve mollusks*. UMRCC. Rock Island IL. 270 pp.
- NC Wildlife Resources Commission (NCWRC) – PAWS. (April 2020). Unpublished Aquatic species database.
- Neves, R. J. and J. C. Widlak. 1987. Habitat Ecology of Juvenile Freshwater Mussels (Bivalvia: Unionidae) in a Headwater Stream in Virginia. *American Malacological Bulletin* 1(5): 1-7.
- Neves, R.J. 1993. A state of the Unionids address. Pp. 1-10 in K.S. Cummings, A.C. Buchanan, and L.M. Kooch, eds. *Proc. of the UMRCC symposium on the Conservation and Management of Freshwater Mussels*. UMRCC. Rock Island IL. 189 pp.

- North Carolina Department of Environmental Quality (NCDEQ) - Division of Water Resources. 2022. 2022 North Carolina Final 303(d) List. <https://deq.nc.gov/about/divisions/water-resources/water-planning/modeling-assessment/water-quality-data-assessment/integrated-report-files>
- North Carolina Department of Environmental Quality (NCDEQ). 2024. NOneMap; Active NPDES discharge permits within the state of North Carolina. Accessed June 2024.
- North Carolina Natural Heritage Program (NCNHP). 2024. Biotics Database. Division of Land and Water Stewardship. Department of Natural and Cultural Resources. April 2024 version.
- O'Neill, C. R., Jr., and D. B. MacNeill. 1991. The zebra mussel (*Dreissena polymorpha*): an unwelcome North American invader. Sea Grant, Coastal Resources Fact Sheet. New York Sea Grant Extension. 12 pp.
- Ortmann, A.E. 1919. A monograph of the naiades of Pennsylvania. Part III: Systematic account of the genera and species. *Memoirs of the Carnegie Museum* 8(1): xvi–384, 21 pls.
- Strayer, D. L., S. J. Sprague and S. Claypool, 1996. A range-wide assessment of populations of *Alasmidonta heterodon*, an endangered freshwater mussel (Bivalvia: Unionidae). *J.N. Am. Benthol. Soc.*, 15(3):308-317.
- Strayer D.L. 1999. Use of flow refuges by unionid mussels in rivers. *Journal of the North American Benthological Society*. 18: 468-476.
- United States Fish and Wildlife Service (USFWS). 1992a. Special report on the status of freshwater mussels.
- United States Fish and Wildlife Service (USFWS). 1992b. Endangered and Threatened species of the southeast United States (The Red Book). FWS, Ecological Services, Div. of Endangered Species, Southeast Region. Govt Printing Office, Wash, DC: 1,070.
- United States Fish and Wildlife Service (USFWS). 2016. Biological Opinion for 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. U.S. Fish and Wildlife Service Raleigh Field Office.
- United States Fish and Wildlife Service (USFWS). 2021. Species Status Assessment Report for the Green Floater (*Lasmigona subviridis*). Version 1.1. New York Field Office, U.S. Fish and Wildlife Service, Cortland, New York. 111 pp + Appendices.
- United States Fish and Wildlife Service (USFWS). 2023. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Green Floater and

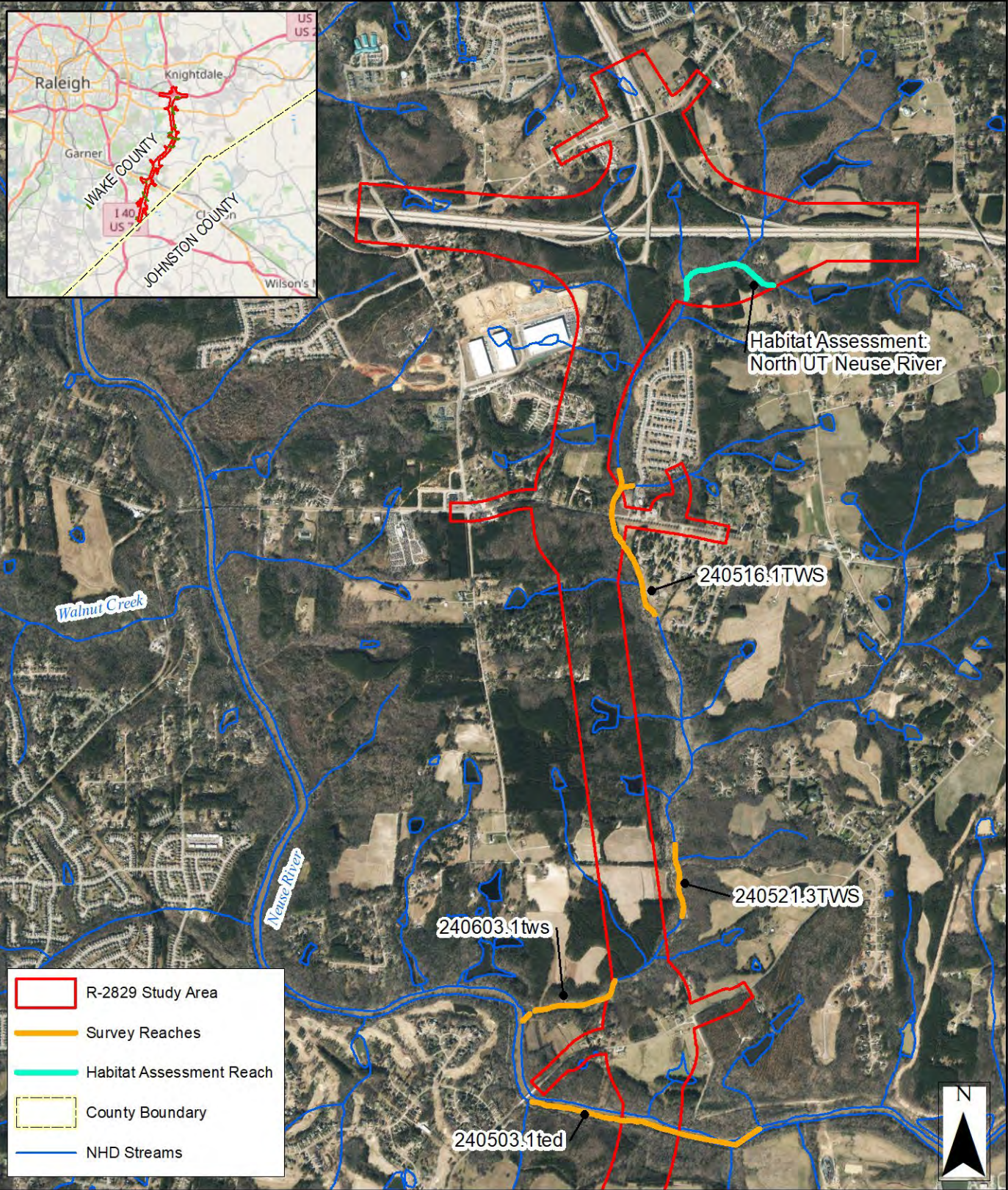
Designation of Critical Habitat. 50 CFR 88:142 RIN 1018-BF80. Docket Nos. FWS-R5-ES-2023-0012; FF09E21000 FXES1111090FEDR 234.

United States Fish and Wildlife Service (USFWS). 2024. USFWS Information for Planning and Conservation (IPAC). Accessed June 2024. <https://ipac.ecosphere.fws.gov/location/index>

Watters, G.T., M.A. Hoggarth, and D.H Stansbery. 2009. The freshwater mussels of Ohio. Ohio State University Press. 419 pp.

APPENDIX A

Figures



Prepared By:



Prepared For:



Freshwater Mussel Survey Report

R-2829:

Complete 540

Green Floater Addendum

Vicinity map and Survey Reaches:

North of Neuse River

Wake County, North Carolina

Date: June 2024

Scale 0 750 1,500 Feet

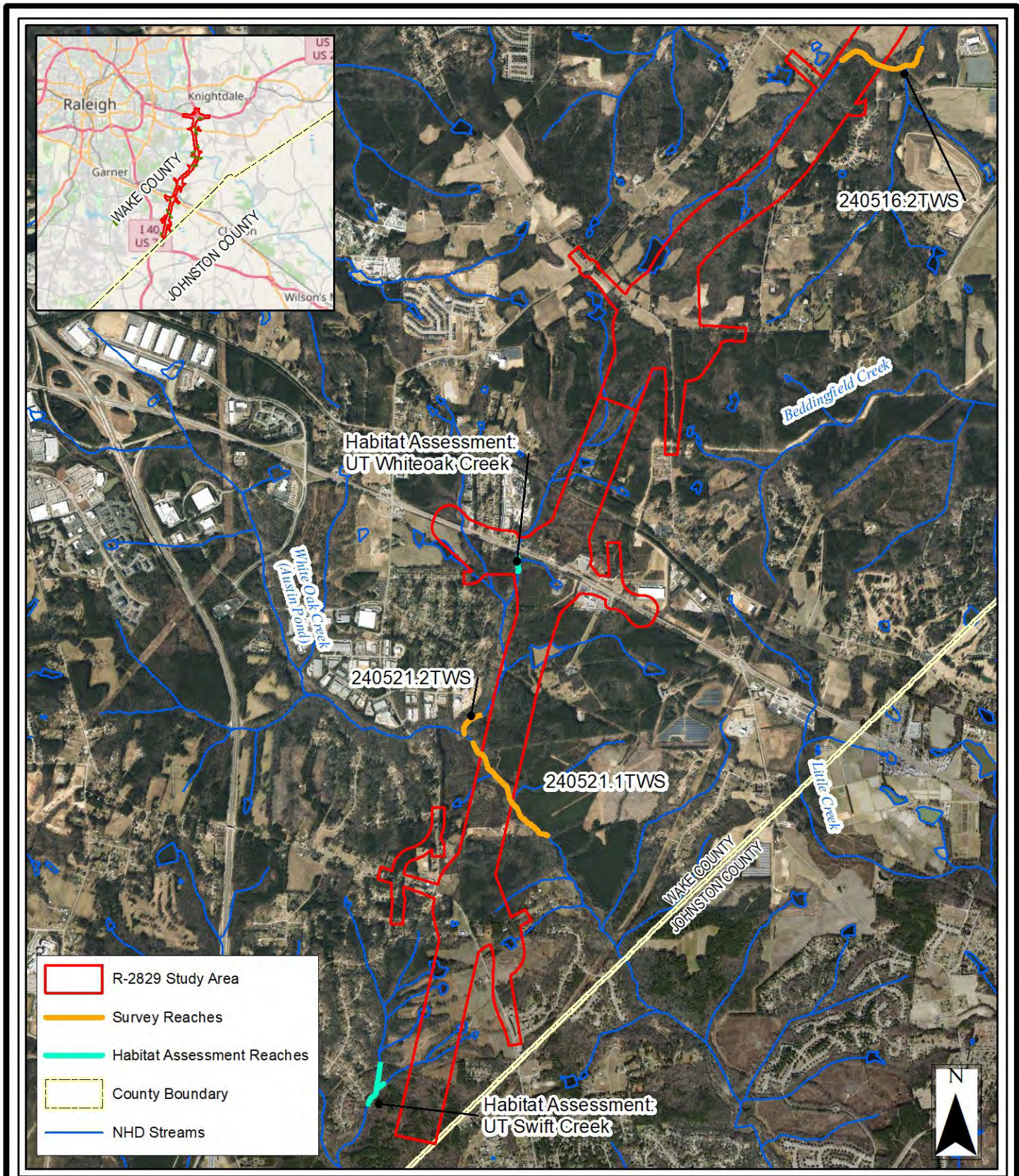
Job No.: 23-310

Drawn By: TDH

Checked By: TED

Figure

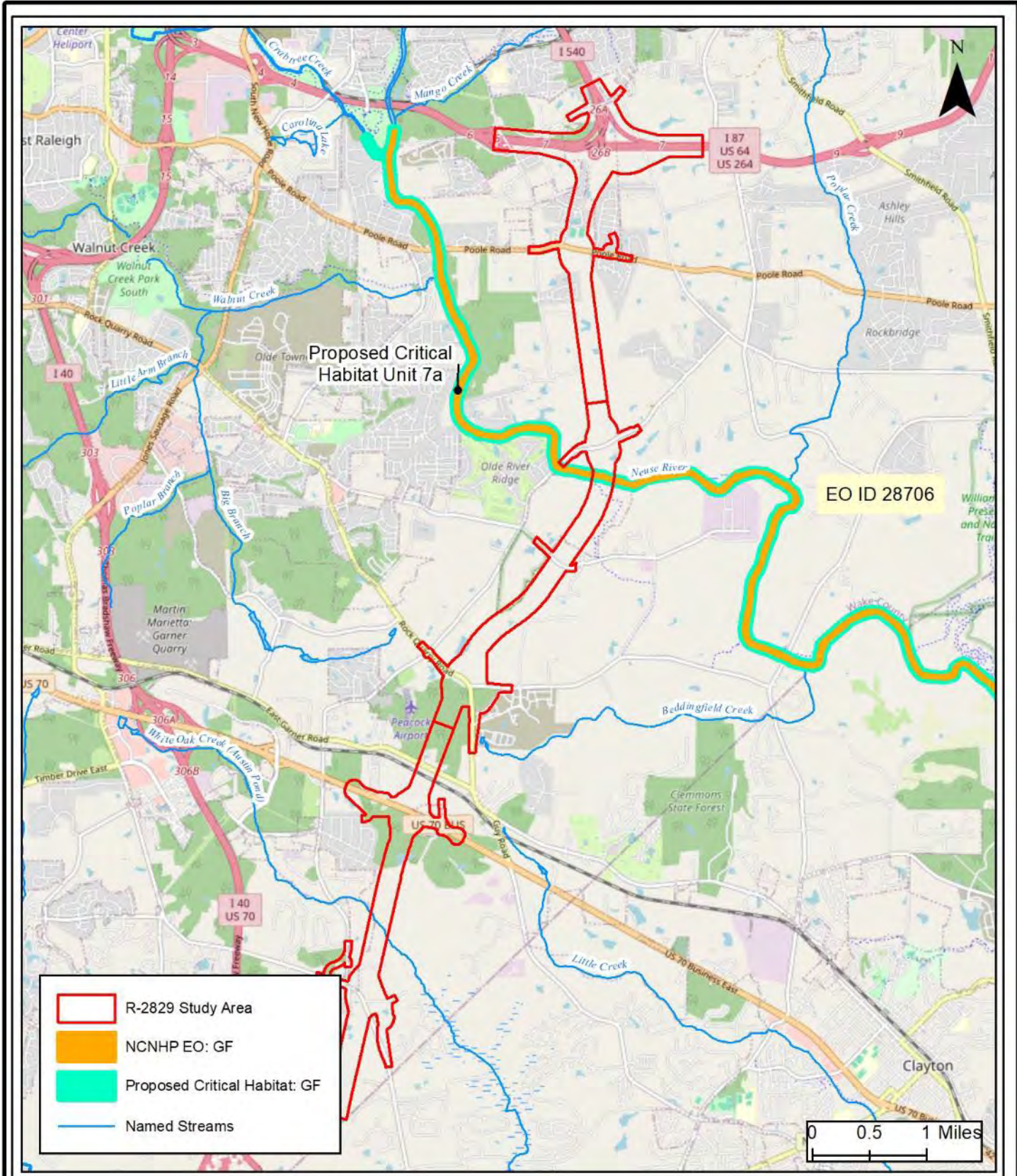
1-1



Freshwater Mussel Survey Report
 R-2829:
 Complete 540
 Green Floater Addendum
 Vicinity map and Survey Reaches:
 South of Neuse River
 Wake County, North Carolina

Date:	June 2024
Scale:	0 750 1,500 Feet
Job No.:	23-310
Drawn By:	Checked By:
TDH	TED

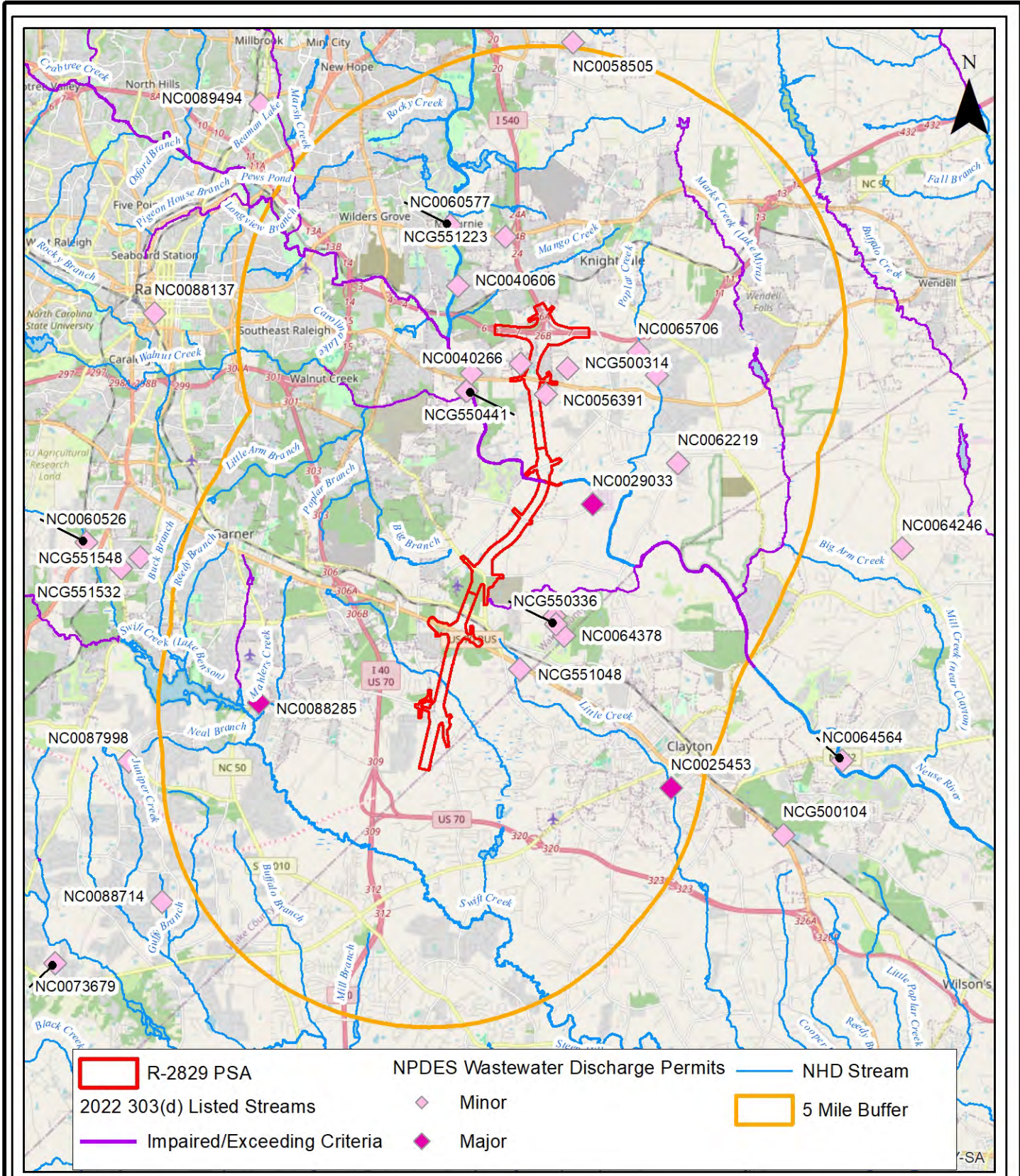
Figure
1-2



Freshwater Mussel Survey Report
 R-2829
 I-540 Completion
 Green Floater Addendum
 NCNHP Element Occurrence and
 Proposed Critical Habitat
 Wake County, North Carolina

Date:	June 2024
Scale:	As Shown
Job No.:	23-310
Drawn By:	TDH
Checked By:	TED

Figure
2



Freshwater Mussel Survey Report
 R-2829
 I-540 Completion
 Green Floater Addendum
 303(d) Listed Streams and
 NPDES Discharges
 Wake County, North Carolina

Date: June 2024
 Scale: 0 0.5 1 Miles
 Job No.: 23-310
 Drawn By: TDH
 Checked By: TED

Figure
3

Appendix B: **Qualifications of Contributors**

Investigator: Tom Dickinson
Education: B.S. Forestry/Natural Resources, Sewanee: The University of the South, 2001
Experience: Environmental Supervisor/Senior Aquatic Biologist, Three Oaks Engineering, 2015-present
Environmental Scientist, The Catena Group 2003-2015
Responsibilities: Project Manager, Field Investigation, Document preparation and review

Investigator: Tim Savidge
Education: B.S. Biology, Guilford College, 1987
M.S. Marine Biology/Biological Oceanography, University of North Carolina – Wilmington, 1998
Experience: Environmental Manager and Aquatic Biologist, Three Oaks Engineering, 2015-present
Environmental Specialist, Endangered Species Coordinator, Environmental Officer Program Coordinator, Environmental Supervisor, NCDOT, 1992-2002
Responsibilities: Field Investigation, Document preparation and review

Investigator: Trevor Hall
Education: B.S. Environmental Science, Organismal Biology, University of Delaware, 2016
Experience: Environmental Scientist, Three Oaks Engineering, 2021-present
Junior Environmental Scientist, NV5 Global Inc., 2019-2021
Responsibilities: Field Investigation, Document preparation, Mapping

Investigator: Nathan Howell
Education: M.S. Plant and Microbial Biology, North Carolina State University, 2015
B.S. Fisheries, Wildlife, and Conservation Biology, North Carolina State University, 2013
Experience: Environmental Scientist, Three Oaks Engineering, 2015- Present
Responsibilities: Field Investigation, Document Review

Investigator: Nancy Oberle
Education: M.E.M Water Resources, Duke University, 2011
B.S. Environmental Science, University of Delaware, 2006
Experience: Environmental Scientist, Three Oaks Engineering, June 2015- Present
Environmental Scientist, The Catena Group, April 2012-June 2015
Responsibilities: Field Investigation

Appendix C:

R-2829 Green Floater Density Estimate Analysis

R-2829 Green Floater Density Estimate Analysis

1.0 INTRODUCTION

A density analysis of the Green Floater (*Lasmigona subviridis*, GF) in the Neuse River portion of the R-2829 Action Area (AA) was performed to estimate the number of individuals present in the river that could potentially experience adverse effects from the proposed action. The methodologies used in this analysis were adapted from methods utilized by the U.S. Fish and Wildlife Service (USFWS) as part of the Biological Opinion (BO) for the I-26 widening project to calculate a density estimate for the Appalachian Elktoe (*Alasmidonta raveneliana*) (USFWS, STIP No. I-4400, I-4700, May 2019).

2.0 METHODOLOGY AND RESULTS

Density estimates were developed from a combination of data collected for this project and an understanding of mussel survey efficiency and species detection levels. Three Oaks surveyed the Neuse River on May 03, 2024. Approximately 800 meters (m) of the Neuse River were surveyed during this effort by six surveyors. Surveyors concentrated on suitable substrates and spent less effort in areas considered unsuitable based on professional opinion. A cumulative 29.7 person-hours (phr) of survey time was spent in the Neuse River and the GF was not located.

2.1 EO Survey Reach Green Floater Density

In addition to surveys completed for this project, this portion of the Neuse River has been surveyed multiple times as it is within the location of the North Carolina Natural Heritage Program (NCNHP) Element Occurrence (EO) # 28706 for the GF. This EO spans from 0.3 stream miles (SM) upstream of Anderson Point (Crabtree Creek confluence) to approximately 0.9 SM downstream of the US 42 crossing of the Neuse River, for a total length of approximately 16.1 SM.

The GF has been reported in small streams to large rivers in habitats with stable flow regimes and substrates, typically in slow-flowing areas, such as pools and eddies. As such, in a water body like the Neuse River, suitable habitat for the species typically occurs in small patches dispersed throughout the larger reach. The Species Status Assessment of the GF noted that “patches of suitable habitat are created and destroyed frequently” and during surveys within occupied reaches, surveyors have noted distances of up to 10 kilometers between detecting individuals (USFWS 2021). Due to the transient nature of the GF habitat occupancy as well as some life history attributes, the species seems to be able to occupy a relatively wide range over a short temporal scale. Therefore, survey history from within this EO was the target of this analysis. The length of this EO serves as the evaluated reach for this analysis.

As with the surveys conducted specifically for this project, search time was recorded in the previous surveys. The PAWS database (unpublished) was consulted to compile all survey data in the EO # 28706 reach (NCWRC 2024) through May 2024. In total, 357.71 phr have been spent in the EO reach with a total of 21 live GF located. Based on professional opinion and experience

surveying for listed mussel species, USFWS, NCDOT, and Three Oaks developed an estimate of the average area surveyed during a survey effort. Appendix A provides a table listing the locations and numbers of Green Floater found during each positive survey. A figure showing these locations is also provided (Appendix A). It is estimated that a surveyor covers a 20-m by 20-m plot (400 square meters [m²]) during one phr. Thus, an estimated 143,084 m² of river bottom was surveyed during the 357.71 phr expended in this EO (400 m² x 357.71) with 21 individuals found. In the 143,084 m² surveyed area, the observed survey density is one (1) GF per 6,813.5 m² (1/(21/143,084 m²)).

2.2 Estimated Density

One factor that impacts density estimates is the probability that a mussel will be detected. Based on an ongoing mark-release-recapture study of the Federally Endangered James Spiny mussel (*Parvaspina collina*) conducted by the Virginia Department of Wildlife Resources (VDWR) (Daguna Consulting and Three Oaks Engineering 2016), USFWS methods, and best professional judgment, detection probabilities are estimated to be between 10% and 25%. Detection probability information for GF is not available, but certain life history attributes of the species suggest that it is also likely to have low detection values. For instance, the GF was observed to bury in the substrate between 10-20 centimeters (cm) below the surface, with juveniles reported up to 38 cm (USFWS 2021), a trait that could inherently make them difficult to detect on a given survey effort.

Using the EO reach survey density of one GF per 6,813.5 m² in the Neuse River and the average area covered per phr (see Section 2.1) and applying the two detection probabilities, results in estimated density values of one GF per 681.3 m² (10% detection) and 1,703.4 m² (25% detection).

3.0 ESTIMATED NUMBER OF GREEN FLOATER AFFECTED BY PROJECT

The AA consists of the intersection of the Neuse River with the project footprint, with an additional 400 m buffer downstream and 100 m buffer upstream, for a total of approximately 800 m in length with a variable width throughout the length of the AA, averaging approximately 40 m wide. The area of the Neuse River within the AA, measured using aerial imagery to account for variability in river width, was approximately 28,700 m². Based on the density estimates and detection probabilities calculated above, the number of GF that could potentially experience adverse effects within the Neuse River portion of the AA ranges from 16.8 (25% detection) to 42.1 (10% detection) individuals depending on the detection rate used in the analysis.

This estimate assumes an even distribution of GF across the entire channel of the Neuse River, which is not likely to be the case. As mentioned above, the GF prefers slow-moving pools and eddies. Currently, within the AA, this habitat is most common along the banks of the river, though there are smaller areas with suitable habitat throughout the channel. However, as discussed earlier, patches of suitable habitat are temporal in nature. While the most recent survey of the AA conducted by Three Oaks did not observe any GF individuals during 29.7 phr of survey time, the dataset used for this estimate demonstrates negative (no individuals detected)

and positive survey results in the same locations at different times; thus, the lack of positive observation in the most recent survey is not indicative of the species' absence from the AA. Tables 1 and 2 below summarize the calculations and values used in this estimate.

Table 1. Calculations for Estimated Density of Green Floater in AA

A. PHR of Survey Time	B. GF Individuals Found	C. Area Surveyed (m ²) (A x 400m)	D. GF AA Survey Density (1 GF/ m ²) (1/(B/C))	E. GF Estimated Density at 10% Detectability Rate (1 GF/ m ²) (D x 0.1)	F. GF Estimated Density at 25% Detectability Rate (1 GF/ m ²) (D x 0.25)
357.7	21	143,084	6,813.5	681.3	1,703.4

Table 2. Estimated Green Floater Individuals in AA within Estimated Detection Range

G. AA Area (m ²)	GF Present in AA at 10% Detectability (G/ E*)	GF Present in AA at 25% Detectability (G/ F*)
28,700	42.1	16.8

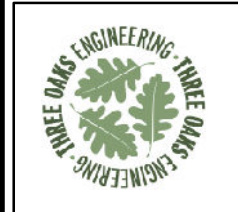
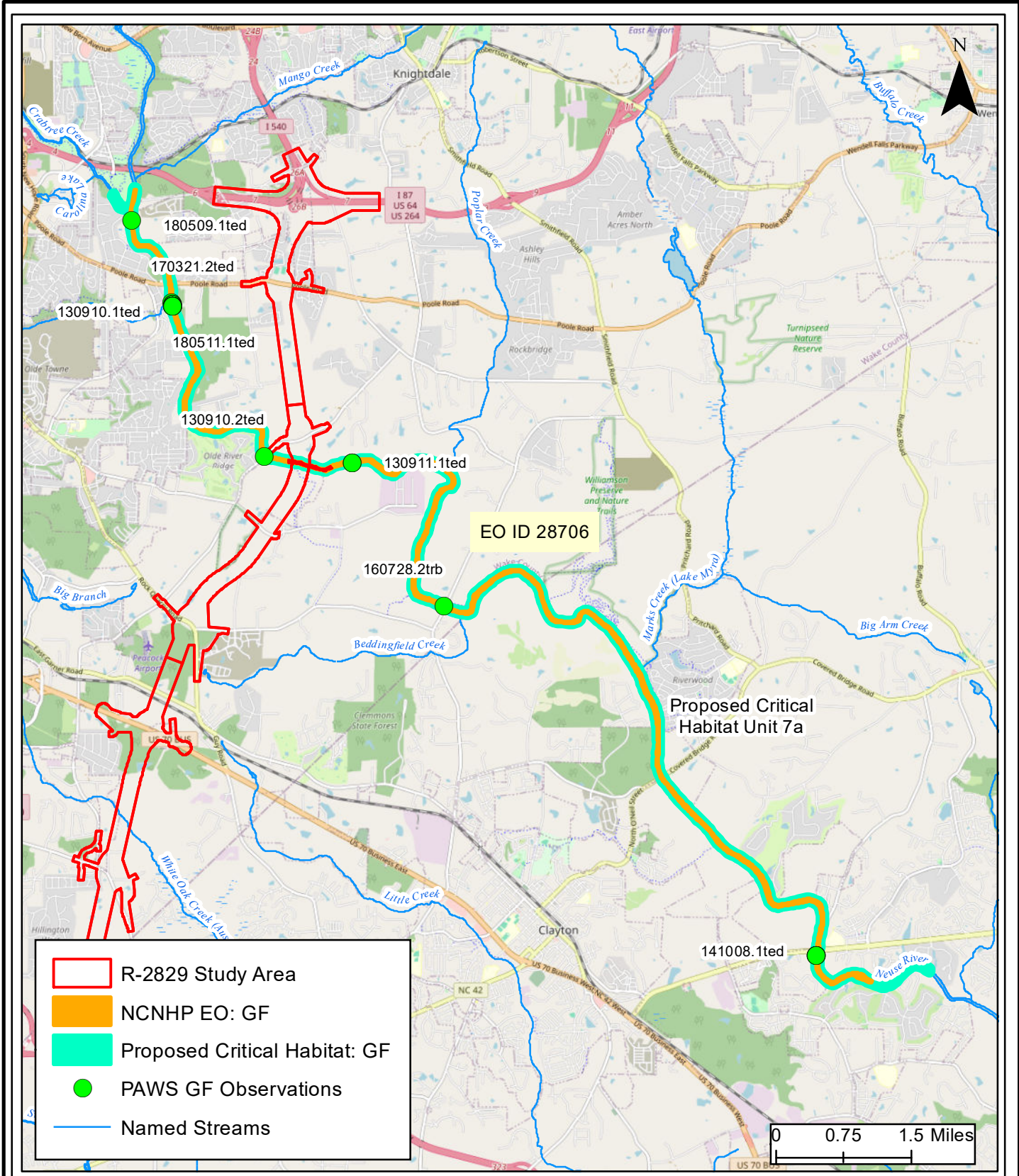
*: "E" and "F" refer to values presented in the respective columns in Table 1.

Works Cited

- Daguna Consulting and Three Oaks Engineering. 2016. Using Mark-Recapture Techniques to Estimate Population Parameters and Detection Probability for the Endangered James Spiny mussel. Unpublished Reporting Under VA Contract No. 2014-14665 to VA Department of Game and Inland Fisheries (VDGIF). May 2016. 83 pp.
- North Carolina Wildlife Resources Commission. 2024. "PAWS" Unpublished Aquatic Species Database. Provided by Eastern Region Non-Game Fisheries Coordinator Michael Fisk.
- United States Fish and Wildlife Service (USFWS). 2019. Biological Opinion I-26 Widening from US 25 near Hendersonville to I-40/I-240 South of Asheville. Asheville, NC. May 2019.
- United States Fish and Wildlife Service (USFWS). 2021. Species Status Assessment Report for the Green Floater (*Lasmigona subviridis*). Version 1.1. New York Field Office, U.S. Fish and Wildlife Service, Cortland, New York. 111 pp + Appendices.

Appendix A:

Figure 1 and NCPAWS GF Records Table



Appendix D
 R-2829: Complete 540
 NCNHP Element Occurrence,
 Proposed Critical Habitat, and
 PAWS Green Floater Observations
 Wake County, North Carolina

Date:	June 2024
Scale:	As Shown
Job No.:	23-310
Drawn By:	TDH
Checked By:	TED

Figure
1

NCPAWS Neuse River Green Floater Records near C540

Site Number	Observation Date	Location Name	Road Number	Search Time	Scientific Name	Common Name	# of Live	# of Shells
180509.1ted	5/9/2018	Anderson Point	US 64	9.25	Lasmigona subviridis	Green Floater	0	1
170321.2ted	3/21/2017	Poole Rd	SR1007	7	Lasmigona subviridis	Green Floater	0	1
170414.2tws	4/14/2017	Poole Rd	SR1007	3	Lasmigona subviridis	Green Floater	1	1
180511.1ted	5/11/2018	Poole Rd	SR1007	11	Lasmigona subviridis	Green Floater	0	2
130910.1ted	9/10/2013	Poole Rd	SR1007	7	Lasmigona subviridis	Green Floater	11	0
130910.2ted	9/10/2013	Auburn-Knightdale Rd	SR2555	5.2	Lasmigona subviridis	Green Floater	1	0
130911.1ted	9/11/2013	Auburn Knightdale Rd	SR2555	9	Lasmigona subviridis	Green Floater	2	0
160728.2trb	7/28/2016	Mial Plantation Rd	SR2509	4	Lasmigona subviridis	Green Floater	1	0
141008.1ted	10/08/2014	NC 42	NC 42	14.87	Lasmigona subviridis	Green Floater	5	0